INDEX

Criterion 2.2.1

The institution assesses the learning levels of the students and organizes special Programmes for advanced learners and slow learners

Induction Programme

Broad basis

1. There would be two sessions of Induction Program: 1 for Management quota students and the second for the Counselling students
2. As of now we are planning on 2 weeks (10 working days) of Induction program: assumes Saturday as a full working day – at least for the Induction program period:*Principal's feedback- we can have 2 weeks of 5 days/week (total 10 days) for Management quota students while for counselling it has to be six working days at best. (this may become necessary due to lack of adequate working days in the semester for the counselling students).*
3. The section on imparting Universal Human Values can be done only by certified faculty members. As of now there are no certified faculty members. We are planning the program now to impart this segment through external motivational speakers. During this year we will get faculty members to get certified and handle this segment in the following years.
4. One major achievement target could be that we get at least 5 Tamizh Medium students (2 from MQ and 3 from CQ) to take up and finish the basic level of BEC certification. *Incentivisation by way of special scholarship may be discussed.*

<u>Tentative Program</u>

Day -1

1. Academic Registration – submission of Certificates, verification etc
2. Diagnostic test: 30 minutes of English, 30 minutes of Maths, 30 Mins of IQ/Reasoning

Day – 2

1. Actual Fresher's day
2. Morning session:
    a. General Address
    b. Principal's Address to Parents
    c. Visit to the department
3. Afternoon Session:
    a. Ice Breaking session
    b. Address by Alumni/ special faculty
    c. General meeting to identify
        i. Extra – curricular talent (debating, music, dance etc)
        ii. Athletic talent (sports ability)
        iii. Leadership quality
4. Day – 2 to Day – 8 (7 working days)
    a. Each day will consist of 2 sessions each
    b. Morning Session will comprise of the Bridge Course. *We can evaluate whether we can use the marks of the diagnostic test to decide on whethera student require help in English/Maths/Reasoning/ All and then decide*

the content. The advantage of doing something like this would be that we will not lose the concentration/involvement of the student in classes. The disadvantage would be the reliability of the diagnostic test result.

c. Afternoon Session will consist of a combination of the following:
   i. External Motivational speakers like
      1. Dr Jayanthishri Balakrishnan
      2. Mr. Ganesh Kumar
      3. Mr. Sujit Kumar
      4. Mr. Irayanbu
      5. Mrs Ranganathan
   ii. Session on Meditation and Yoga (external + internal)
   iii. Session on counselling for planning for success (external)
   iv. Lectures on placement related subjects (external + internal)
   v. Career Counselling/ Entrepreneurship (external + internal)
   vi. School to college course (external – SMART)
   vii. Book reading and Review: Each student should read 2 books and submit a written review not less than 1 page - 1 English and 1 Mother tongue (if their MT book not available then Tamizh or English

additional book). Best review(s) to be presented in assembly and rewarded.

viii. Debate on a contemporary topic related to education/ethics/ values

ix. Play /mime on social topics with a strong social message

x. Visit to local area of interest – UchiPillayarkoil/ Kallanai/ Big Temple accompanied by faculty

xi. Visit to NSS village

xii. Green Campus concept, participate in CFU on one of the two Sundays, visit to orphanage/old age home to sensitize the students on being under privileged

xiii. Address by Alumni who were involved in relief activities

xiv. Preparation for the extra-curricular/ sports competition to be held on Day 14 & 15

xv. Each afternoon session could be divided into 2 halves – one half covering any of the points I to vi above and the other half covering the balance

xvi. Yoga sessions may have to be held in the morning, on those days the order could be adjusted

5. Day -9

a. Presentation by freshers – every student must present. The presentation can be based on the mentor – mentee group so that bonding occurs at the early stage itself.
b. Feedback collection on the program : feedback from freshers; from parents based on student feedback and from participating faculty

6. Day - 10
    a. Identify extra-curricular talent as sports talent from among freshers.
    b. Morning session fresher’s cultural program
    c. Afternoon session : freshers + alumni + faculty vs college team two matches : may be cricket- men and girls volleyball

Online Student Induction Program (eSIP) – AY (2020-21)

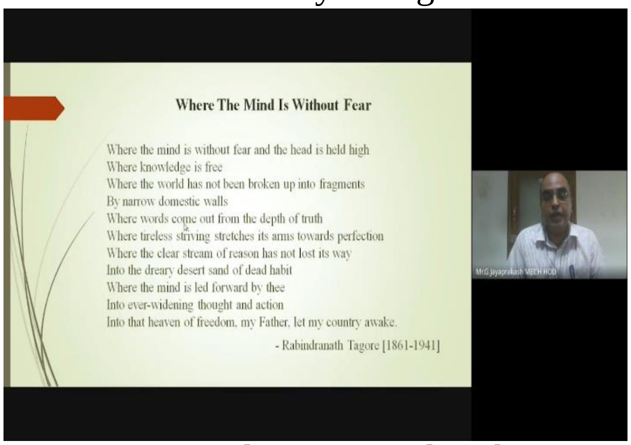
The online student induction program for first year students (AY 2020 -21) was conducted from 16-11-2020 to 21-11-2020. The program started with Principal's address on the first day.

The induction program had four sessions every day. The first session of every day was an expert lecture in which students were exposed to lectures on various topics such as "our rich heritage", "Ways and means to be Successful", "Handling School to college transition", "Universal human values" and "Placement & Technology" etc.

Expert lecture on the Topic – Know your heritage delivered by Prof. Gopal Iyer, Academic chairperson, SCE

My Success – Mrs.Meera Ramesh
Consultant Psychologist

School to College transition – Dr.K.Karthikeyan
HOD/MBA dept.



Universal Human Values by
Dr.G.Jayaprakash, HOD/Mech

Placement & Technology by
Dr.S.M.Giriraj Kumar, HOD/ICE

During the second session, students were exposed to basic programming skills. Senior faculty members of Computer Science Engineering & Information Technology departments handled these sessions.

The third session was a module on Communication skill development, handled by faculty members of English department. In these sessions, students were exposed to nuances of listening, speaking, reading & writing skills.

The fourth session involved an Activity based learning module that was handled by faculty members of Mathematics department. During this session, students participated in various activities like mathematic modelling, Puzzle solving, Fun with numbers, etc.

The online student program (eSIP) very successfully concluded on 21st November after covering all the various modules. The program has received a very favorable response from the students as is evident from their enthusiastic participation in all the interactive sessions as well as the high rating the program received as feedback.

04-09-2020

Circular

Do-IT Association of the Department of Information Technology has planned to conduct a Webinar on "Computer Ethics" for the II year IT students on 10.09.2020 at 4.00 p.m

Resource Person: **Ms. N.Bhavani, Associate Professor/IT**

Coordinator: Ms.**J.Sangeetha Priya**

R. Sumathi

HoD / IT
Dr. R.Sumathi

SARANATHAN COLLEGE OF ENGINEERING
DEPARTMENT OF INFORMATION TECHNOLOGY
WEBINAR ON COMPUTER ETHICS

DATE : 10.09.2020

S.No	BatchNo	Name
1	224001	AARTHIKHA. R
2	224002	ABIMANYU. T
3	224003	ABINAYA. S
4	224004	ABISHEK. A S
5	224005	AJET GANAPATHY. A
6	224006	AMRESH. K
7	224007	ANUVARSHINI . G
8	224008	ARSAH. A
9	224009	ARUN KUMAR. S
10	224010	ASWINI DEVI. B
11	224011	BOWSHIYA RANI. R
12	224013	DEVI. E
13	224015	DHIVAGAR. P
14	224016	DIVYAA. S K
15	224017	GANESH. V
16	224019	HARINI. S
17	224021	HARSHAVARTHAN. S R
18	224022	INDHUMATHI. A
19	224025	KAAVYA. R
20	224026	KALAIARASU. T
21	224027	KALPANA. S
22	224028	KAROLIN KIRUBA. R
23	224029	KAVIYA THARSINI. L
24	224030	KEERTHANA. M
25	224031	KEERTHANA. S
26	224032	KIRUTHIKA. K
27	224033	KISHAN. I
28	224034	KISHORE. M.G
29	224035	MALOLAN. B A
30	224036	MANOJ DEEPAK. S
31	224037	MOHAMED AMEEN. A
32	224038	MOHAN RAM. M
33	224039	MUKESH BALAJI. N
34	224040	NARAESH ARCHUN. K
35	224041	NAVEEN. T
36	224042	NEEKITHA. C
37	224043	NISHA. M
38	224044	NISHANTHINI. S
39	224045	PRAJITH. R
40	224046	PRITHIKA. T
41	224047	RABEKA. S
42	224048	RAHUL. R

43	224049	RAJAMURUGAN. M
44	224050	RAMACHANDRAN. A
45	224051	RATNAKUMAR. A
46	224052	SABARISHAN. M
47	224053	SAMYUKTHA. C
48	224054	SEENI ARIVAZHAKAN
49	224055	SHAHIN ASHRA. S
50	224056	SINDHUJA. J
51	224057	SRI JANE. A
52	224058	SRINIVASAN. M A
53	224059	SURIYANAD. S
54	224060	VAITHEESWARAN. L M
55	224061	VENNKAT BHARATHI. S

R. Sumathi

Coordinator
J.Sangeetha Priya

HoD / IT,
Dr. R.Sumathi

10-09-2020

Headline:

Department of Information Technology conducted a webinar on Computer Ethics for II year IT students in association with DO-IT on 10.09.20.

Description:

- To enrich the students with the knowledge of Ethics in Engineering, a Webinar was on "Computer Ethics" was conducted on 10.09.2020 at 4.00p.m.
- The Resource Person was Ms.N.Bhavani, Associate Professor, Department of IT.
- About 55 students of II IT have attended the Webinar.
- The Resource Person explained the usage of computer as an instrument of unethical behavior and the Computer code of Ethics.

Faculty Organizer: **Ms. J.Sangeetha Priya, AP/IT**

Coordinator
J.Sangeetha Priya

HoD / IT,
Dr. R.Sumathi

SARANATHAN COLLEGE OF ENGINEERING
Department of Information Technology
(Accredited by NBA & IEI)

21-3-2021

Circular

Department of Information Technology (Do-IT Association) with IEI Students Chapter has planned to conduct online workshop on Recent trends in Computer science for III year IT on 22.3.2021.

Faculty Organizer: Ms. M. Padma Priya

HoD / IT, 21/3/2021

Dr. V. Punitha

H.O.D.-IT
Saranathan College of Engg.
Trichirapalli - 620 012.

Saranathan College of Engineering
Department Of Information Technology
Webinar on Recent trends in Computer Science
Attendance –III year IT 22.3.2021

S.No	BatchNo	Regno	Name
1	214001	813818205001	AISHWARYA. W
2	214002	813818205002	AKSHAYA. V
3	214003	813818205003	ANTONY OBENA. A
4	214004	813818205004	AZHAGUMEENATCHI. C
5	214005	813818205005	DEEPTHA SREE. S
6	214006	813818205006	DHILIBAN. R
7	214007	813818205007	DHINUSHREE. K
8	214008	813818205008	DINESH. S
9	214009	813818205009	DURGA DEVI. R
10	214010	813818205010	GOKUL. B
11	214011	813818205011	GOKULAKRISHNAN. N
12	214012	813818205012	HEMALATHA. A
13	214013	813818205013	HEMAMALINI. P
14	214014	813818205017	JACKSON STUWART. A I
15	214015	813818205014	JAYALAKSHMI. L
16	214016	813818205015	JHANANI. R.S
17	214017	813818205016	JOSE IMMANUVEL. J
18	214019	813818205019	KAREESHINI. S
19	214020	813818205020	KARPAHALAKSHMI. S
20	214021	813818205021	KARTHIK. R
21	214022	813818205022	KARTHIKA. D.R
22	214024	813818205024	KEERTHANA. P
23	214025	813818205023	KEERTHANA. P
24	214026	813818205025	KIRUTHIKA. C
25	214027	813818205026	LOKEESH BHARATHI. S
28	214034	813818205033	PRIYADARSHAN. M
29	214035	813818205034	RAGAVAN. R
30	214036	813818205035	RAJKUMAR. V
31	214037	813818205036	SABARISAN. K V
32	214038	813818205037	SAFRIN FATHIMA. R
33	214039	813818205038	SAHAYA CLEMENT. V
34	214040	813818205039	SAKTHIVEL. B
35	214041	813818205040	SANTHANA PRIYA. K
36	214042	813818205041	SARANYA. B
37	214043	813818205042	SELVA PRAKASH. B
38	214044	813818205043	SHERIN. R
39	214045	813818205044	SIVAGIRI. V S
40	214046	813818205045	SNEHA. S
41	214047	813818205046	SUBALAKSHMI. S
42	214048	813818205047	SUBHA ILAKIYA. P
43	214049	813818205048	SUDERSHAN. S
44	214050	813818205049	THAGASIN. M
45	214051	813818205050	THANGA SRI. R
46	214052	813818205051	VAISHNAVI. M
47	214053	813818205052	VALLIAMMAI. A
48	214054	813818205053	VIGNESH. R
49	214055	813818205054	VIGNESH. S
50	214056	813818205055	VIGNESWAR. S
51	214057	813818205056	VIJAYALAKSHMI. S
52	214058	813818205057	VINOTHKUMAR. M

22/3/2021

H.O.D. (IT)
Saranathan College of Engg.
Trichirapalli - 620 012.

SARANATHAN COLLEGE OF ENGINEERING

Department of Information Technology

(Accredited by NBA & IEI)

24-03-2021

Headline:

Department of Information Technology conducted a webinar Recent trends in Computer science for III year IT students in association with DO-IT on 22.3.2021

Description:

- To enrich the students with the knowledge of Recent trends in Computer science, a Webinar was on "**Recent trends in Computer science**" was conducted on **22.3.2021**at 2.00p.m.
- The Resource Person was **Mr. P. Anand, Assistant Professor,** Department of IT.
- About 55 students of III IT have attended the Webinar.
- The Resource Person explained recent trends in computer science.

Faculty Coordinator: **Ms. M. Padma Priya/AP/IT**

M. Padma Priya

Coordinator

Ms. M. Padma Priyaa

HoD / IT, 24/3/21

Dr.V. Punitha

H.O.D. (IT)
Saranathan College of Engg.
Trichirapalli - 620 012.

TAMILNADU STATE COUNCIL FOR SCIENCE AND TECHNOLOGY Student Project Scheme -2020-2021

Applicant's registration for data collection. After submitting necessary details, enable the send copy of this form [at the bottom left;] filled application will be sent to email id mentioned. Take a printout of the same, get signatures and send it with project details [5 pages only].

Email address *

delphinlydia99@gmail.com

GUIDE NAME *

Ms.J.Sangeetha Priya

DESIGNATION *

Assistant Professor

DEPARTMENT *

Information Technology

NAME OF THE INSTITUTION *

Saranathan College Of Engineering

INSTITUTION ADDRESS WITH PINCODE *

Venkateshwara Nagar,Panjappur,Trichy - 620012

TITLE OF THE PROJECT *

Chatbot for College Management System

DISCIPLINE-SCIENCE

	AS	BS	ES	MS	PS	SS	VS
CODE	◉	○	○	○	○	○	○

DISCIPLINE-ENGINEERING

	CSE	ECV	EME	EEE	CHE
CODE	◉	○	○	○	○

INSTITUTION CATEGORY *

	GOVT.	SELF FINANCE	GOVT. AIDED	UNIVERSITY
STATUS	○	◉	○	○

GUIDE CONTACT MOBILE NUMBER *

9443900909

GUIDE EMAIL-ID *

jspriya-it@saranathan.ac.in

STUDENT(S) NAME (Maximum 4 students) *

DELPHIN LYDIA B , DHIVYA JAI SREE G B , VIDHYA V , VIJAYA MEENA S

STUDENT(S) NAME (Maximum 4 students) *

DELPHIN LYDIA B , DHIVYA JAI SREE G B , VIDHYA V , VIJAYA MEENA S

STUDENT STUDYING *

	U.G ENGINEERING	P.G PROFESSIONAL COURSE	P.G SCIENCE
COURSE	◉	○	○

CERTIFICATE

This is to certify that Mr./Miss. B. Delphin Lydia, G.B dhivya Jaishree, V. Vi S. vijayameena is a bonafide final year student of P.G. Science / U.G. Engineering / P.G. professional courses of our college and it is also certified that two copies of utilization certificate and final report along with seminar paper will be sent to the Council after completion of the project by the end of April 2021.

PRINCIPAL
Saranathan College of Engineering
TRICHY - 12.
PRINCIPAL, HEAD OF THE IN...

Signature of GUIDE

HOD

~~Guide~~
~~Principal~~/ Head ~~of the Institution~~

H.O.D. (IT)
Saranathan College of Engg.
Trichirapalli - 620 012.

Note:
N.B.: 2 copies of the proposals are to be submitted through proper channel to The Member Secretary, TNSCST, DOTE Campus, Chennai - 600 025 on or before 21 January 2021, 5.00PM

Chat-bot for College Management System

A

Student Project Proposal

Submitted by

Ms. B. Delphin Lydia

Ms. G.B. Dhivya Jai Sree

Ms. V. Vidhya

Ms. S. Vijaya Meena

Department of Information Technology

Saranathan College of Engineering

Panjappur, Tiruchirappalli - 620 012

Tamilnadu

STUDENT PROJECTS SCHEME

TAMILNADU STATE COUNCIL FOR SCIENCE AND TECHNOLOGY

DOTE Campus, Chennai - 600 025

January 2021

FORMAT FOR STUDENT PROJECT PROPOSAL

1.	Name of the Student (s)	: Ms. Delphin Lydia B Ms. Dhivya Jai Sree G B Ms. Vidhya V Ms. Vijaya Meena S
	One valid e-mail id	: delphinlydia99@gmail.com
2.	Name of the Guide (s)	: Ms. J. Sangeetha Priya
	Department / Designation	: IT / Assistant Professor
	Institutional Address	: Venkateshwara nagar, Panjappur, Tiruchirapalli-620012.
	Phone No. & Mobile No.	: 9443900909
3.	Project Title	: Chat-bot for College Management System
4.	Sector in which your Project proposal is to be Considered	: **Engineering & Tech (Computer Science)**
5.	Project Details	: Annexure - I 1. Introduction 2. Objectives 3. Methodology 4. Work Plan 5. Budget
6.	Has a similar project been carried out in your college / elsewhere? If so furnish details of the previous project and highlight the improvements suggested in the present one	: NO

CERTIFICATE

This is to certify that **Ms. B. Delphin Lydia , Ms. G.B. Dhivya Jai Sree , Ms. V. Vidhya , Ms. S. Vijaya Meena** are bonafide final year students of B.Tech Information Technology of our college and it is also certified that two copies of utilization certificate and final report along with seminar paper will be sent to the Council after completion of the project by the end of April 2021.

Signature of the Guide

Signature of the HOD

H.O.D. (IT)
Saranathan College of Engg.,
Trichirapalli - 620 012.

PRINCIPAL
Saranathan College of Engineering
TRICHY - 12.

Signature of the Principal
Head of the Institution

ANNEXURE - I

Chatbot for College Management System

ABSTRACT

This project is a **CHATBOT** based on **COLLEGE MANAGEMENT SYSTEM**. The college inquiry chat-bot can be built using artificial algorithms that analyse user's queries and understand user's text message or voice message . This chat-bot is designed for both internet and intranet college portal. The response principle is matching the input sentence from a user. The system manages the college information, student information and various different types of events going on in the college. It also keeps track of records of all the information regarding the students and the college . The User can post queries related to college activities through the chat-bot without physically being available to the college for inquiry. With the help of artificial intelligence, the chat-bot analyses and answers the query asked by the students. The system replies using an effective Graphical User Interface as if a real person is chatting to the user.

1. INTRODUCTION

A chat-bot is a software application created using artificial intelligence which is a digital assistant that can conduct an online chat conversation via text or voice between human and the system. The college management system manages the college information, student information and various different types of events going on in the college. It also keeps track of records of all the information regarding the students and the college. Our Chat-bot is developed using Python. No matter what time it is , the chat-bot allows to the user to post any queries regarding the college and ensures that the responses are given effectively at that instant of time.

2. PROBLEM IDENTIFICATION

Let's face the truth. In the current world, chat-bots are being available immensely in all web applications. The challenge is that how effectively and quickly the chat-bot could provide services to the users. The chat-bots must be able to be accessible to multiple users simultaneously from anywhere. It should be able to fetch the correct information requested by the user flawlessly. T he retrieved information must be sent to the user in an instant of time .The user accessing the chat-bot must be completely satisfied with its service.

3. OBJECTIVES

- The main objective of this project is to provide full functional reports to the users about any aspects of college.
- The core of designing chat-bot for college management system is to manage the information related to college and students and answer all the queries of students/faculties/administrator and public users
- This chat-bot is fast, accurate, consistent , reliable and flexible enough so that it can incorporate any future enhancements.
- Every user such as student, parent, staff and administrator must be able to see the information of college and each student must be able to view their details from their specific login.
- This chat-bot is designed in view of reducing the need for manual communication.

4. METHODOLOGY

Modules

- Chat User Module : The proposed system has a client server architecture. All the information will be kept in an optimized database on the central server. This information can be accessed by the users through the chatbot in the web application.

- Chatbot Module : Chatbots control conversation flow based on the context of the users requests and respond with natural language phrases to provide direct answers to the queries asked.

- Query Matching Module : The Chatbot sends the query to the system for comparing.The matching response to the query is retrieved from the database.

- Response Module : The Chatbot responds to the user with the required information based on each query exactly.

5. WORK PLAN

The detailed work plan for the proposed project work is shown in Table 1.

Table 1: Proposed Work Plan

S.No	Activities	Month - 1 (Days)		Month - 2 (Days)		Month – 3 (Days)	
		1-15	16-31	1-15	16-30	1-15	16-31
1.	Literature Review						
2.	Identifying Problems						
3.	Designing						
4.	Coding						
5.	Experimentation						
6.	Testing and Validation						
7.	Preparation of Report						

6. BUDGET

The approximate cost estimation for implementing the project work is shown in Table 2.

Table 2: Cost Estimation

S. No.	Details of expenditure	Type (Recurring / non-recurring)	Estimated Cost In Rs.
1.	Realtime Database	Recurring	9,000
2.	Hosting application on server	Non-Recurring	3000
	TOTAL		**12,000**

7. EXPERIMENTATION

1. Verify that the chat window is available in the college website for the users.
2. Verify that the user can view the college activities and upcoming events in the college.
3. Verify that the users can post queries only regarding the college to the chat-bot.
4. Verify that the chat-bot could receive the message query posted by the user.
5. Verify that the chat-bot could recognize the query incase of voice message.
6. Verify that the chat-bot could retrieve the particular information required by the user from the database.
7. Verify that the chat-bot could respond correctly to the query asked by the user.
8. Verify that the student/faculty could login incase of intranet portal.
9. Verify that a message is popped up incase of incorrect login by the user.
10. Verify that the chat window is available in the intranet portal for the particular user's profile.
11. Verify that the student/faculty can view their profile.
12. Verify that the students can post queries regarding their information to the chat-bot.
13. Verify that the faculty can post queries regarding their information to the chat-bot.
14. Verify that the faculty can view the information of all the students of their department.
15. Verify that the chat-bot could receive the query posted by the student/faculty.
16. Verify that the student/faculty receives the correct response to their query by the chat-bot.
17. Verify that the chat-bot can be enabled for multiple users at the same time.
18. Verify that how much time is taken to send a message from the user to the chat-bot.
19. Verify that how much time the chat-bot takes to respond to the user's query.
20. Verify that the database gets updated daily.

There are many more Test Cases/Scenarios that can be implemented.

8. OUTCOME OF THE PROJECT WORK

- Hence the Chat-bot for College Management System has been developed using artificial intelligence algorithms and implemented successfully.
- Front end and Back end code has been developed.
- The Front End provide the user interface for the user to easily access the college portal.
- The Back End is the database that stores all the data and it gets updated daily.
- The Chat-bot responds to all the queries of the users regarding the college activities effectively.

REFERENCES

- Health Assistant Bot : A Personal Health Assistant for the Italian Language published on 8 June 2020 by Marco Polignano , Fedelucio Narducci , Andrea Iovine , Cataldo Musto , Marco De Gemmis and Giovanni Semeraro (http://ieeexplore.ieee.org/document/09110847/)
- https://en.wikipedia.org/wiki/chatbot

SARANATHAN COLLEGE OF ENGINEERING PANJAPUR ,TRICHY - 12

DEPARTMENT OF INFORMATION TECHNOLOGY

PROJECT APPLICATION FORM –APR-2020/21

1. Title of the project: **Stock prediction using Linear regression**

2. Name of the Students:

Mohammed Shirajudden.A, Mukilan.B,Sabarinathan.G,Sameer Ahamed.K

Batch No:204025,204027,204042,204043

University Reg. No i)813817205025 ii)813817205027 iii)813817205042 iv)813817205043

3. Motivation for doing this project: For predicting the stock

4. Input's to the project: data sets given as a input the project

5. Output metrics: Predicting the results of stock

6. Estimated duration for completion: 3 months

7. Software requirement: Python

8. References: Stock Market Prediction using Machine Learning Algorithm

Signature of the internal guide with Name

Manoj Kumar V., Assistant Professor/IT

Signature of the students:

i) Mukilan B

ii)Mohammed Shirajudden.A

iii)Sabarinathan.G

iv)Sameer Ahamed.K

NOTE:

- Last Date of submission of Application Form : **26/12/20**
- Submit one page of synopsis of the project on or before your Zeroth review date **28.12.2020**

Office use only **Project Batch No: Dept of IT, SCE, Panjappur, Trichy-620 012** **13**

VIDEO AND TEXT SUMMARIZATION OF FOOTBALL VIDEOS USING DEEP LEARNING

A

Student Project Proposal

Submitted by

Ms.Joys Princia A

Ms.Kalai Selvi J

Ms.Rithi Afra J

Ms.Rukshana S

Department of Information Technology

Saranathan College of Engineering

Panjappur, Tiruchirappalli - 620 012

Tamilnadu

STUDENT PROJECTS SCHEME

TAMIL NADU STATE COUNCIL FOR SCIENCE AND TECHNOLOGY

DOTE Campus, Chennai - 600 025

January 2021

FORMAT FOR STUDENT PROJECT PROPOSAL

1.	Name of the Student (s) one valid e-mail id	: Ms.Joys Princia A Ms.Kalai Selvi J Ms.Rithi Afra J Ms.Rukshana S : joysarock06@gmail.com Kalaijagadeesan1710@gmail.com rithijerald@gmail.com rakshu24sekar@gmail.com
2.	Name of the Guide (s)	: Mrs. J. Sangeetha Priya
	Department / Designation	: IT / Assistant Professor
	Institutional Address	: Venkateshwara nagar, Panjappur, Tiruchirapalli-620012.
	Mobile No.	: 9443900909
3.	Project Title	:VIDEO AND TEXT SUMMARIZATION OF FOOTBALL VIDEOS USING DEEP LEARNING
4.	Sector in which your Project proposal is to be Considered	: **Engineering & Tech (Computer Science)**
5.	Project Details	: Annexure - I 1.Abstract 5.Methodology 2.Introduction 6.Work plan 3.Problemdefinition 7.Results 4.Objectives 8.Outcome
6.	Has a similar project been carried out in your college / elsewhere? If so furnish details of the previous project and highlight the improvements suggested in the present one	: NO

CERTIFICATE

This is to certify that **Ms. A Joys Princia, Ms. J Kalai Selvi, Ms. J Rithi Afra and Ms. S Rukshana** is a bonafide final year students of B.Tech Information Technology of our college and it is also certified that two copies of utilization certificate and final report along with seminar paper will be sent to the Council after completion of the project by the end of April 2020.

Signature of the Guide	Signature of the HOD	Signature of the Principal/ Head of the Institution
	H.O.D. (IT) Saranathan College of Engg., Trichirapalli - 620 012.	PRINCIPAL Saranathan College of Engineering TRICHY - 12.

SARANATHAN COLLEGE OF ENGINEERING TRICHY 620 012.

ANNEXURE - I

Video and Text Summarization of football match videos using Deep Reinforcement Learning

ABSTRACT

The main intent of this project is to facilitate video browsing in a large scale by producing concise summaries. We have decided to formulate video summarization as a sequential decision making process. A Deep Sequential Network(DSN) will be developed. DSN will predict a probability for each video frame. In order to train our DSN, an end-to-end , reinforcement based framework is proposed.In this framework, we design a novel reward function which summarizes the diversity and representativeness reward. It does not rely on labels or user interactions. For text summarization part, we propose a general neural network configuration that uses Convolutional Neural Network(CNN).

Keywords: CNN, DSN, reinforcement learning, reward function, diversity and representativeness reward

1. INTRODUCTION

The large number of video data makes it hard to review and navigate, especially long videos such as sports matches. It takes so much of time to know the highlights of the entire match. Thus this project aims at helping the people to get to know the highlights easily using video and text summarization using deep reinforcement learning.

2. DEEP LEARNING NEURAL NETWORKS:

Recurrent Neural Network is a class of artificial neural networks where connections between the various nodes form a directed graph. This facilitates it to exhibit temporal dynamic behaviour. It is derived from feedforward neural networks. It can be used for handwriting recognition and speech recognition. Convolutional Neural Network is most commonly used for analysing visual imagery. It is also called as shift invariant or space invariant artificial neural networks (SIANN). It uses little preprocessing when compared to the other image classification algorithms. It is inspired by biological processes.Bidirectional Recurrent Neural Networks work on connecting to hidden layers of opposite directions to the same output. This helps the output layer to get information from past and future states simultaneously.

3.REINFORCEMENT LEARNING:

It is an area of machine learning which concerns with how intelligent agents must take actions in an environment in order to maximize the notion of cumulative reward. This does not need labelled input or output pairs. The environment will be stated in the form of Markov Decision Process. It can be used in situations where a model of the environment is known, but the analytic solution will not be available.

4.DEEP REINFORCEMENT LEARNING:

It is a subfield of machine learning which combines the concepts of deep learning and reinforcement learning. It incorporates deep learning into solution thereby allowing the agents to take finite decisions from the unstructured input data that is present.

5.PROBLEM IDENTIFICATION:

The sports lovers find it difficult to spend so much time to get to know the important happenings in a match. They find it difficult to balance the time between their sports love and day to day activities.Thus to keep their sports spirits high, this will help them in saving their time yet knowing the highlights of the match.

6. OBJECTIVES

- To help people save time
- To help the sports lovers know the highlights
- To summarize videos into video frames
- To summarize videos into text
- To quickly know the important captions

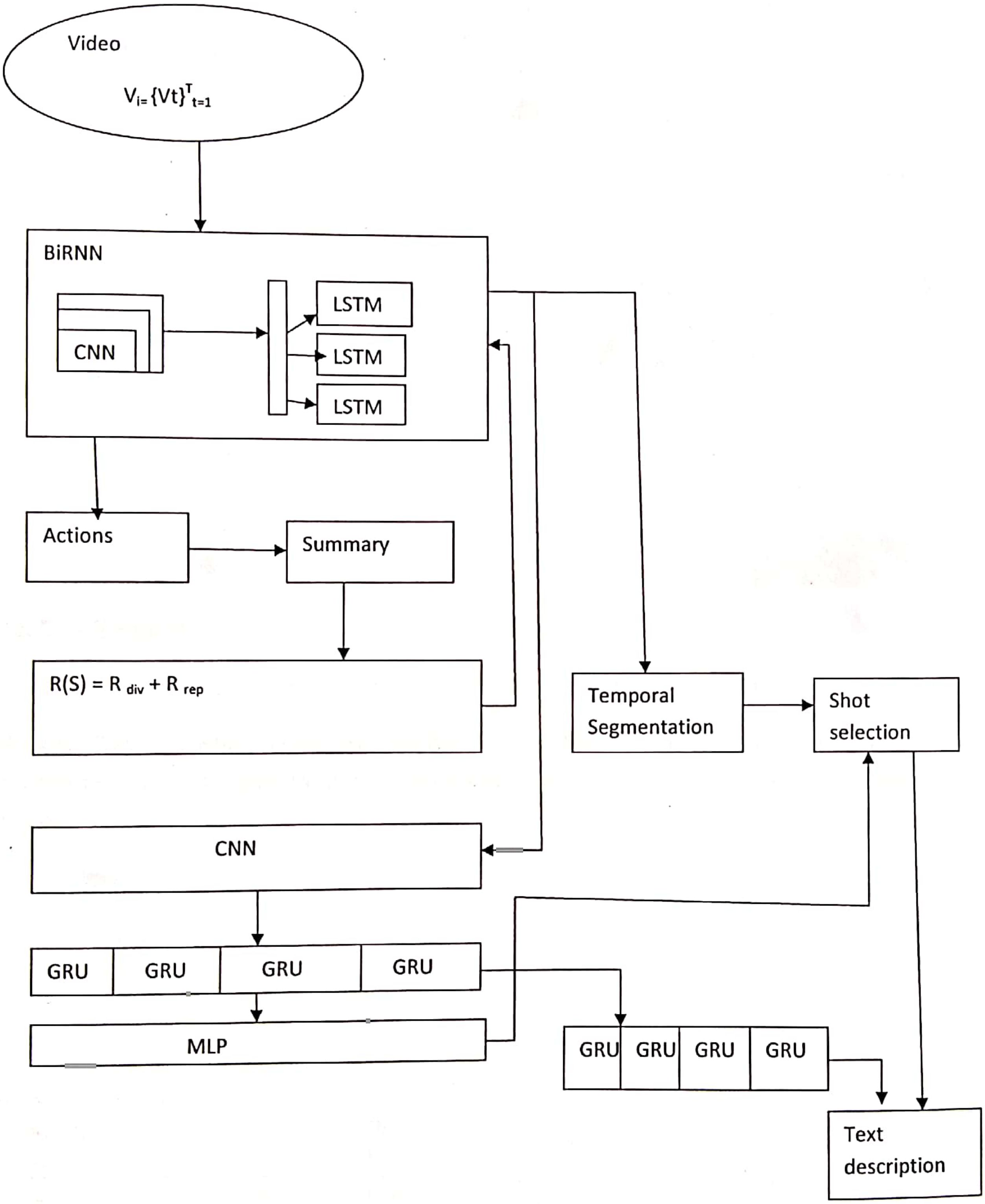
7. METHODOLOGY

- Deep Summarization Network: The encoder-decoder framework is adopted for our deep summarization network. The encoder is formed by convolutional neural network. This extracts the visual features. The Bidirectional Recurrent Neural Network forms the decoder. The visual features are given as input and it produces the corresponding hidden states.

- Diversity Reward: The degree of diversity of a generated summary is evaluated

- Representativeness Reward: This is a measure of how much a generated summary matches the original video.

8.GRAPHICAL REPRESENTATION:



9. WORK PLAN

The detailed work plan for the proposed project work is shown in Table 1.

Table 1: Proposed Work Plan

S. No.	Activities	Mile Stone - 1 (Days)		Mile Stone - 2 (Days)		Mile Stone - 3 (Days)	
		1-15	16-31	1-15	16-30	1-15	16-31
1.	Literature Review						
2.	Problem Identification						
3.	Designing						
4.	Coding						
5.	Experimentation						
6.	Investigation, Testing & Validation						
7.	Preparation of report						

10. DISCUSSION:

These are the results of the existing model which has video summarization only.

Results (%) of unsupervised approaches on SumMe and TVSum. Our DR-DSN performs the best, especially in TVSum where it exhibits a huge advantage over others.

Method	SumMe	TVSum
Video-MMR	26.6	-
Uniform sampling	29.3	15.5
K-medoids	33.4	28.8
Vsumm	33.7	-
Web image	-	36.0
Dictionary selection	37.8	42.0
Online sparse coding	-	46.0
Co-archetypal	-	50.0
GANdpp	39.1	51.7
DR-DSN	**41.4**	**57.6**

ABBREVIATION:

- **CNN-** Convolutional Neural Network
- BiRNN- Bidirectional Recurrent Neural Network
- LSTM- Long Short Term Memory
- MLP- Multi Layer Perceptron
- GRU- Gated Recurrent Units

REFERENCES

- Zhou, K., Qiao, Y., & Xiang, T. (2018). Deep Reinforcement Learning for Unsupervised Video Summarization With Diversity-Representativeness Reward. Proceedings of the AAAI Conference on Artificial Intelligence, 32(1). Retrieved from https://ojs.aaai.org/index.php/AAAI/article/view/12255

- Bor-Chun chen, Yan-Ying Chen and Francine Chen. Video to text summary: Joint Video Summrization and Captioning with Recurrent Neural Networks. In T.K. Kim, S. Zafeiriou, G. Browstow and K. Mikolajczyk, editors, proceedings of the British Machine Vision Conference (BMVC), pages 118.1-118.14. BMVA Press, September 2017.

Thanks for filling out _

Here's what we got from you:

Edit response

TAMILNADU STATE COUNCIL FOR SCIENCE AND TECHNOLOGY
Student Project Scheme -2020-2021

Applicant's registration for data collection. After submitting necessary details, enable the send copy of this form [at the bottom left;] filled application will be sent to email id mentioned. Take a printout of the same, get signatures and send it with project details [5 pages only].

Email address *

joysarock06@gmail.com

GUIDE NAME *

Mrs. J. Sangeetha Priya

DESIGNATION *

Assistant Professor

DEPARTMENT *

Information Technology

NAME OF THE INSTITUTION *

Saranathan College of Engineering

INSTITUTION ADDRESS WITH PINCODE *

620012

TITLE OF THE PROJECT *

Video and text summarization of Football videos using Deep Learning

DISCIPLINE-SCIENCE

	AS	BS	ES	MS	PS	SS	VS
CODE	◉	○	○	○	○	○	○

DISCIPLINE-ENGINEERING

	CSE	ECV	EME	EEE	CHE
CODE	◉	○	○	○	○

INSTITUTION CATEGORY *

	GOVT.	SELF FINANCE	GOVT. AIDED	UNIVERSITY
STATUS	○	◉	○	○

GUIDE CONTACT MOBILE NUMBER *

9443900909

GUIDE EMAIL-ID *

jspriya-it@saranathan.ac.in

STUDENT(S) NAME (Maximum 4 students) *

Joys Princia A , Kalai Selvi J , Rithi Afra J , Rukshana S

STUDENT STUDYING *

	U.G ENGINEERING	P.G PROFESSIONAL COURSE	P.G SCIENCE
COURSE	◉	○	○

CERTIFICATE

This is to certify that Mr./Miss. Joys Princia kalaiselvi, Rithi Afra Rukshana is a bonafide final year student of P.G. Science / U.G. Engineering / P.G. professional courses of our college and it is also certified that two copies of utilization certificate and final report along with seminar paper will be sent to the Council after completion of the project by the end of April 2021.

Signature of

Guide	HOD	Principal/ Head of the Institution
	H.O.D. (IT) Saranathan College of Engg., Trichirapalli - 620 012.	PRINCIPAL Saranathan College of Engineering TRICHY - 12.

Note:

N.B.: 2 copies of the proposals are to be submitted through proper channel to The Member Secretary, TNSCST, DOTE Campus, Chennai - 600 025 on or before 21 January 2021, 5.00PM

SARANATHAN COLLEGE OF ENGINEERING TRICHY 620 012.

ORGIN	TRZ 19/01/21
FROM : Jays Princia	
GSTIN : TRZ	

THE PROFESSIONAL COURIERS
(DOMESTIC, INTERNATIONAL & CARGO)
NO.50,WILLIAMS ROAD, CONTONMENT, TRICHY-1,PH:0431-4226000.

TRZ9514 3833

DESTINATION:

TO, The member Secretary

Chennai

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Sign & stamp

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22nd January 2021

To

Saraswathi
157 G, AMN Building
Big Bazaar
Tiruchirappalli – 620 008

Letter of Appointment

Dear **Ms.Saraswathi,**

Subsequent to the interviews we had on campus at Saranathan College of Engineering on 22nd January 2021, we are pleased to offer you an **Internship + Data Scientist (Full Time) position** at **CourseBricks**, located at Thillai Nagar, Tiruchirappalli with effect from **18/02/2021** on the following terms and conditions.

1. Accountability:

You will report directly to the **Founder.**

2. Internship Duration:

Internship duration would be approximately **3 months**. You would be absorbed as a full time Data Scientist on successful completion of your final semester courses/projects as well as internship.

3. Remuneration:

You will be paid an **annual** renumeration of **Rs. 4,00,000/-** on a cost to company basis for the **full time Data Scientist** position. You will also be paid a **stipend** of Rs. **10,000 per month** during your **internship** with us. The remuneration offered to you is absolutely confidential.

4. Working Hours:

You will be required to work eight hours a day and forty hours a week for five days a week in any one of the shifts during the day or night. Your duty hours will be fixed from time to time depending upon the exigencies of the business.

5. Duties:

Yours will be a full time salaried position with no overtime compensation. You shall perform such duties, observe, and conform to such directions as may be assigned or communicated to you by the Management or such officers who are placed in authority over you. You will also be responsible for control and supervision of the employees working under you if any.
The Management will be within its rights to allot you additional jobs within your department or any other department to which you cannot raise any objection.

6. Address:

You will keep the Management informed of any change in your residential address. In case of your inability to do so, any communication sent at the address available with the Management will be deemed to have been served on you.

7. Benefits:

You will be eligible to avail 20 days of earned leave per year with prior approval from the manager.

8. Notice Period:

Your services may be terminated by either side giving 30 days notice to the other or 30 Days salary in lieu thereof, which shall be prorated for the period of notice being un-served.

9. Service Rules:

You shall abide and be bound by the company's Service Rules, as these Service Rules will form part of this contract of employment. You will also carry out and abide by any instruction, House Rules and Office Orders issued by the Management from time to time. Your appointment and continuation in service is subject to satisfactory verification of your credentials, testimonials, etc., and not having concealed any material information from us or having given false particulars in your application.

10. Non Disclosure Agreement (NDA):

You will not divulge any information regarding intellectual Property, software process, technical know-how, security arrangements, administrative accounts, marketing areas, organization matters pertaining to the company whether confidential or otherwise, patented or non-patented, operational, technical or financial either pertaining to the company, or its customers, vendors, or internal processes, orally, inscribed, recorded, written electronically processed either tapes, disks, chips, floppies or any other form of communication like films, micro films, drawings etc to anyone else, without the prior approval of the company. It is absolutely at the discretion of the company to decide whether any information is divulged under the normal course of business and the employee in any manner cannot challenge the same.

You shall undertake not to discuss, disclose, or expose any information which the company may classify as confidential, including technology, ideas, concepts evolved by the company and such information shall of all kinds in which include, words, scripts, documents., electronically stored data, encrypted information, designs, formulae, source codes, object codes, any intellectual property being developed or developed by the company. The terms and conditions stated in the said undertaking shall be in force even after you cease to be in the employment of the company.

Breach of terms and conditions contained herein shall be considered a breach of the terms and conditions of your employment and as misconduct on your part and may result in termination of your services by the Company, without notice or pay in lieu thereof.

Kindly sign and return to us a copy of this letter as confirmation of your acceptance of this appointment and the terms and conditions of your employment.

We wish you a long and fruitful association with CourseBricks.

Sincerely,

R. Ravi Shan

Ravishankar Rajagopalan
Founder
CourserBricks
ravishankar@coursebricks.com
+91 96633 97694

I have read, understood and agree to the terms and conditions set forth in this appointment letter

Signature:

____

Date:

Location:

HIBIZ SOLUTIONS
Technology • Innovation • Excellence

To,
Mr S. Seturathnam
No. 95, Sriramapuram, Royarthope,
Srirangam,
Trichy-620006
Email : sethurathinams14@gmail.com
Tel : 8903573191

Date: 29-Dec-2020

Letter of Offer

Dear Mr Seturathnam,

Further to our discussion we had with you, we are delighted to offer you the position of **System Analyst / Developer - Intern** with **Hibiz Solutions and Consultants** at Chennai.

Below are the specific terms and conditions of our offer – please read these important details including compensation and benefits and acknowledge.

Offer of Employment :
Your appointment will be effective on your date of joining, which shall be as soon as your complete your graduation / postgraduation but no later than **02nd June 2021**. Please contact us should you require an alternative date of joining.

As a campus select, you are also required to undergo an internship program from **18th Jan 2021 to May 31st 2021**. The program is being scheduled from Monday to Friday during this period and any exception to the above program will have to be with prior approval of management based on academia.

In the event of you fail to join us on or before **02nd June 2021**, this offer for appointment will stand automatically withdrawn without any further obligation from our side.

Probation Period : You will be on probation for a period of one year from your date of joining.

Remuneration:
During the Internship Program you will be paid a monthly stipend of **INR 12000** (Twelve thousand Rupees)
Upon employment you will be paid a monthly salary of **INR 25,000** (Twenty Five thousand Rupees only)
Post completion of the probation period , you will be entitled for a revision in compensation , and other benefits based on the policies applicable. Periodic performance reviews will be shared as part of our continuous performance initiatives .

Service Agreement :
You are required to agree and accept the service agreement for a 2 year period given the fact that the company will be investing in your professional development.

The roles and responsibilities of your assignment will be communicated to you on joining.

On behalf of the management, I extend to you a warm welcome and look forward to a mutually beneficial and enduring relationship.

Best Wishes,
K.Shelvakumari
For Hibiz Solutions and Consultants

Accepted :
Date :

C
Y
B
E
R
P
S
Y

St. MARTIN'S ENGINEERING COLLEGE

(UGC AUTONOMOUS)
A NON MINORITY COLLEGE, AFFILIATED TO JNTUH, APPROVED BY AICTE.
ACCREDITED BY NBA & NAAC A+, NIRF RANKED, ISO 9001:2008 CERTIFIED
SIRO RECOGNITION BY MINISTRY OF SCIENCE AND TECHNOLOGY, GOVT.OF INDIA
Dhulapally, Near Kompally, Secunderabad-500 100. T.S. India. www.smec.ac.in

Organized by Departments of Computer Science and Engineering & Information Technology, in Association with CYBERPSY

Certificate of Participation

Ms. Keerthana

Student, Department of IT

Saranathan College of Engineering, Tamilnadu

has actively participated in five days exclusively for women online workshop on "Women in Cyber Security and Privacy in 2020" from 6th to 10th July 2020.

Dr. P. Udaya Kumar	**Dr. S. V. Achuta Rao**	**Dr. P. Santosh Kumar Patra**
HOD - CSE	**HOD - IT**	**Principal**

TCS iON | Digital Learning Hub
Learn, Share, Collaborate

TATA CONSULTANCY SERVICES

This is to certify that

Shalini S

has successfully completed

Interview Skills

online course offered by TCS iON

Start Date: 16 Jun 2020 | **End Date:** 11 Jul 2020

Topics:

- Objectives
- Process before the Interview
- Process during the Interview
- Process after the Interview
- FAQ's

CERTIFIED
Cert. ID.: 66789-6514084-1016
Dated: 11 Jul 2020

Head - Learning,
iON Digital Learning Hub

Bishop Heber College

(Nationally Reaccredited with 'A' Grade by NAAC with a CGPA of 3.58 on 4 point scale)
(Recognized by UGC as 'College of Excellence')
Tiruchirappalli, Tamil Nadu.

CERTIFICATE OF PARTICIPATION

This certificate is to certify that Dr./Mr./Ms.

Aswini Devi.B of

Saranathan College of Engineering

has participated in the webinar **"Research Writing Tools and Techniques"** organized by the PG Department of Computer Applications, Bishop Heber College, Trichy on 15th July 2020 .

Thamarai Selvi. R

Dr. R. Thamarai Selvi,
Head, PG Department of Computer Applications,
Bishop Heber College, Trichy 17.

Dr. D. Paul Dhayabaran,
Principal,
Bishop Heber College, Trichy 17.

ANURAG UNIVERSITY

UNIVERSAL IN NATURE. INDIAN IN SPIRIT.

Ghatkesar, Hyderabad, Telangana - 500088

CERTIFICATE OF APPRECIATION

This is to Certify that Ms.M.R.Shalini of Saranathan College of Engineering participated in national level online "R Programming" Quiz Contest on 19th July 2020 and scored 68%, organized by MIND club of centre for training and development in advanced technologies (CTDAT), Dept. of ECE in association with ISTE.

K Sai Krishna Co-Convenor Anurag University	Dr. S. Sathees Kumaran Convenor & HOD/ECE Anurag University	Dr. K.S.Rao Director AGI

ID: F60A1F2BC90D

HackerRank

Certificate

This is to certify that

Vaitheeswaran L.M

has successfully cleared the assessment for the skill

Python (Basic)

25 Jul, 2020

Date

Harishankaran K

CTO, HackerRank

GUVI

tech deserves you

Vaitheeswaran L.M

is here by awarded the certificate of achievement for

the successful completion of

Step into Robotic Process Automation

during GUVI's RPA SKILL-A-THON 2020

S.P.Balamurugan

Co-founder, CEO

Valid certificate ID 455k09I7616j2T5u90

Verified certificate issue on July 26 2020

Verify certificate at www.guvi.in/certificate?id=455k09I7616j2T5u90

In association with

UiPath Academic Alliance

deeplearning.ai

COURSE CERTIFICATE

Aug 5, 2020

M.R.Shalini

has successfully completed

AI For Everyone

an online non-credit course authorized by DeepLearning.AI and offered through Coursera

EDUCATION FOR EVERYONE coursera COURSE CERTIFICATE

Adjunct Professor Andrew Ng
Computer Science Department
Stanford University

Verify at coursera.org/verify/3C62QECD3U95

Coursera has confirmed the identity of this individual and their participation in the course.

P. E. S. COLLEGE OF ENGINEERING, MANDYA

(An Autonomous Institution Affiliated to VTU, Belagavi, Aided by Govt. of Karnataka, Recognized by AICTE, New Delhi)

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

(NBA Accredited)

Collaborative Partner NATIONAL LEVEL ONLINE CODING CONTEST *Sponsored by*

eBOX AN AMPHISOFT PRODUCT 'C'ode Trek 1.0 TEQIP-3 Technical Education Quality Improvement Programme

Certificate of Participation

This is to Certify that Mr/Mrs/Ms Shalini S

of Saranathan College Of Engineering

has participated in the National Level Online Coding Contest titled as **'C'ODE Trek 1.0**, *organized by Department of IS & E, PESCE, Mandya in association with E - Box on 20th August 2020.*

Bramesh S M	**Dr. Vinay S**	**Dr. B. Dinesh Prabhu**	**Dr. H. V. Ravindra**
Event Co-ordinator	Professor & HOD	TEQIP Co-ordinator	Principal

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15/11/2020

Congratulations

Lavanya. G

For Passing The Quiz On Topic “Virtual Reality”
Conducted On 15th November 2020

Tharsini
COO

Microsoft

futureskills NASSCOM futureskills prime

CERTIFICATE

NALINI KG

PARTICIPATED IN

Microsoft AI Classroom Series

11-03-2021
Date of issue

Rohini Srivathsa
National Technology Officer
Microsoft India

Amit Aggarwal
CEO IT ITeS SSC
NASSCOM

SARAMAIL

Ms.Sangeetha Priya IT Depart <jspriya-it@saranathan.ac.in>

Fwd: MOU Between Saranathan and Inlustro -reg

2 messages

Ms.V.Punitha Asso Prof CSE Depart <punitha-it@saranathan.ac.in> Sat, Feb 27, 2021 at 8:07 PM
To: IT Depart Group <itstaff@saranathan.ac.in>

Dear Colleagues,
Kindly register yourself and ask your students to register.
CCs, collect students name list along with mail ids. Further instruction and installation procedure will be shared with you through email.
Regards,

---------- Forwarded message ---------
From: **Dr. S. A. Sahaaya Arul Mary CSE HOD** <mary-cse@saranathan.ac.in>
Date: Sat, Feb 27, 2021, 6:25 PM
Subject: Fwd: MOU Between Saranathan and Inlustro -reg
To: Ms.V.Punitha CSE Depart <punitha-it@saranathan.ac.in>

Dear Punitha,
Pls ask It students to attend this program by Inlustro

A Candle Loses Nothing by Lighting Another Candle
Dr. S. A. Sahaaya Arul Mary,
Head of the Department,
Computer Science and Engineering,
Saranathan College of Engineering,
Venkateswara Nagar, Panjapur,
Trichy -12.

---------- Forwarded message ---------
From: **Nithya Venkatesan** <nithya@inlustro.co>
Date: Fri, 26 Feb 2021 at 17:52
Subject: Re: MOU Between Saranathan and Inlustro -reg
To: Aditya Sambamoorthy <aditya@inlustro.co>
Cc: Dr. S. A. Sahaaya Arul Mary CSE HOD <mary-cse@saranathan.ac.in>, Principal of Saranathan College , <principal@saranathan.ac.in>, Aditya Sambamoorthy <aditya.sambamoorthy@steerclear.co>, Niwin Santhosh <niwin@inlustro.co>

Hello Ma'am

Greetings to you from InLustro!

We are writing this email to invite your students and faculty to a **statewide free-of-cost online data science Bootcamp.**

We are an Edutech firm (InLustro) that specialises in developing learning programs for college students aimed at preparing them for a successful career in today's competitive business landscape. We are partnering with a global nonprofit organisation **VizForSocialGood** (https://www.vizforsocialgood.com/) along with a couple of other corporates and colleges to organize this data science drive consisting of a **10-hour session spread over 5 days(2 hours each day).** We will be covering the basics of different aspects of Data Science that will help create a career pathway for the students in this emerging data-powered economy.

Schedule for the event:

DATE	TIME	TOPIC
1-3-2021	7 PM - 9 PM IST	**Data Visualisation**
2-3-2021	7 PM - 9 PM IST	**Basics of AI/ML**
3-3-2021	7 PM - 9 PM IST	**Deep Learning Part- 1**
4-3-2021	7 PM - 9 PM IST	**Deep Learning Part- 2**
5-3-2021	7 PM - 9 PM IST	**Reinforcement Learning**

Technologies Covered: **Scikit-learn, Tensorflow, Tableau**, and a few others.

This is an exclusive event wherein **participation is by invitation only**.

We are pleased to extend our invitation to the students and faculty of your esteemed institution.

For participating in the event kindly reach out to support@inlustro.co with the list of names and contact details of the participants.

Event link, installation instructions and set up details for the boot camp will be shared through a subsequent email to the participants.

Why Data Science?

>It's estimated that **over 1.5 lakh data science-based job openings will be generated in India within the next one year (2020-21)**

>70% of those openings will be aimed at freshers -just out of college with 0 yrs of work experience.

>However only 3% of our engineering graduates are qualified enough to take up the emerging job opportunity, leaving a majority of the vacancies unfilled.

Why this proposal now?

>Given the current Covid situation with the majority of students working from home, a virtual event will have tremendous participation, thereby benefiting a large number of students.

>We will be bringing multiple corporate speakers working for top firms to address the students in the workshop, giving them industrial exposure and an excellent networking opportunity.

>We will be certifying students participating in our hands-on training session and have planned an exhaustive syllabus that will qualify students for beginner level job openings in Data Science. This upskilling event will have an **unprecedented impact on graduate employability creating over 1 lakh job opportunities for our graduates with an average salary of 7 lakhs per annum**.

Who are we?
We are an ed-tech firm (InLustro) that collaborates with colleges to institute a customized and holistic learning program that trains students in the latest technological frameworks, while simultaneously exposing them to real-life problems through internships and other hands-on opportunities and equipping them with an array of people skills to embellish their portfolio.
We have over 300 students on our platform and have been running the program successfully for the past year **generating over 192 internship opportunities(within India and abroad), a 96% program placement rate, 20+ latest technology platforms, and multiple industry networking sessions. Under our tutelage, our students were selected for the nationwide CAWACH initiative as well.**

Our website link: https://www.inlustro.co

Please find attached the link for registration

Thanks,
Nithya V
Business Development Executive
Team Strategic Partnerships
InLustro

On Fri, 20 Nov 2020 at 09:01, Aditya Sambamoorthy <aditya@inlustro.co> wrote:

Respected Ma'am,

Thank you for the email. We have certainly reached the first milestone in our journey and I'm confident that with the support of the institution and under the approval and able guidance our honourable Principal and you, we can create a unique and powerful learning environment for our students to shape them into the leaders of tomorrow.

With Respectful Regards,
Aditya Sambamoorthy

On Thu, 19 Nov 2020 at 1:37 PM, Dr. S. A. Sahaaya Arul Mary CSE HOD <mary-cse@saranathan.ac.in> wrote:

Dear Aditya,
We have completed the MOU signing process. Scanned copy of the Signed MOU is attached for your reference.

thanks and regards
A Candle Loses Nothing by Lighting Another Candle
Dr. S. A. Sahaaya Arul Mary,
Head of the Department,
Computer Science and Engineering,
Saranathan College of Engineering,
Venkateswara Nagar, Panjapur,
Trichy -12.

InLustro Data Science Bootcamp (1).pdf
11070K

Ms.Sangeetha Priya IT Depart <jspriya-it@saranathan.ac.in> Sat, Feb 27, 2021 at 10:20 PM
To: saraIT2k17-21@googlegroups.com

Dear Students,

Free webinar has been arranged for you from inlustro.Data science bootcamp is more emerging area and very demanded course in industry.please go thro' the email enclosed with this mail.
College has arranged this at free of cost.Do registration before tomorrow morning 11am.
It's compulsory to everyone.
After registration, pls enter your name,batch no, email id in the following link.
https://drive.google.com/file/d/1OIRkNDUY2Tawx0C18zV5OsEgg97s8EvR/view?usp=drivesdk

Thanks
[Quoted text hidden]

InLustro

viz for social good

This certifies that

Dhivya Jai Sree G B

has successfully taken the **1st step towards a career in Data Science** by attending the Statewide Data Science Bootcamp conducted from **1st March - 5th March, 2021**

ADITYA SAMBAMOORTHY
Founder & CEO
InLustro Learning Pvt.Ltd.

AISHWARYA SIVAKUMAR
Chennai/Bangalore Chapter Leader
VizForSocialGood

CERTIFICATE OF COMPLETION

THIS CERTIFIES THAT

DHIVYA JAI SHREE G B

has successfully completed the course - **Introduction to Machine Learning** and the examination

ADITYA SAMBAMOORTHY
FOUNDER, INLUSTRO

InLustro

CERTIFICATE OF COMPLETION

THIS CERTIFIES THAT

LAVANYA G

has successfully completed the course – **Introduction to Machine Learning** and the examination

ADITYA SAMBAMOORTHY

FOUNDER, INLUSTRO

InLustro

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This certifies that

Keerthana Shanmugam

has successfully taken the ***1st step towards a career in Data Science*** *by attending the Statewide Data Science Bootcamp conducted from* ***1st March - 5th March , 2021***

ADITYA SAMBAMOORTHY
Founder & CEO
InLustro Learning Pvt.Ltd.

AISHWARYA SIVAKUMAR
Chennai/Bangalore Chapter Leader
VizForSocialGood

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CERTIFICATE OF COMPLETION

This recognizes

KEERTHANA S

as having successfully completed the Basics of Data Structures and Algorithms course and passed the examination with Honours.

ADITYA SAMBAMOORTHY

Founder, InLustro

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Course Name	Exam date
Data Mining	17-12-2020
Basics in Inorganic Chemistry	17-12-2020
Basics in Inorganic Chemistry	17-12-2020
Basics in Inorganic Chemistry	17-12-2020
Microprocessors and Interfacing	17-12-2020
Microprocessors and Interfacing	17-12-2020
Electrical Machines - II	17-12-2020
Microprocessors And Microcontrollers	17-12-2020
Microprocessors And Microcontrollers	17-12-2020
Fuzzy Logic and Neural Networks	17-12-2020
Fuzzy Logic and Neural Networks	17-12-2020
Transform Calculus and its applications in Differential Equations	17-12-2020
Transform Calculus and its applications in Differential Equations	17-12-2020
Transform Calculus and its applications in Differential Equations	17-12-2020
Transform Calculus and its applications in Differential Equations	17-12-2020
Principles of Human Resource Management	17-12-2020
Principles of Human Resource Management	17-12-2020
Principles of Human Resource Management	17-12-2020
Marketing Research and Analysis - II	17-12-2020
Electromagnetism	17-12-2020
Electromagnetism	17-12-2020
Demystifying Networking	18-12-2020
Patent Drafting for Beginners	18-12-2020
DC Microgrid and Control System	18-12-2020
Body language: Key to professional Success	18-12-2020
Body language: Key to professional Success	18-12-2020
Advances in UHV Transmission and Distribution	18-12-2020
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Body language: Key to professional Success	18-12-2020
DC Microgrid and Control System	18-12-2020
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Demystifying Networking	18-12-2020
Product Design and Development	18-12-2020
Solar Photovoltaics Fundamentals, Technology And Applications	18-12-2020
Advanced Probability Theory	18-12-2020
Introduction to Programming in C	18-12-2020
Selection Of Nanomaterials For Energy Harvesting And Storage Application	18-12-2020
Introduction to Smart Grid	18-12-2020
Patent Drafting for Beginners	18-12-2020
Product Design and Development	18-12-2020
Solar Photovoltaics Fundamentals, Technology And Applications	18-12-2020
Selection Of Nanomaterials For Energy Harvesting And Storage Application	18-12-2020

Advanced Probability Theory	18-12-2020
Python for Data Science	18-12-2020
Product Design and Development	18-12-2020
Demystifying Networking	18-12-2020
Technologies For Clean And Renewable Energy Production	18-12-2020
Geotechnical Engineering Laboratory	18-12-2020
Introduction to Operating Systems	18-12-2020
Cloud computing	18-12-2020
Problem solving through Programming In C	19-12-2020
Problem solving through Programming In C	19-12-2020
Digital Circuits	19-12-2020
Numerical methods	19-12-2020
Corrosion - Part I	19-12-2020
Numerical methods	19-12-2020
Co-Ordination Chemistry (Chemistry Of Transition Elements)	19-12-2020
Digital Circuits	19-12-2020
Biomedical nanotechnology	19-12-2020
Object Oriented System Development using UML, Java and Patterns	19-12-2020
Solar Energy Engineering and Technology	19-12-2020
Problem solving through Programming In C	19-12-2020
The Joy of Computing using Python	19-12-2020
Programming in Java	19-12-2020
Introduction to Industry 4.0 and Industrial Internet of Things	19-12-2020
Application of Spectroscopic Methods in Molecular Structure Determination	20-12-2020
A basic course in number theory	20-12-2020
Introductory Organic Chemistry I	20-12-2020
Power system analysis	20-12-2020
Introduction to Wireless and Cellular Communications	20-12-2020
Microwave Theory and Techniques	20-12-2020
Basic Electrical Circuits	20-12-2020
A basic course in number theory	20-12-2020
Design of photovoltaic systems	20-12-2020
Microwave Theory and Techniques	20-12-2020
A basic course in number theory	20-12-2020
Power Electronics	20-12-2020
A basic course in number theory	20-12-2020
Design of photovoltaic systems	20-12-2020
Introduction to Wireless and Cellular Communications	20-12-2020
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Introduction to Wireless and Cellular Communications	20-12-2020
Ecology and Environment	20-12-2020
Basic Electrical Circuits	20-12-2020
A basic course in number theory	20-12-2020
Basics Of Finite Element Analysis-I	20-12-2020
Big Data Computing	20-12-2020

Introduction to internet of things	20-12-2020
Developing Soft Skills and Personality	20-12-2020
International Business	20-12-2020
Soil Mechanics/Geotechnical Engineering I	20-12-2020
Developing Soft Skills and Personality	20-12-2020
Basics Of Finite Element Analysis-I	20-12-2020
Soft skills	20-12-2020
Introduction to Machine Learning	20-12-2020
Basics Of Finite Element Analysis-I	20-12-2020
Automation in Manufacturing	20-12-2020
Soft skills	20-12-2020

Exam session	Test Center name
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Total number of candidates certified in this course: **3157**

Prof. G P Raja Sekhar
Dean, Continuing Education
IIT Kharagpur

Sep-Dec 2020
(12 week course)

Prof. Debjani Chakraborty
Coordinator, NPTEL
IIT Kharagpur

Indian Institute of Technology Kharagpur

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Roll No: NPTEL20CS58S62410487

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1919,RKVNAGAR, NO.1 TOLGATE, BIKCHANDAR
KOIL(PO)
MANNACHANALLUR(TK)
TRICHY
TAMILNADU - 621216
PH. NO :8524800534

Score	Type of Certificate
>=90	Elite+Gold
75-89	Elite+Silver
>=60	Elite
40-59	Successfully Completed
<40	No Certificate

No. of credits recommended by NPTEL:3

An additional 1 credit may be awarded if the University deems it fit, based on the actual student effort involved.

Elite

NPTEL Online Certification

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KEERTHANA S

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Programming in Java

with a consolidated score of **80** %

Online Assignments	24.56/25	Programming Exam	23.25/25	Proctored Exam	32/50

Total number of candidates certified in this course: **3157**

Prof. G P Raja Sekhar
Dean, Continuing Education
IIT Kharagpur

Sep-Dec 2020
(12 week course)

Prof. Debjani Chakraborty
Coordinator, NPTEL
IIT Kharagpur

Indian Institute of Technology Kharagpur

FREE ONLINE EDUCATION swayam

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SARANATHAN COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

(Accredited by NBA)

REPORT FOR SLOW LEARNERS

Academic Year: 2020-2021 **26.03.21**

Due to the Pandemic situation we have conducted classes through online mode. To enable the Slow Learners we have sent Part-A question & answers for all the five units. Important questions for Part B were sent to the slow learners. Periodically we have conducted the Assessment test for those students. Based on the feedback of the assessment test, we have conducted retest to the slow learners. Important and expected part C questions were taught to those students.

26/3/21

HoD/CSE

SARANATHAN COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
TIRUCHIRAPALLI - 620 012.

Date: 31.05.2020

Submitted to: The Principal

Through : The HOD/ECE

Sub: Requisition letter for conducting Workshop for Second year ECE Students during Lockdown days- Reg

Respected Sir,

We are planning to conduct a Workshop on **"Practical Intro to image processing on Google Colab - Python Platform"** for second year ECE students during lock down days between 10.06.2020 and 12.06.2020, Timing 11.00 AM to 12.30 PM. This workshop will be useful for the students to explore about cloud serviced Google Colab which offers a free GPU for processing. We hereby attached the invitation and schedule for your kind perusal. We kindly request you to provide approval for the above mentioned workshop.

Thanking you

Regards,

Ms.A.Shamim Banu & Ms.V.Ramya/ AP/ECE

SARANATHAN COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
TIRUCHIRAPALLI - 620 012.

Date: 31.05.2020

Workshop on "Practical Intro to image processing on Google Colab - Python Platform"

Date: 10.06.2020, 11.06.2020, 12.06.2020

Participants: Second year ECE students

Course Co ordinators: Ms.A.Shamim Banu & Ms.V.Ramya/AP/ECE

Benefits of the workshop

Gain a good exposure to the python and Google colab
Fully Hands on experience
Can use this experience to develop good projects in image processing domain
E certificates to all the participants

Requirement for this online workshop

Desktop computer or laptop with sufficient Internet speed.

Registration link

https://docs.google.com/forms/d/e/1FAIpQLSfuj00cDaqQ6RUK2O8x9WSko7L0wyMnQn6oJ1bWFj2cjiXm7g/viewform?usp=sf_link

SARANATHAN COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
TIRUCHIRAPALLI - 620 012.

Date: 31.05.2020

No Registration Fee

Workshop on "Practical Intro to image processing on Google Colab - Python Platform"

Topics to be covered

Day 1

Introduction to Digital Image Processing

Introduction to Python and Google colab Libraries

Fundamental of digital image- Colour Space RGB, Lab, Hsv

Data visualization – Line chart , Histograms , Box Plot

Day 2

Pre Processing of digital Images- Resizing, Gray scaling and image denoising

Thresholding- Simple, Adaptive , Otsu's Binarization.

Morphological Operations – Erode, Dilate

Edge Detection- Canny, sobel operators

Day3

Image segmentation using Water shed algorithm and K Means Clustering

Color Detection

Assessment Test to the participants

SARANATHAN COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
TIRUCHIRAPALLI - 620 012.

Date: 31.05.2020

Feedback about the workshop

SARANATHAN COLLEGE OF ENGINEERING
DEPARTMENT OF ECE
Practical Intro to image processing on Google Colab - Python Platform
Quiz score

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SARANATHAN COLLEGE OF ENGINEERING
DEPARTMENT OF ECE
Practical Intro to image processing on Google Colab - Python Platform
ATTENDANCE ON 10.6.2020

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SARANATHAN COLLEGE OF ENGINEERING
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41	Poornima	212071	poornimas013@gmail.com
42	Preethi.B	212073	preethimsi216@gmail.com
43	Rahul R	212075	rahulrio2001@gmail.com
44	M. Rathna	212077	rathnamuthukumar18@gmail.com
45	M.Rithikaa	212081	rithikaapillai236@gmail.com
46	RUBIGA M	212082	sandhinikrishnan143@gmail.com
47	N.Santhosh	212087	nsnthsh50@gmail.com
48	B.Sathya	212089	sathiyaababy1@gmail.com
49	Sharmila	212093	sharmiravi161@gmail.com
50	sharmini.s	212094	ssharmini.2000@gmail.com
51	Swasthika R	212108	swasthikaraju@gmail.com
52	Swathi	212109	swathiravi1611@gmail.com
53	Tejaswini	212110	tejasaravanan13@gmail.com
54	varadakrishnan B	212113	bkvarada59@gmail.com
55	M.varshaa	212114	varshaanetball@gmail.com
56	Uma Ramakrishnan	212112	umaramki.er@gmail.com
57	Gokila.v	212119	

SARANATHAN COLLEGE OF ENGINEERING

DEPARTMENT OF ECE

Practical Intro to image processing on Google Colab - Python Platform

ATTENDANCE ON 12.6.2020			
S.No	**Student Name**	**Batch Number**	**e-mail address**
1	M.Aaisha Thahseena	212001	amrkayisha2000@gmail.com
2	ABDUL RAHMAN.M	212002	rahman786786abdul@gmail.com
3	S.Abinaya	212004	abinayasammandam@gmail.com
4	A.AJAIPRAMOTH	212007	ajaipramothtvr@gmail.com
5	S.Ajay	212008	ajayajay5489@gmail.com
6	Akshaya Godina	212009	akshayagodina@gmail.com
7	R. Atchaya	212013	atchayarajendran116@gmail.com
8	Atshaya R	212015	atshaya0106@gmail.com
9	Banupriya.B	212017	bbanu5057@gmail.com
10	Caroline Ruby	212019	rubycaroline2000@gmail.com
11	Cavwin Dheepak R	212020	cavwindheepak30600@gmail.com
12	M. Charudharshana	212021	charumahes2000@gmail.com
13	B. Dhaarani	212023	dhaaranibalakrishnan0@gmail.com
14	G.Dhanavidhya	212024	dhanavidhya0711@gmail.com
15	J.Dhaniya lakshmi	212025	dhanilakshu97@gmail.com
16	R.Dinesh ram	212027	rdineshram2001@gmail.com
17	M.Diravidamani	212028	diravidamani2507@gmail.com
18	S.Divya Bharathi	212029	sriyadiv@gmail.com
19	R.Durgasri	212030	durgasri462@gmail.com
20	D. Jannifer	212035	janniferraj2829@gmail.com
21	Jayapriya.M	212036	jayapriyamehanathan@gmail.com
22	Jayashree.RI	212037	jayashreesubha20@gmail.com
23	kadhirmani.s	212040	kadhirmoney12122000@gmail.com
24	G.karishma	212042	karishma.gs22@gmail.com
25	karthiga devi .g	212043	karthigs2000@gmail.com
26	Kavimani A	212045	kavikavi2781@gmail.com
27	S. Kaviya	212046	kaviyasureshsk2000@gmail.com
28	kavya ks	212047	kskavya2000@gmail.com
29	G.R.Keerthana	212048	keerthugr30@gmail.com
30	Kingsley Patrick Joy J	212049	kingsleyjoy0810@gmail.com
31	G. Kishore	212050	kishorekeer7520@gmail.com
32	Manikandan	212056	rmanikandan1811@gmail.com
33	V. Manodurga	212057	manodurga09@gmail.com
34	Mohamed Uwais K	212061	mohameduwais22@gmail.com
35	Nagammai N	212062	kaaviyanagappan31@gmail.com
36	NIKHIL RAJ	212064	nikhilmanimaran23@gmail.com
37	Niruban	212065	nirubanjeevarathinam@gmail.com
38	B.pavitra	212068	pavi29bala@gmail.com
39	D.POOJA	212070	poojagomez111@gmail.com
40	Preethi.B	212073	preethimsi216@gmail.com
41	Rahul R	212075	rahulrio2001@gmail.com
42	M. Rathna	212077	rathnamuthukumar18@gmail.com
43	M.Rithikaa	212081	rithikaapillai236@gmail.com
44	RUBIGA M	212082	sandhinikrishnan143@gmail.com
45	N.Santhosh	212087	nsnthsh50@gmail.com
46	Sharmila	212093	sharmiravi161@gmail.com
47	sharmini s	212094	ssharmini.2000@gmail.com
48	Swasthika R	212108	swasthikaraju@gmail.com
49	Swathi	212109	swathiravi1611@gmail.com
50	Tejaswini	212110	tejasaravanan13@gmail.com
51	Uma Ramakrishnan	212112	umaramki.er@gmail.com
52	varadakrishnan B	212113	bkvarada59@gmail.com
53	m.varshaa	212114	varshaanetball@gmail.com
54	V.Gokila.	212119	abarnavetri10@gmail.com

SARANATHAN COLLEGE OF ENGINEERING
DEPARTMENT OF ECE
Practical Intro to image processing on Google Colab - Python Platform
Feed back Given by students

Email Address	Name of Participant	Batch Number	would you rate the	you prefer more	the quality of the	would you rate the	would you rate the	would you rate your	7. Do you have any suggestion(s) as to how we could improve similar programmes/activities in future?
a2000@gmail.com	Thahseena	212002	3	4	3	3	4	3	No suggestion
rahman786786abdul@gmail.com	ABDUL RAHMAN.M	212002	4	5	4	4	5	5	Im not having any suggestion mam..the work shop was very useful and we can able to utilize these lock down days to gain some knowledge about something which we don't know at all..thank you mam
mmandam@gmail.co	S.Abinaya	212004	3	5	5	4	4	4	By giving some more time for practicing the program
89@gmail.com	S.Ajay	212008	5	5	5	5	5	5	Keep doing this kind of workshop its very useful to us!!
dina@gmail.com	Akshaya Godina	212009	5	5	4	5	4	4	No
endran116@gmail.co	R. Atchaya	212013	5	5	5	5	5	5	No
kar@gmail.com	Aathisankar	212014	4	4	4	4	3	3	Nothing
06@gmail.com	Atshaya R	212015	4	5	5	5	5	4	The timming of the workshop can be extend like for 3 hrs per day and so we can learn may more programs.
7@gmail.com	B.Banupriya	212017	5	4	4	5	4	5	It was so good and informative.
ne2000@gmail.com	Caroline Ruby	212019	4	5	5	5	4	5	Like to have more workshops like this
epak30600@gmail.c	Dheepak R	212020	4	5	4	4	4	5	I think more time can be given to explaining the programs, since many felt it to be new. Apart from that, it was good and interesting.
es2000@gmail.com	Charudharshana	212021	5	5	4	5	5	5	No
alakrishnan0@gmail.	B. Dhaarani	212023	5	5	5	5	5	5	You could conduct more workshops based on programing skills
ya0711@gmail.com	G.Dhanavidhya	212024	4	4	4	4	3	4	No ,Felt good
u97@gmail.com	J.Dhaniyalakshmi	212025	4	4	4	4	4	4	Yes
m2001@gmail.com	R.Dineshram	212027	5	5	5	5	5	5	We want more useful programs like this in future
sriyadiv@gmail.com	S.Divya Bharathi	212029	3	4	4	3	5	3	No suggestion
2829@gmail.com	D. Jannifer	212035	4	5	5	5	5	4	Already it's the better way of teaching, but due to some network issues I can't get some points u told otherwise it's good mam □,thank you
ehanathan@gmail.co	Jayapriya.M	212036	5	5	5	5	5	5	Honestly this is very innovative and informative workshop ...I want some more useful workshops like this ...□
ubha20@gmail.com	Jayashree .RI	212037	4	5	4	4	4	4	we expect more workshop like this
ey12122000@gmail.	kadhirmani. s	212040	4	5	4	4	3	3	This need to be some more interactive
gs22@gmail.com	G.karishma	212042	4	5	4	4	4	3	Program should be briefly taught
00@gmail.com	Karthiga devi .g	212043	5	5	5	5	5	5	Same procedure can be followed as a spark this workshop was very interesting.
81@gmail.com	KAVIMANI A	212045	5	5	5	5	5	5	It's good only. No any suggestions
shsk2000@gmail.co	S. Kaviya	212046	5	5	5	5	5	5	the staffs who took efforts for us to teach such an interesting and wonderful concept to us. We will really try to know more about this topic in order to get the basic more stronger.it was really very helpful.
00@gmail.com	kavya.ks	212047	4	4	4	4	4	4	We expect more workshop like this.
0@gmail.com	G.R.Keerthana	212048	5	5	4	4	4	5	Nothing
y0810@gmail.com	Y PATRICK	212049	5	5	5	5	5	5	It would be easier for us if there are workshops and other activities on Saturday's in our college for gaining knowledge apart from syllabus.
r7520@gmail.com	G. Kishore	212050	4	5	5	5	4	4	Try to extend the period of the workshop. It will help to learn more topics
hank00@gmail.com	Madhesh. S	212054	4	4	4	4	3	3	If possible many ideas and examples could improve us further
a09@gmail.com	V.Manodurga	212057	5	4	5	5	4	4	It is well and good for me
gappan31@gmail.co	Nagammai N	212062	5	4	5	5	5	4	No...the session was very useful
maran23@gmail.co	NIKHIL RAJ	212064	4	3	3	4	4	4	None
varathinam@gmail.	Niruban	212065	5	4	5	5	5	5	THIS WORKSHOP IS USEFUL FOR FURTHER WORKSHOPS WE EXPECT YOU TO GIVE MORE EXPLANATION ABOUT PROGRAM
@gmail.com	B pavitra	212068	4	5	4	4	5	4	Yes mam ,this course was useful and learning about an unknown topic is quite interesting and we can do go through workshops with different topics as well.
z111@gmail.com	D.POOJA	212070	4	3	4	4	4	4	---
216@gmail.com	Preethi.B	212073	5	5	4	4	4	4	No more suggestions mam....only the quality of the network can be improved .
01@gmail.com	Rahul R	212075	4	5	5	4	4	4	Can give more examples to a program...
hukumar18@gmail.c	M. Rathna	212077	4	4	4	4	4	4	Give some aliter method to executive program
ai236@gmail.com	M.Rithikaa	212081	4	4	5	4	4	4	Except for a few network issues everything went well during the workshop.
shnan143@gmail.co	RUBIGA M	212082	4	4	5	4	4	4	I except more workshops like this.
@gmail.com	N.Santhosh	212087	4	4	5	5	4	4	Useful and need more with short days courses
by1@gmail.com	B.Sathya	212089	4	4	4	4	5	3	I have no suggestions now itself it's very good maybe the time duration can be extended for learning more like having two sessions a day
161@gmail.com	R. Sharmila	212093	4	4	4	5	4	4	Audio clarity
2000@gmail.com	sharmini s	212094	5	5	5	4	5	4	yes , we atr interested in learning similar activities in future
1611@gmail.com	Swathi IR	212109	4	5	4	4	5	4	Breaking of voice can be reduced...other than that ..it's a very usefull informative session
nan13@gmail.com	Tejaswini	212110	4	4	5	4	4	4	No, the way of teaching by the staff members was very good.
er@gmail.com	Ramakrishnan	212112	5	5	5	5	5	3	No mam..i think this was more than enough.□
tball@gmail.com	M.varshaa	212114	4	5	5	4	4	4	Its good & i request you to have workshop on Artificial Intelligence
i10@gmail.com	V.Gokila	212119	5	5	4	5	5	5	No
@outlook.com	Nigilesh	212063	5	5	5	5	5	5	This workshop is very much useful for me. In future the materials can be provided at the earliest for our reference as this could save some plenty of time and we could explore more. Ppt can also be sent to students after the workshop finished.

https://docs.google.com/spreadsheets/d/1tvJ8qnIEBOaK3t8BspzRG-C4ho3oGNR4g4SCXbBhPgM/edit#gid=1872868914

SARANATHAN COLLEGE OF ENGINEERING, TRICHY-621112

Department of ECE

12.06.2020

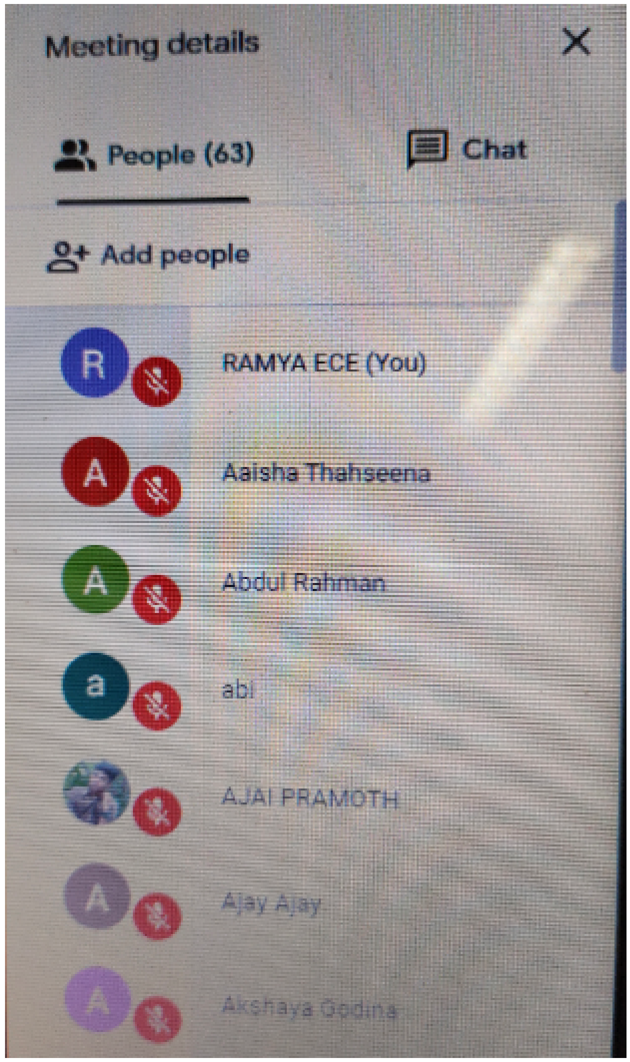
During COVID19 pandemic, Department of ECE organized an online workshop on **"Practical Intro to Image Processing on Google Colab - Python Platform"** between 10.06.2020 and 12.06.2020 during 11.00 A.M to 12.30 P.M. In this workshop, 54 students of second year ECE actively participated.

In this workshop, Basic concepts, Morphological operations, Thresholding, Binarization, Edge detection and Segmentation algorithms of Image Processing and programming on Google Colab in python Platform were discussed. At the end of the workshop, online quiz was conducted to assess the performance to the students.

To motivate their continuous learning in this domain, they are insisted to do a project and submit the same on 17.06.2020(Wednesday).

Some snaps during the workshop


12


Meeting details
People (63)
Chat
Add people
RAMYA ECE (You)
Aaisha Thahseena
Abdul Rahman
abi
AJAI PRAMOTH
Ajay Ajay

SARANATHAN COLLEGE OF ENGINEERING

Venkateswara Nagar, Panjapur,Tiruchirappalli-620012.

Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms M.Aaisha Thahseena of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

SARANATHAN COLLEGE OF ENGINEERING

Venkateswara Nagar, Panjapur,Tiruchirappalli-620012.

Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms **ABDUL RAHMAN M** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

SARANATHAN COLLEGE OF ENGINEERING

Venkateswara Nagar, Panjapur,Tiruchirappalli-620012.

Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms **S.ABINAYA** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
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SARANATHAN COLLEGE OF ENGINEERING

Venkateswara Nagar, Panjapur,Tiruchirappalli-620012.

Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms A.AJAIPRAMOTH of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
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Venkateswara Nagar, Panjapur,Tiruchirappalli-620012.

Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms S.Ajay of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
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Convenor & Head/ECE
Dr. M.Santhi

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms **Akshaya Godina** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms R.Atchaya of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
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Department of Electronics and Communication Engineering

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This is to certify that Mr/Ms R.Atshaya of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020*****.**

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Ms. V.Ramya
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms **B.Banu priya** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators Ms.A.Shamim Banu & Ms. V.Ramya AP-ECE	Convenor & Head/ECE Dr. M.Santhi	Principal Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms Caroline Ruby of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020*****.**

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms Cavwin Dheepak of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

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Dr. M.Santhi

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms **M. Charudharshana** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Certificate Of Participation

This is to certify that Mr/Ms **B.Dhaarani** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms G.Dhanavidhya of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Certificate Of Participation

This is to certify that Mr/Ms **J.Dhaniya lakshmi** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
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Certificate Of Participation

This is to certify that Mr/Ms R.Dinesh Ram of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
AP-ECE

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms M.Diravidamani of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms S.Divya Bharathi of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

SARANATHAN COLLEGE OF ENGINEERING

Venkateswara Nagar, Panjapur,Tiruchirappalli-620012.

Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms R.Durgasri of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020*****.**

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms D. Jannifer of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

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Dr.D.Valavan

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Certificate Of Participation

This is to certify that Mr/Ms M. Jayapriya of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020*****.**

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

SARANATHAN COLLEGE OF ENGINEERING

Venkateswara Nagar, Panjapur,Tiruchirappalli-620012.

Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms Jayashree.RI of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators
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Ms. V.Ramya
AP-ECE

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms S.Kadhirmani of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms G.karishma of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co- ordinators
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Ms. V.Ramya
AP-ECE

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms **G. karthiga Devi** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Ms. V.Ramya
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms A.KAVIMANI of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

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Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms **S.Kaviya** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Ms. V.Ramya
AP-ECE

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Principal
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Certificate Of Participation

This is to certify that Mr/Ms KS.Kavya of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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AP-ECE

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms G.R.Keerthana of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms **J. Kingsley Patrick Joy** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators
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Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms G.Kishore of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
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Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms S. Madhesh of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators **Ms.A.Shamim Banu &** **Ms. V.Ramya** **AP-ECE**	**Convenor & Head/ECE** **Dr. M.Santhi**	**Principal** **Dr.D.Valavan**

SARANATHAN COLLEGE OF ENGINEERING

Venkateswara Nagar, Panjapur,Tiruchirappalli-620012.

Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms Manikandan of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms V.Manodurga of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms K.Mohamed Uwais of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020*****.**

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms N. Nagammai of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms D.Nigilesh of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
Ms.A.Shamim Banu &
Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms M.NIKHIL RAJ of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms **Niruban** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms B.pavitra of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms D.POOJA of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms B.Preethi of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
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AP-ECE

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Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms **R.Rahul** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Ms. V.Ramya
AP-ECE

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Principal
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms M. Rathna of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
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AP-ECE

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Principal
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms M.Rithikaa of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
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Ms. V.Ramya
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms RUBIGA M of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
AP-ECE

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms **N.Santhosh** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Principal
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms B.Sathya of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Ms. V.Ramya
AP-ECE

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Principal
Dr.D.Valavan

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Certificate Of Participation

This is to certify that Mr/Ms R.Sharmila of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Ms. V.Ramya
AP-ECE

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Dr. M.Santhi

Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms S.Sharmini of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
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Ms. V.Ramya
AP-ECE

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Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms R.Swasthika of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Ms. V.Ramya
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms Swathi. IR of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms S.Tejaswini of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Certificate Of Participation

This is to certify that Mr/Ms R.Uma of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020.*

Co-ordinators
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Certificate Of Participation

This is to certify that Mr/Ms **B.Varadakrishnan** of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" *from 10.06.2020 to 12.06.2020*.

Co-ordinators
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AP-ECE

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Principal
Dr.D.Valavan

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Department of Electronics and Communication Engineering

Certificate Of Participation

This is to certify that Mr/Ms M.Varshaa of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020.***

Co-ordinators
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Ms. V.Ramya
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Principal
Dr.D.Valavan

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Certificate Of Participation

This is to certify that Mr/Ms V. Gokila of Second year ECE Student attended the Online Workshop on "Practical Intro to Image Processing on Google Colab - Python Platform" ***from 10.06.2020 to 12.06.2020*****.**

Co-ordinators
Ms.A.Shamim Banu & Ms. V.Ramya
AP-ECE

Convenor & Head/ECE
Dr. M.Santhi

Principal
Dr.D.Valavan

Dated: 27th May, 2020

F. No.67-20/RIFD/GOC/POLICY-1/2018-19

All India Council for Technical Education
(A Statutory body under Ministry of HRD, Govt. of India)
Nelson Mandela Marg,Vasant Kunj, New Delhi-110070 Website: www.aicte-india.org

GOC - Sanction Letter for E-Conference

To

The Director/ Principal/ Registrar
Saranathan College of Engineering,
Venkateswara Nagar, Edamalaipattipudur-Post,
Panjappur-Village, Srirangam-Taluk,
Tiruchirappalli, Tamil Nadu-620012

Subject: To organize Conference in online mode i.e. **E-Conference** under the scheme **Grant for Organizing Conference (GOC)**-reg.

Sir/ Madam,

With reference to the Sanction Letter No.67-20/RIFD/GOC/POLICY-1/2018-19 dated-15.11.2019 and proposal submitted by your institute, this is to convey that an amount of Rs. **500000/- (Rupees Five lakh only)** was sanctioned and released to your institute in the month of December-2019 for organizing Conference under the scheme **Grant for Organizing Conference (GOC)**, as per details given below:

1.	Name and address of the Beneficiary Institution:	**Director/ Principal/ Registrar** Saranathan College of Engineering, Venkateswara Nagar, Edamalaipattipudur-Post, Panjappur-Village, Srirangam-Taluk, Tiruchirappalli, Tamil Nadu-620012
2.	Permanent ID of Institute:	1-4190371
3.	Title of Conference:	International Conference on Cutting Edge Technologies on Electrical, Communication, Embedded system and soft computing techniques
4.	Name of Coordinator:	Dr. Vijayalakshmi Subramanian

The grant was released to the institute's account as per details given in table below:

Institute PAN No.	Bank Name	Bank Branch Name	Bank Branch Address	Account Holder Name	Account Type	Account Number	IFSC Code
AAETS6115N	CITY UNION BANK	TIRUCHIRAPALLI MAIN	Kalli Amman Koil Street, SIGC Campus, Tiruchirapalli	SARANATHAN COLLEGE OF ENGINEERING	Saving Account	02300100013831 8	CIUB0000023

The grant was released to organize the conference in physical mode, but due to outbreak of COVID-19, the Council has decided to give option to the institutions to organize the conference in online mode only i.e. E-Conference with additional terms and conditions.

Note:

1. If your institute has organized the conference in the stipulated time, then you are intimated to submit the requisite documents along with balance amount, if any.
2. If your institute has not organized the conference after receipt of grant, then you are allowed to organize the conference in online mode i.e. E-Conference within 6 months of receipt of this letter.
3. If your institute does not want to organize the **E-conference**, then you are required to refund the complete grant along with the interest accrued thereon.
4. The grant from AICTE will be **Rs. 50,000 or 1/3rd of the total expenditure incurred** for organizing the **E-Conference**, whichever is lesser. Rest amount is required to be refunded to AICTE.

The instructions/guidelines to be followed by College/Institution

I. Limit of Funding

a. The grant from AICTE will be **Rs. 50,000** or **1/3rd of the total expenditure incurred** for organizing the **E-Conference**, whichever is lesser.
b. The balance amount should be immediately refunded to AICTE with interest accrued thereon.

There may be the following expenditure heads under **E-Conference**:

a. Certificate/Brochure and other documents designing.
b. Conference website designing & updating.
c. Honorarium to Experts/ Resource Persons.
d. Publication of proceedings.
e. Miscellaneous.

II. Submission of documents by college/institution to AICTE on receipt of this letter/grant

a. The Acceptance letter with dates for Organizing **E-Conference** should reach this office within 15 days from the date of receipt of this Sanction Letter duly signed and sealed by Coordinator and Head of the institution along with permission/clearance of Govt. of India for organizing E-Conference.

III. Maintenance of accounts

a. The Institute shall strictly follow the provisions laid down in this Letter No. F. No. 67-20/ RIFD/GOC/Policy-1/2018-19 dated: 27-05-2020 issued by this office. All correspondence related to the conference must contain this number along with year of sanction of the conference failing which correspondence will not be entertained.
b. Funds covered by this grant shall be kept separately and would not be mixed up with other funds, so as to know the amount of interest accrued on the grant.
c. The University/College/Institute shall maintain proper accounts of the expenditure out of the grant.
d. The Council or its nominee shall have the right to check/verify the account to satisfy that the fund has been utilized for the purpose for it was sanctioned.

IV. Refund of grant to AICTE (by way of a demand draft in favour of Member Secretary, AICTE, New Delhi)

a. In case the event is cancelled or institute does not want to organize the E-Conference, the fund released should be immediately refunded to AICTE with interest accrued thereon.
b. The grant shall be refunded to AICTE if the Letter of Approval (LOA) or Extension of Approval is not issued by AICTE to the institute for the academic year 2019-20
c. The proposed/approved **E-Conference** shall be conducted within 6 months from the date of receipt of this letter. If **E-conference** is not conducted within stipulated time period, the released amount, along with interest accrued thereon, has to be necessarily returned to AICTE within one month, failing which penalty @ 18% will be levied.
d. Interest accrued on the grant released, shall be refunded to AICTE.
e. No payment is permissible against the conference **already conducted** before the receipt of grant. Institutions are liable to refund the grant if received after the conduct of conference and have no plan of conducting the **E-conference** ahead.
f. As AICTE needs adequate time for depositing the Demand Draft in the bank, the same be immediately dispatched to avoid any lapse of the validity period.

V. Submission of documents by college/institution to AICTE after conduct of conference

The following documents must be submitted to AICTE within a period of one month, from the date of conduct of Conference:

a. Feedback form in the prescribed proforma.

b. Original Statement of actual Expenditure & Utilization Certificate in the prescribed proforma duly signed by the Head of the institution and countersigned by Registrar/Finance Officer/Govt. Auditor. In case of self-financing/private institutions, Statement of actual Expenditure & Utilization Certificate are required to be audited & signed by a Charted Accountant (with membership no., full address & stamp). Photocopies of formats are enclosed.

c. Copy of the proceedings/Project completion report.

d. Attested photocopies of supporting vouchers/bills of expenditure incurred for Organizing Conference.

e. Soft copy of photographs of conference.

f. One video of 1-minute duration mentioning: (i). Introduction of the Coordinator mentioning the name and state of institute. (ii). Conference details and achievements attained through Conference (iii). How the Conference was beneficial to students, faculty and institute? (iv). Thanking message for AICTE support.

VI. General instructions

a. Any Change in the programme for holding Conference, change of Coordinator name, Venue and Date should be effected with prior approval of the Council, failing which the sanction for the grant already issued would be treated as automatically withdrawn.

b. The assets acquired wholly or substantially of the All India Council for Technical Education's grants shall not be disposed or encumbered or utilized for the purposes other than those for which it was given without proper sanction of the Council and should, at any time the Institution ceased to function, such assets shall revert to the All India Council for Technical Education.

c. The beneficiary institute will make best efforts to promote the scheme by mentioning the sponsorship/ support from AICTE, carrying the Logo of AICTE in conference and other means.

d. The grantee Institution shall observe all financial norms and guidelines as prescribed by the AICTE/ Government of India from time to time. GOI GFR rules (@https://doe.gov.in/order-circular/general-financial-rules2017-0) should be followed during utilization of grant.

Yours sincerely,

Neeraj Saxena
Advisor (IDC)

Copy forwarded for information and necessary action to:

1. **Name and Address of the Coordinator**
   Dr. Vijayalakshmi Subramanian,
   Saranathan College of Engineering, Venkateswara Nagar, Edamalaipattipudur-Post, Panjappur-Village, Srirangam-Taluk, Tiruchirappalli, Tamil Nadu-620012

2. **Guard File**

ORGANIZING COMMITTEE

Chief Patron : Shri.S.Ravindran
Secretary, Saranathan College of Engineering.

Patron : Dr.D.Valavan
Principal, Saranathan College of Engineering.

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General Co-Chairs : Prof.A.Krishnamoorthy, Dean(H & S)
Prof.Iyer Gopal, First Year Coordinator

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Ms.N.Bhavani, Associate Professor / IT
Dr.M.Shanmugavalli, Professor / ICE

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Dr.Liaquat Hayat
Professor, Department of E&IE, Yanbu Industrial College, Saudi Arabia.

KEYNOTE SPEAKER

Prof.Dr.Seok-Bum Ko
Professor, University of Saskatchewan, Canada

He is currently working as Professor in Electrical and Computer Engineering at University of Saskatchewan, Canada. His research interest includes VLSI based Wireless System Design/Physical Layer Design, Network Security, IOT, Digital VLSI Design.

He obtained 13 patents. He has completed more than 30 R & D Projects in Wireless Communication, FPGA implementation of multiple Antenna Wireless Communication Systems, VLSI, etc. He has published more than 100 papers in referred journals. He is a sole author for 2 books.

SARANATHAN
College of Engineering
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Venkateswara Nagar, Panjappur, Trichy - 620 012.

INTERNATIONAL e-CONFERENCE ON CUTTING EDGE TECHNOLOGIES IN ELECTRICAL, COMMUNICATION, EMBEDDED SYSTEM AND SOFT COMPUTING TECHNIQUES (ICECES '20)

November 05 & 06, 2020

Sponsored by

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ABOUT THE CONFERENCE

This conference will explore the new horizon of innovations from distinguished researchers, scientists, and eminent authors in academia and industry working for the advancements in Science, Engineering and Technology from all over the world. This conference aims to bring together Academicians, Scientists, Research scholars and Students, to share and disseminate information on knowledge and scientific research works related to above topics and confers the practical challenges encountered and the solutions adopted.

The conference will create a path to establish a research relation for the authors and listeners with opportunities for National and International collaboration and networking among the universities and institutions from India and abroad for promoting research and developing technologies.

ABOUT THE INSTITUTION

Saranathan College of Engineering was established in the year 1998 by an eminent educationist Sri. K. Santhanam. It was so named in respectful memory of his Guru Principal Saranathan, the greatest ever Principal of National College. It is one of the premier institutions in India. It is a self financing college approved by AICTE and affiliated to Anna University, Chennai.The campus is spread over 40 acres with a built up area of 2,60,000sq.ft.. on Chennai – Madurai Expressway at Panjappur. SCE offers 7 UG and 5 PG programmes. Three departments are recognised as research centers by Anna University, Chennai. The aim of the institute is to provide quality education to the students to enrich their knowledge in the latest technologies and developments with the state-of-the-art laboratories and research. All the programmes are affiliated to the Anna University, Chennai, and approved by AICTE, New Delhi. All the 6 eligible undergraduate courses have been accredited by NBA. The College central Library is a vast storehouse of books with over 55,688 volumes and more than 300 regularly subscribed journals. This includes foreign IEEE and ASME Online journals. Our institute has strong Training and Placement Cell which takes care of the Campus Connect Programme. Students of SCE have been placed in Domestic, Global and Public Sector Firms. The Faculty with an outstanding academic background and sound conceptual knowledge of contemporary engineering studies and practices ably complete the process of converting the budding students into employable technocrats.

ABOUT THE DEPARTMENTS

Department of Electrical and Electronics Engineering (EEE) was established in 1998. The department offers an UG programme and a PG programme in Power Electronics and Drives. It is equipped with modern facilities besides conventional infrastructures. The Department of EEE, ever since its inception, has been consistently producing electrical engineering graduates with good academic record accompanied by many university ranks. This department is a recognized as research centre by Anna University, Chennai and has been executing funded research projects from central and state government organizations like MNRE, DRDO, CSIR, AICTE and TNSCST, filing patents and extending consultancy services to the industries. A value added Protection and Switchgear Laboratory in the department regularly offers short term courses for the students and practicing engineers to meet the challenges and demands for the industrial skills in terms of quality of professional, safety, time & technical excellence.EEE dept has signed MOUs with Asia Power Quality Initiative (APQI) India and Green Connect Solutions. EEE department is well known as the best in class infrastructure and faculty members that attract talented students across the country because of the sheer hard work and enthusiasm of the faculty and students of the department. E-magazines are published periodically with the staff and students' enthusiastic participation. Students are encouraged to publish their project papers in the students' e-journal (SJEEE) released by the department with ISSN identity.

The department of ECE has built an excellent reputation in teaching and research and it was established in the year 1998. Department offers an UG programme (ECE) and a PG programme in Communication Systems. ECE Department has been consistently producing Electronics and Communication Engineering graduates with good academic record accompanied by many university ranks since its inception. The department has shown exceptional growth in terms of modernization of the existing laboratories and establishment of new laboratories equipped with state-of–the-art facilities, placement of the students and research. Department has been accredited by NBA in 2009 and in 2018. The department has 9 doctorates with blend of rich experience and research exposure help in imparting knowledge in Major areas like Communication, VLSI, Signal Processing, Wireless Networks, NoC, Nanotechnology, Embedded Systems, Antenna Design and other emerging fields. The Department of ECE was recognized as a research Centre in the year 2013. ECE department is executing funded research project by TNSCST and MODROBS funded by AICTE. The department also conducted National Seminars, Conference and Workshops funded by AICTE, CSIR, DRDO and TNSCST. The department signed MoUs with TI, Vi Microsystems, RAACTS. Department is also publishing e-Magazine with active participation of students and faculty. The department won the title of Smart India Hackathon in 2019 & 2020.

ABOUT TIRUCHIRAPPALLI

Tiruchirappalli, also called as Trichy, is the fourth largest city as well as the fourth largest urban agglomeration in the state. It is located on the banks of river Cauvery. This city has numerous temples and monuments. It is an important tourist destination in Tamilnadu modern Trichy is developed around the Rock Fort and it is a commercial city as well as pilgrim center. It has well connected roads and Railways to all the important cities in our country. Tiruchirappalli is connected by air, rail and road, which connect to many parts of the country. State buses and private vans operate to most of the tourist places regularly. Excellent lodging facilities are available in the city. Taxi and auto rickshaws can be hired for local transport. Rock Fort is the important Land Mark in Trichy. Trichy Tourism has lot of enthusiastic, cultural and architectural Heritage places. They are Rock Fort, Grand Anaicut, Samayapuram Mari Amman Temple, Shri Renganathar Temple, Shri Jambukeshwarar Temple. Kumaravayalur Murugan Temple and Mukkombu etc. Tiruchirappalli is also noted for its beautiful churches, mosques and missions dating back to 1760.

AUTHOR GUIDELINES

1. Authors shall mail a soft copy of the full-length paper to iceces20@gmail.com.
2. Atleast one author per paper must register and present the paper.
3. All the registered participants will be issued participation certificates.
4. The authors are invited to send their papers in IEEE format. A copy of full paper not exceeding six pages should be sent to the above e-mail.
5. All accepted high quality paper will be published in Scopus Indexed Journal and SCI Journals given below based on authors interest

PLAGIARISM ALERT

Contributors are advised to be strict in academic ethics with respect to acknowledgement of the original ideas borrowed from others. The conference team & editors will not be held responsible for any such lapse of the contributor regarding plagiarism and unwarranted quotations in their manuscripts. All submissions should be original and must be accompanied by a declaration stating your research paper as an original work and has not been published anywhere else. It will be the sole responsibility of the authors for such lapses, if any on legal binding and ethical code of publication.

CALL FOR PAPERS

The E-Conference will provide an opportunity for interactive discussions with experts in the emerging areas of research in Electrical Engineering, Electronics Engineering, Communication Engineering, Information Technology, Mechanical Engineering, and Civil Engineering. Original unpublished works are solicited for presentation in this conference.

Papers are invited in the following areas of interest but not limited to the given list.

AREA OF INTEREST

- Power Systems & Power Electronics
- Smart Grid & Renewable Energy Sources
- Power Quality & FACTS Controllers
- Electrical Machines
- Process Control & Instrumentation
- Signal Processing & Wireless Communication
- RF Engineering & Ad-hoc and Sensor Network
- Biomedical Engineering/Informatics
- Cloud and Mobile Computing
- Embedded Systems & Image Processing
- VLSI Design
- Nanotechnology
- Soft Computing Techniques
- Green Technologies

JOURNALS LIST

Scopus Indexed Journals:

1. Journal of Critical Reviews
2. Test Engineering and Management

SCI and Annexure -1 Journals:

1. Interdisciplinary Sciences : Computational Life Sciences, Springer Journal
2. International Journal of Heavy Vechicle Systems
3. Medical Imaging & Health Informatics
4. ASC – Intelligent Automation & Soft Computing
5. Journal of Ambient Intelligence and Humanized Computing

WHO TO ATTEND?

- This conference is aimed at educators, researchers and practitioners in the areas of innovations and engineering growth.
- The conference will have a balance of lectures and presentations from the academic as well as the practitioners' perspective and will have renowned speakers.
- It is aimed at creating a platform for a healthy exchange, debate and development of ideas and emerging issues in the cutting edge technologies
- It also provide an opportunity to present your research work at international level and chance to publish your research paper in a referred journal.
- It seeks to bring academic and practitioners closer for the further development of the subject areas.

IMPORTANT DATES

Full Paper Submission Date : **October 10, 2020**

Acceptance Notification : **October 15, 2020**

Registration without fine : **October 20, 2020**

Registration with fine : **October 27, 2020**

PAYMENT DETAILS

Category	Earlybird Registration on or before October 20, 2020		After October 21, 2020 to October 27, 2020	
	National	International	National	International
UG / PG / Research Scholars	Rs. 1000	$ 20	Rs. 1200	$ 25
Academician	Rs. 1200	$ 25	Rs. 1500	$ 30
Industry /R&D	Rs. 1500	$ 30	Rs. 1800	$ 35

Bank Details:

Account Name : Saranathan College of Engineering

Account Number :023001000138533

Bank/Branch : City Union Bank Ltd., Tiruchirapalli Main

IFSC Code : CIUB0000023

Swift Code : CIUBIN5M

CONTACT DETAILS

The Coordinators, ICECES-2020,
Saranathan Collge of Engineering,
Venkateswara Nagar, Panjappur,
Tiruchirappalli, Tamilnadu, India-620 012.
Mobile No : 9842138779, 9894047396
Email : iceces20@gmail.com
Website : www.saranathan.ac.in

International e-Conference on Cutting Edge Technologies in Electrical, Communication, Embedded System, and Soft Computing Techniques

(ICECES-2020)

November 05 & 06, 2020

REGISTRATION FORM

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Organization : ....
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Mailing Address: ....
....
....
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Country : ....

Mobile No : ....

E-Mail ID : ....

Participant Category:

Industry / R&D / Academician

UG / PG / Research Scholar

Payment Details:

NEFT / RTGS

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Signature of Participant

Address for Communication:

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AICTE SPONSORED TWO-DAY INTERNATIONAL e-CONFERENCE ON CUTTING EDGE TECHNOLOGIES IN ELECTRICAL, COMMUNICATION, EMBEDDED SYSTEM AND SOFT COMPUTING TECHNIQUES (ICECES '20)

November 05 & 06, 2020

KEYNOTE ADDRESS BY

Dr.Seok-Bum Ko
Professor, University of Saskatchewan, Canada

Dr.Y.Venkataramani
Dean (R&D), Saranathan College of Engineering

All are cordially invited

Dr.S.Vijayalakshmi
Dr.C.Vennila
Programme Coordinators
ICECES'20

Dr.C.Krishnakumar
Dr.M.Santhi
Conveners
ICECES'20

Dr.D.Valavan
Principal

Shri.S.Ravindran
Secretary

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AICTE SPONSORED INTERNATIONAL e-CONFERENCE ON CUTTING EDGE TECHNOLOGIES IN ELECTRICAL, COMMUNICATION, EMBEDDED SYSTEM AND SOFT COMPUTING TECHNIQUES (ICECES '20)

November 05 & 06, 2020

DATE	TIME	EVENTS
DAY - 1 05.11.2020	10.00AM- 10.45AM	**Keynote Address by Prof.Dr.Seok-Bum Ko,** Professor, University of Saskatchewan, Canada
	10.45AM- 11.00AM	Break
	11.00AM- 02.00PM	Session 1
	01.00PM- 04.00PM	Session 2
DAY - 2 06.11.2020	10.00AM- 10.45AM	**Keynote Address by Prof.Dr.Y.Venkataramani,** Dean (R&D), Saranathan College of Engineering, Trichy, TN
	10.45AM- 11.00AM	Break
	11.00AM- 02.00PM	Session 1
	02.00PM- 04.00PM	Session 2

INSTRUCTION TO THE AUTHORS FOR PAPER PRESENTATION

1. Maximum slides allowed for presentation is 20.
2. Time allotted for presentation is 10 minutes for presentation, followed by 3 mins for Q/A.
3. At the conference: Please present yourself to the Session Chair in advance of the session.
4. Please prepare your talk such that you will end on time. Session chairs will be advised to keep a strict timing.
5. Fonts: Widely used sans serif fonts size as Arial or Helvetica is recommended for clarity and compatibility. Confirm a font size of at least 24 points for body text and 36 to 40 fonts for headings. Light coloured text on a dark background is advised. Avoid using red or green. Confirm that the maximum number of lines in text slides is not more than 7 or 8.
6. Papers presented during conference only will be published in proceedings.
7. Best paper presentation award will be issued for every session

AICTE sponsored Two-day International e-Conference on "Cutting Edge Technologies in Electrical, Communication, Embedded System and Soft Computing Techniques (ICECES'20)

The Departments of Electrical and Electronics Engineering & Electronics and Communication Engineering of Saranathan College of Engineering, Trichy, jointly organized an AICTE sponsored Two-Day International e-Conference on **"Cutting Edge Technologies in Electrical, Communication, Embedded System and Soft Computing Techniques (ICECES '20)"**, on **5th November & 6th November 2020**. The theme of this conference was envisaged keeping in mind the role of technology and/or computing play in building the knowledge society. 143 papers, out of the 150 received for the conference, were presented. Around 300 students, research scholars and faculty members from various Engineering colleges participated in this presentation of their research findings in this virtual e-Conference.

On 5th November 2020, the inaugural function started with the lighting of the "kuthuvilakku" by **Dr.D.Valavan** – the Principal, Convenors,, **Dr.C.Krishnakumar – HOD/EEE & Dr.M.Santhi – HOD/ECE**, Programme Coordinators, **Dr.C.Vennila** - Professor/ECE and **Dr.S.Vijayalakshmi** - Associate Professor/EEE.

Dr.S.Vijayalakshmi, welcomed the gathering and the Principal, **Dr. D. Valavan** delivered the presidential address. The inaugural ceremony witnessed the address by eminent keynote speaker, **Dr.Seok-Bum Ko, Professor, University of Saskatchewan, Canada.** He enlightened the participants with his insightful speech on the significance of research in VLSI incorporated with Deep Neural Networks, Machine Learning, Image Processing. He reiterated the need for Deep Learning, Quality education, integrity and utmost dedication in the research in this field of cutting-edge technology.

The inaugural ceremony concluded with a vote of thanks given by **Dr.C.Vennila**. The inaugural function was followed by paper presentation sessions of various departments. They were presented in the virtual mode and in a multi-track fashion.

In Track 1, **Dr.A.Nazar Ali**, Associate Professor/EEE, Rajalakshmi Engineering College, Chennai, performed the role of judge/jury in the FN session while **Dr.K.Dhayalini**, Professor & Head/EEE, K.Ramakrishnan College of Engineering, Trichy did that role in the AN session.

In Track 2, **Dr.J.Manikandan,** Professor, Crucible of Research and Innovation (CORI), PES University, Bangalore was the judge/jury in FN session while **Dr.K.Swaminathan,** Head-FPGA Design Team, Jiva sciences Pvt. Ltd, Bangalore, Karnataka,in the AN session.

In Track 3, **Dr.R.Gandhimathi,** Assistant Professor/Civil, NIT, Trichy was the judge/jury in FN session.

The second day of the conference, 6th November 2020, saw the keynote address being delivered by **Dr.Y.Venkataramani, Dean (R&D), Saranathan College of Engineering, Trichy.** He presented a very informative session about the significance of Machine Learning in Wireless & 5G Communication. A vote of thanks was delivered by **Dr.M.Santhi,** Convener, HoD/ECE. The virtual paper presentation sessions followed in a virtual fashion.

In track 1, **Dr.G.Kannan**, Associate Professor/ECE, B.S.Abdur Rahman Crescent Institute of Science & Technology, Chennai, took on the role of judge/jury in the FN session while **Dr.R.Shenbagalakshmi**, Professor/EEE, SKN Sinhgad Institute of Technology & Science, Lonavala, Maharashtra, performed that role in the AN session.

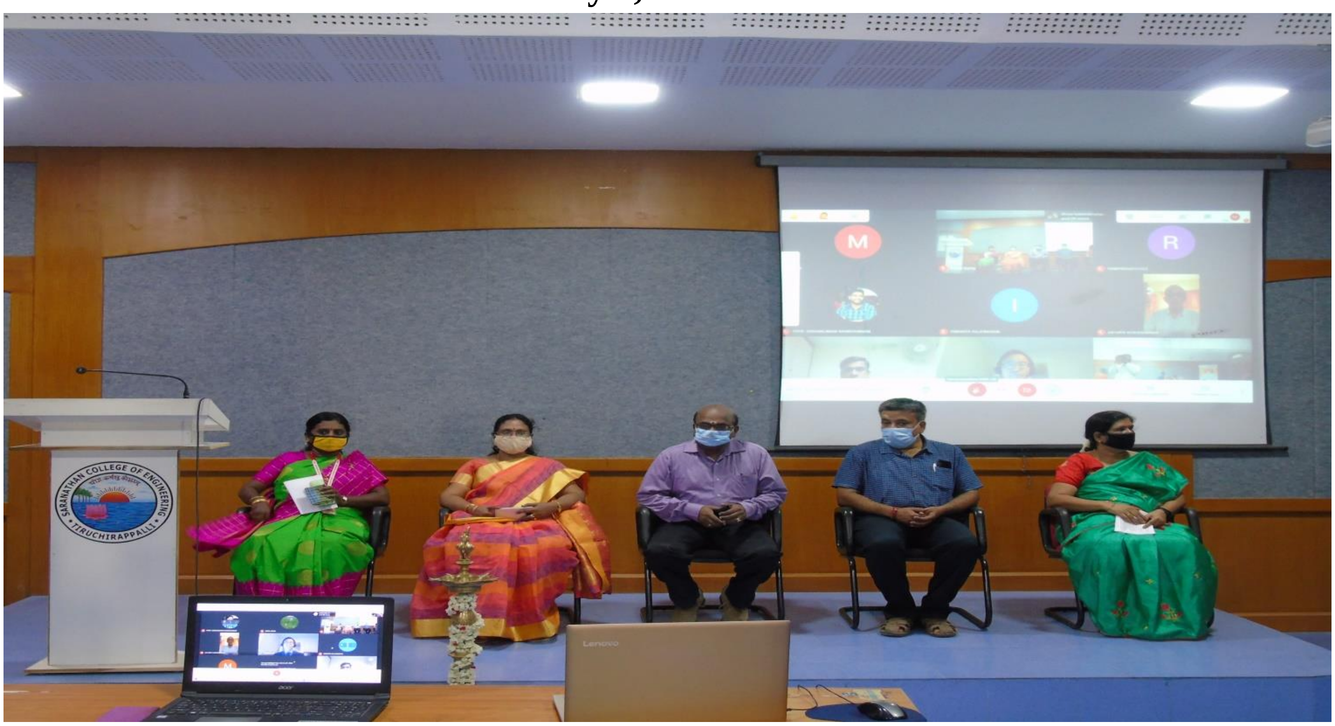
In track 2, **Dr.M.Maheswari**, Professor & Head/ECE, K.Ramakrishna College of Engineering, Trichy, was the judge/jury in FN session while **Dr.R.Rajeswari**, Professor/ECE, Rajalakshmi Institute of Technology, Chennai, took on that role in AN session.

In track 3, **Dr.Jasmine Beulah Gnanadurai**, Professor, Kristu Jayanti College, Bangalore was the judge/jury in FN session.

In all there were 10 paper presentation sessions spread over 2 days/4 sessions/ 3 tracks. In each of these sessions two faculty members from Saranathan were also present in the jury panel. On both the days of the e-conference, track wise – session wise the jury adjudged the best paper presented. A "Best paper award" was awarded to each one of these presentations.

The conference received positive feedback from all the participants as it provided the ideal platform to the students and research scholars to share their research findings in a forum that had veteran academicians.

Day 1, 05-11-2020



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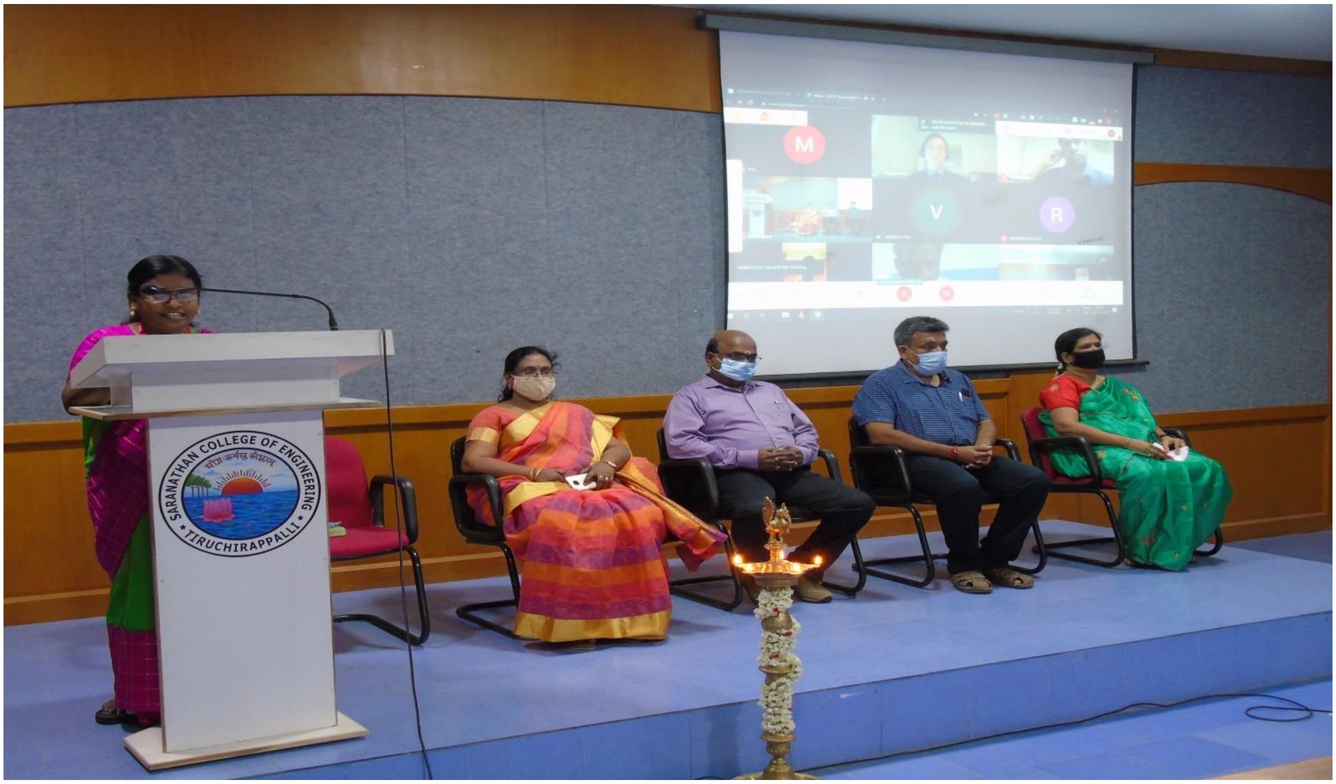
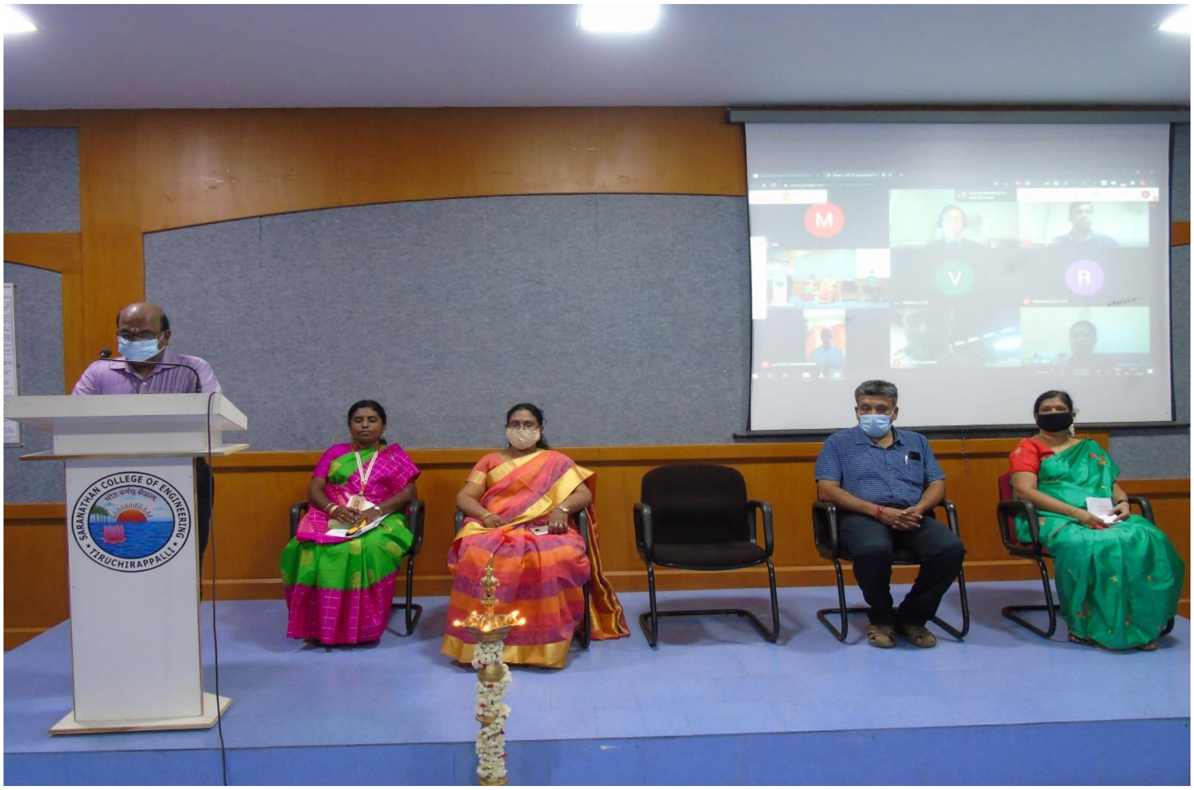
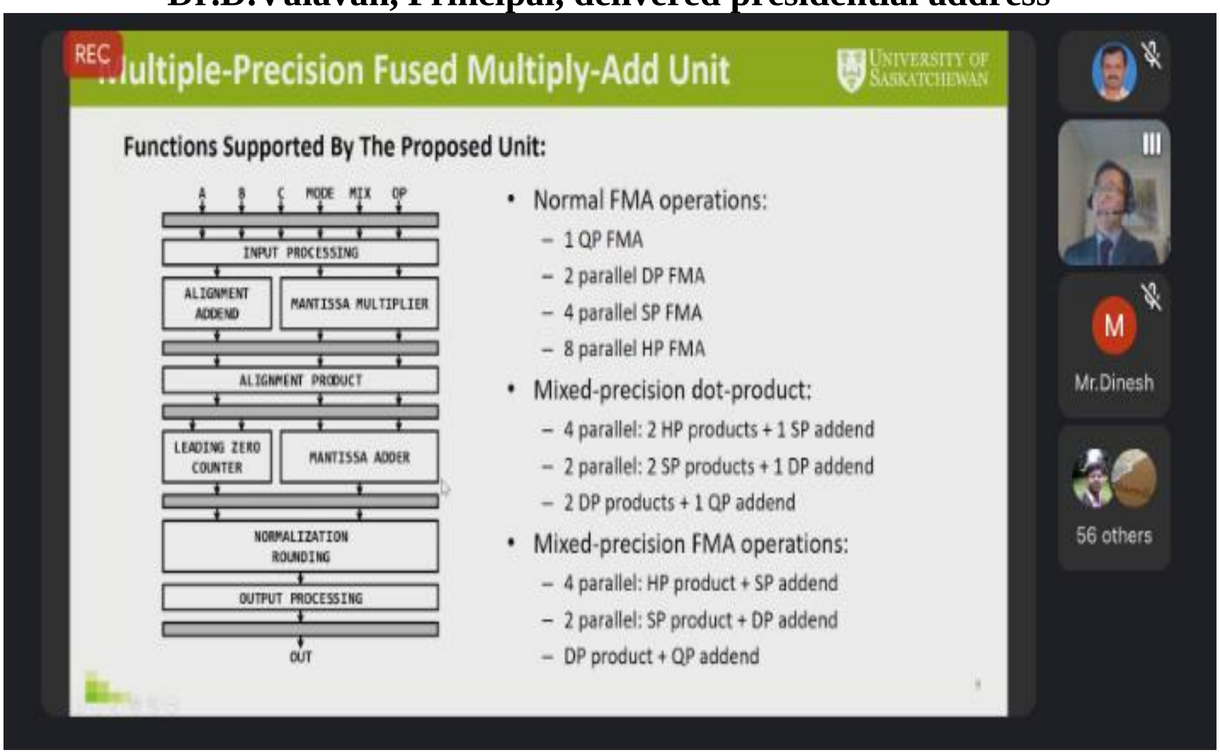


Dr.S.Vijayalakshmi, Associate Professor, Programme Coordinator/ EEE, delivered welcome address

Lighting of Kuthuvilaku in the Conference



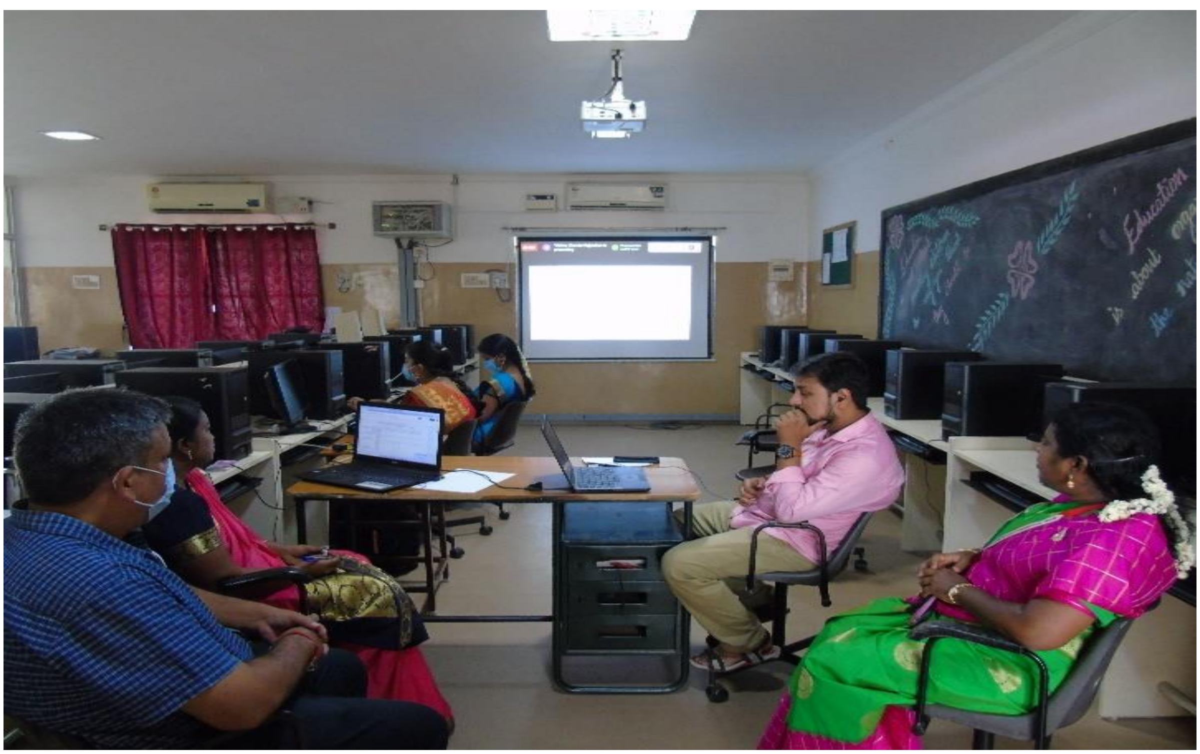
Dr.D.Valavan, Principal, delivered presidential address



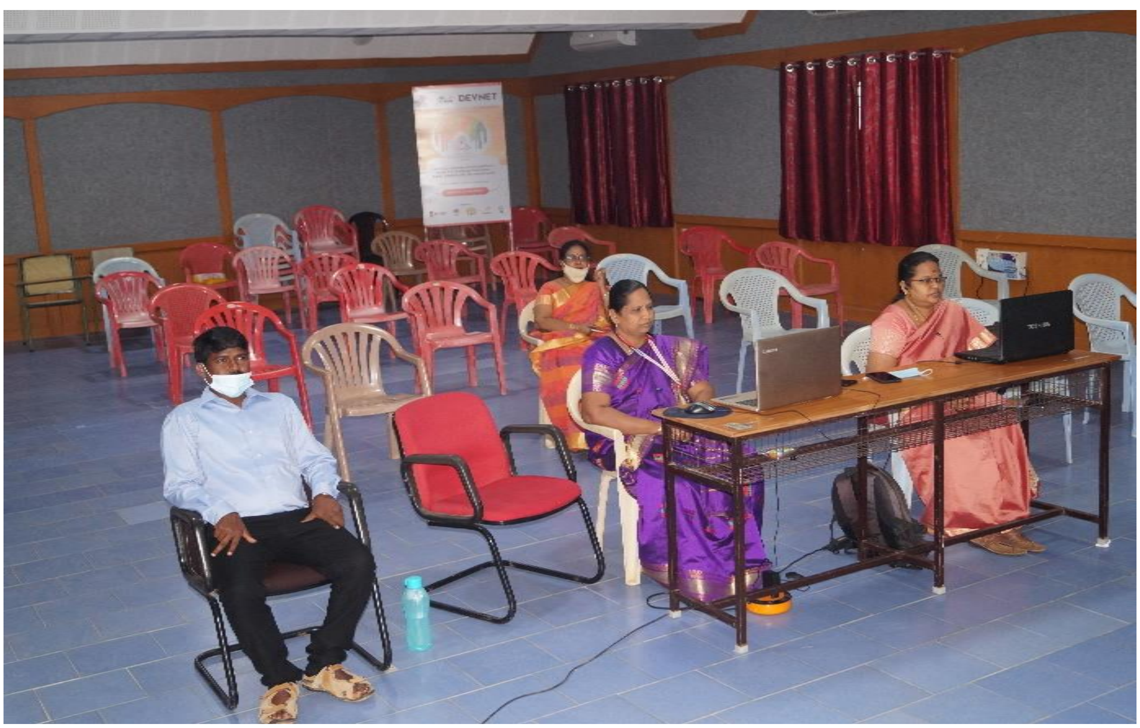
Dr.Seok-Bum Ko, Professor, University of Saskatchewan, Canada delivered keynote address

Dr.C.Vennila, Professor, Programme Coordinator/ ECE, delivered vote of thanks

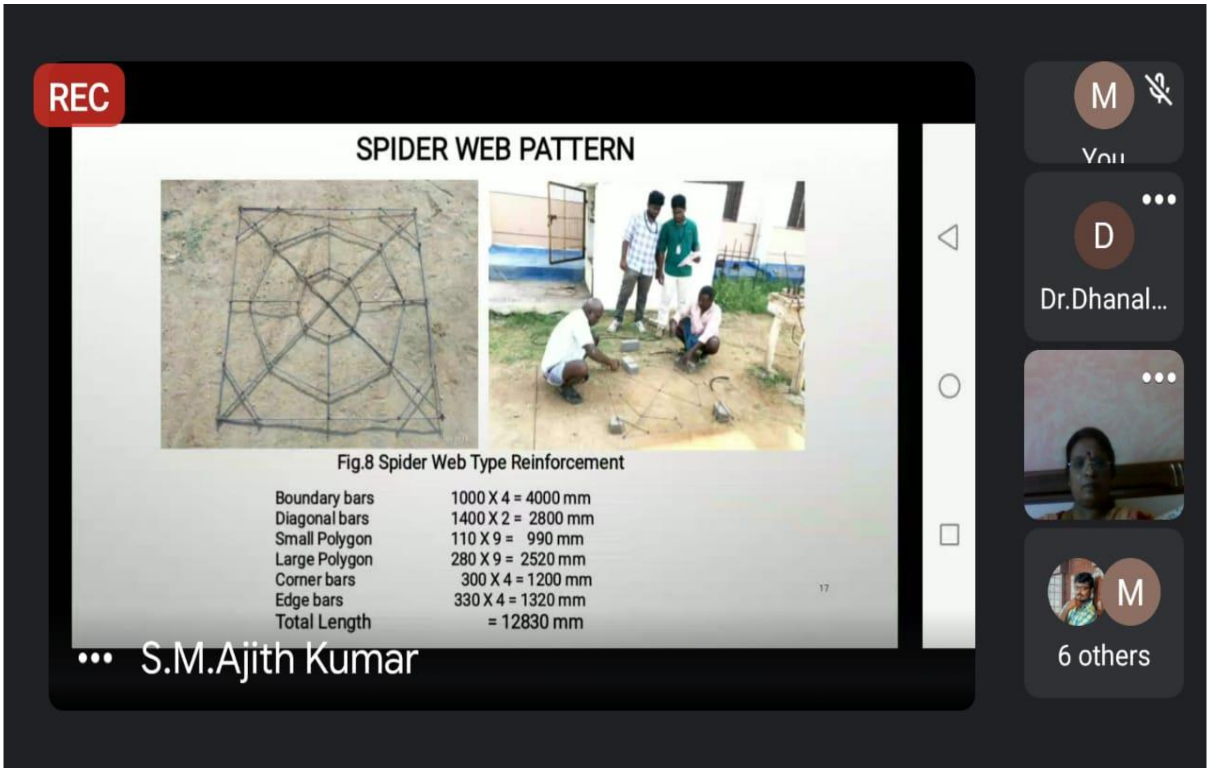
Track – 1 (FN)



Track 2 (FN)



Track 3 (FN)


REC
SPIDER WEB PATTERN
Fig.8 Spider Web Type Reinforcement
Boundary bars 1000 X 4 = 4000 mm
Diagonal bars 1400 X 2 = 2800 mm
Small Polygon 110 X 9 = 990 mm
Large Polygon 280 X 9 = 2520 mm
Corner bars 300 X 4 = 1200 mm
Edge bars 330 X 4 = 1320 mm
Total Length = 12830 mm
S.M.Ajith Kumar
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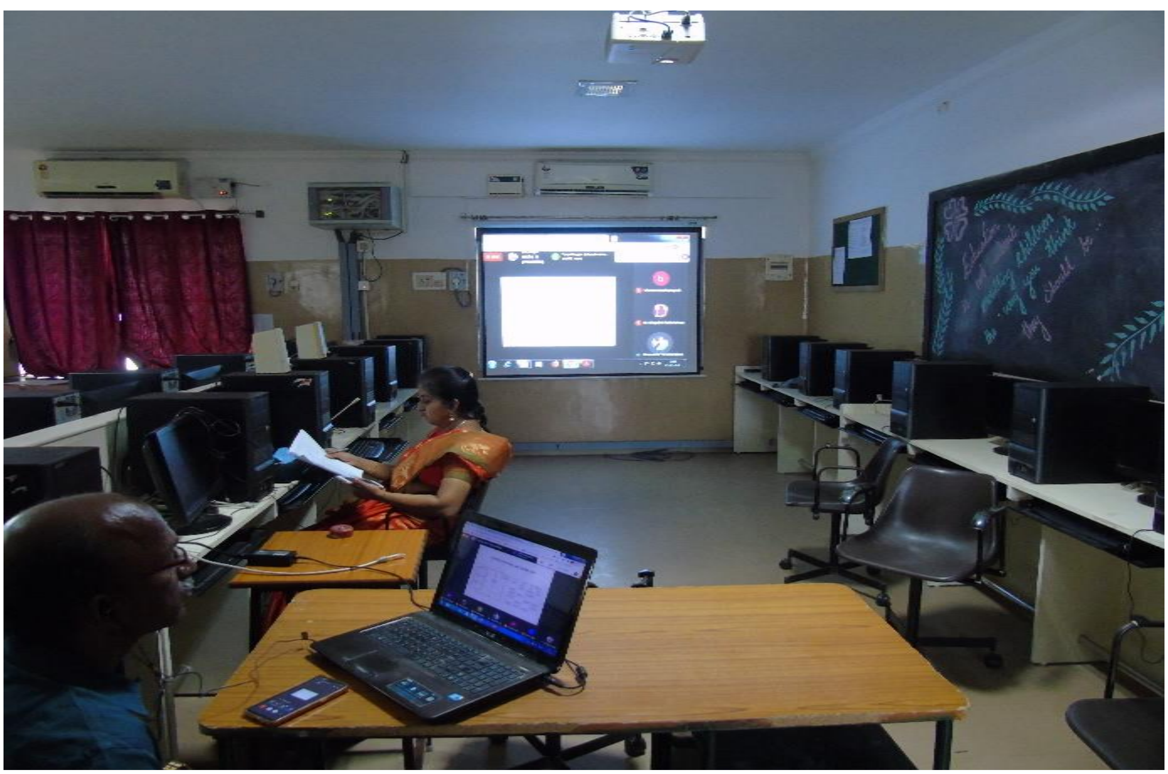
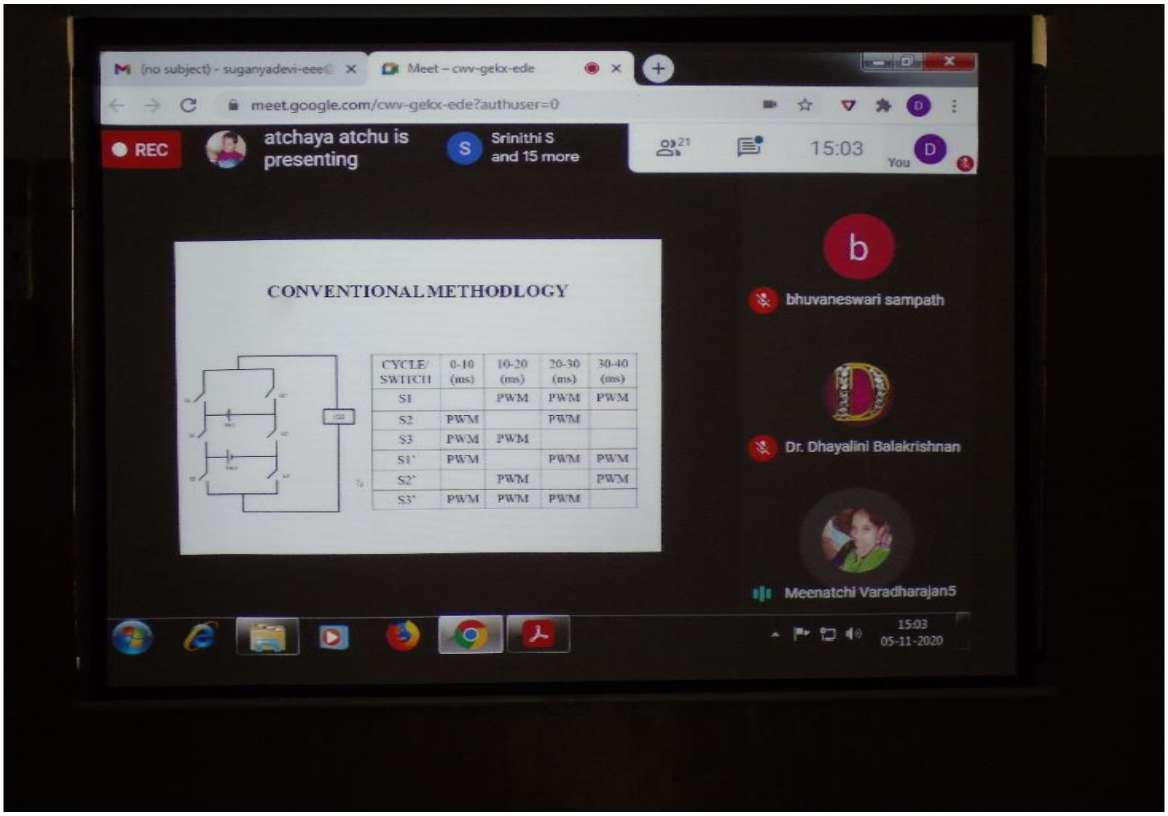
Dr.Dhanal...
M
6 others

Track 1 (AN)

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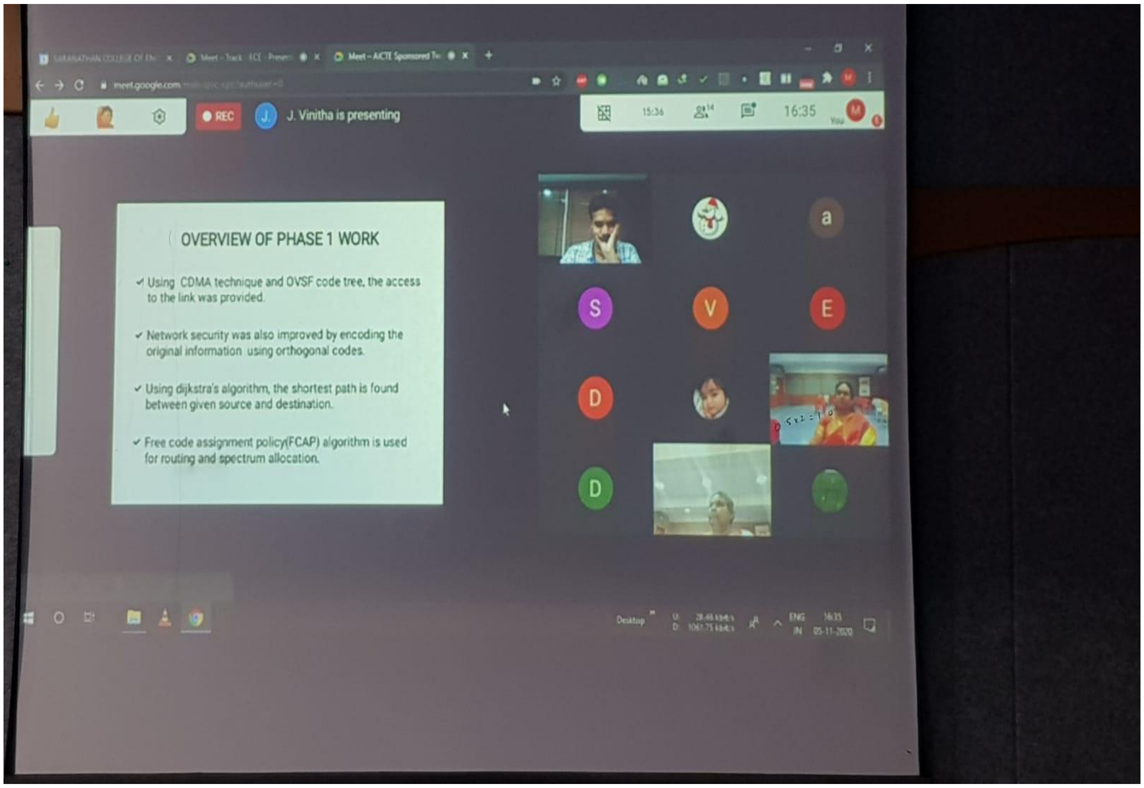
S3' | PWM | PWM | PWM |
bhuvaneswari sampath
Dr. Dhayalini Balakrishnan
Meenatchi Varadharajan5
15:03
05-11-2020

Track 2 (AN)

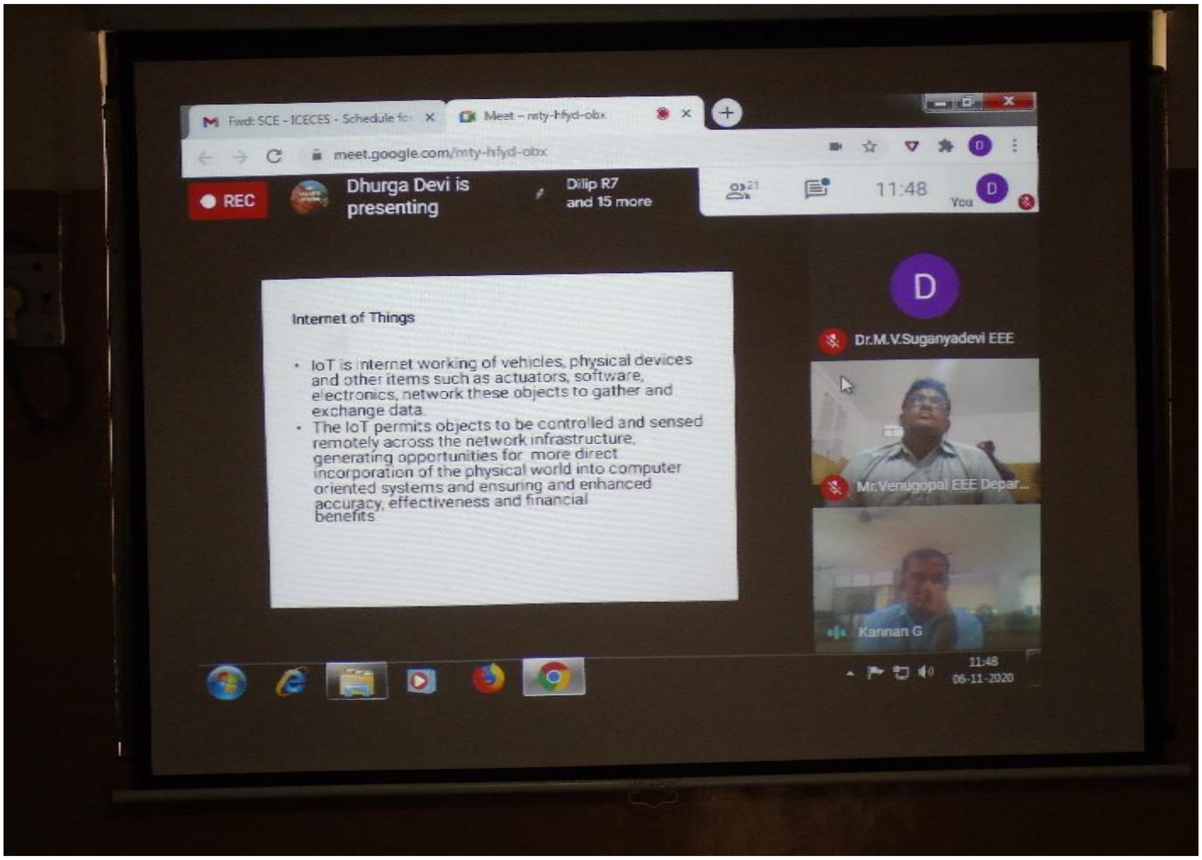


Day 2 (06-11-2020)

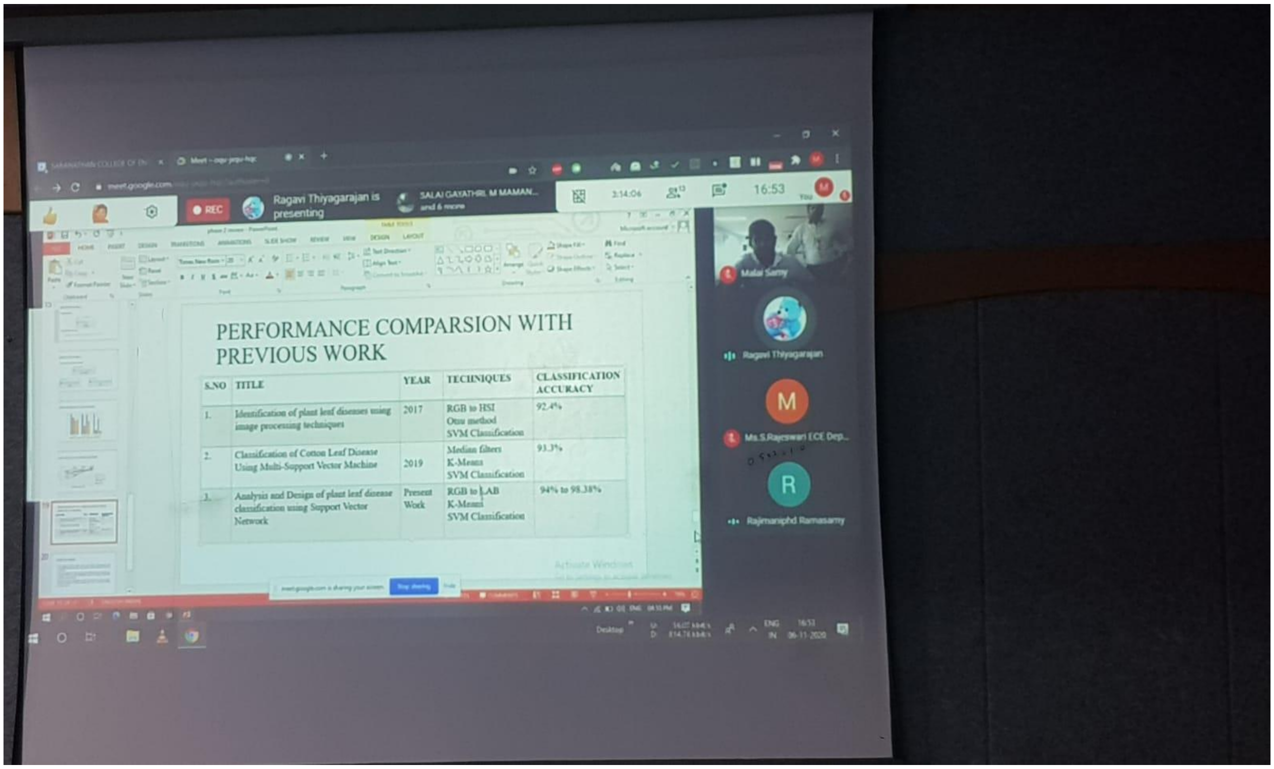
Dr.Y.Venkataramani, Dean (R&D), Saranathan College of Engineering, Trichy, delivered the keynote address

Dr.M.Santhi, HoD/ECE, Convener, delivered vote of thanks

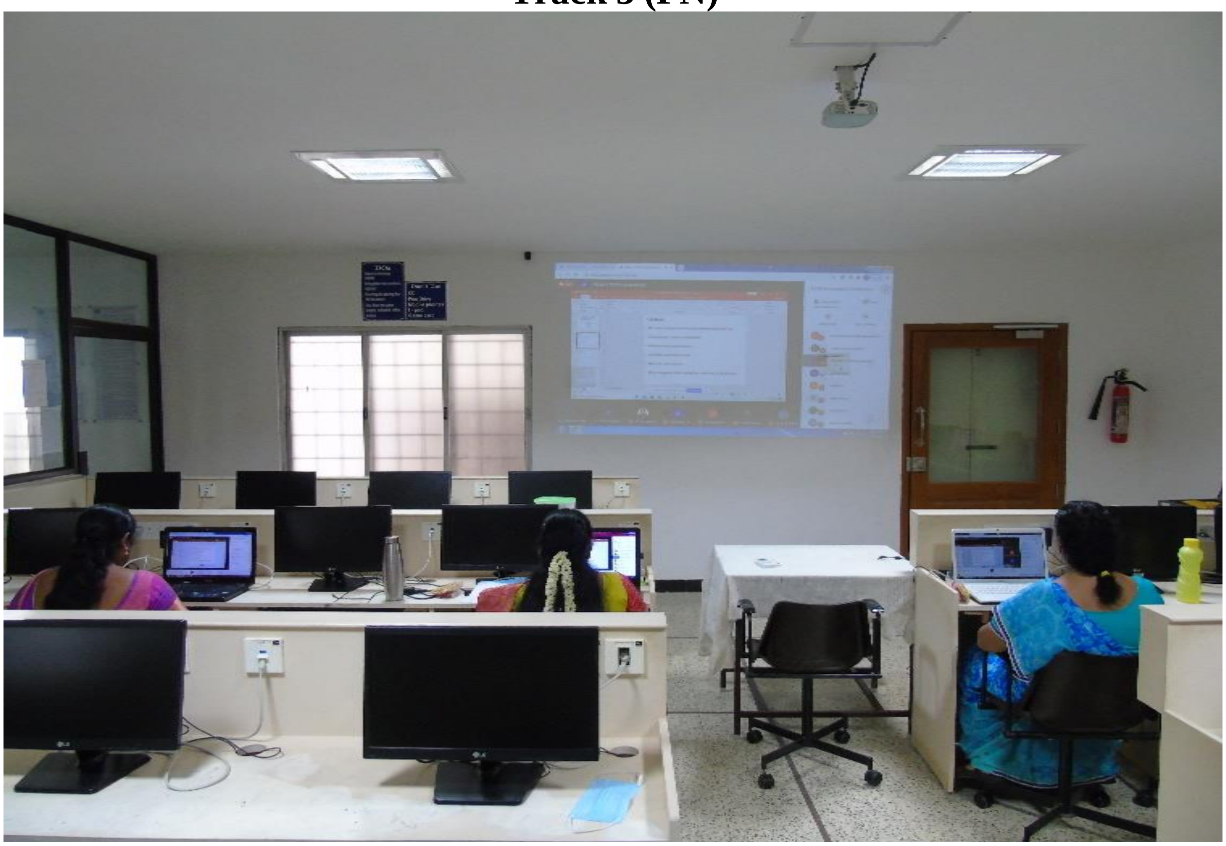
Track 1 (FN)

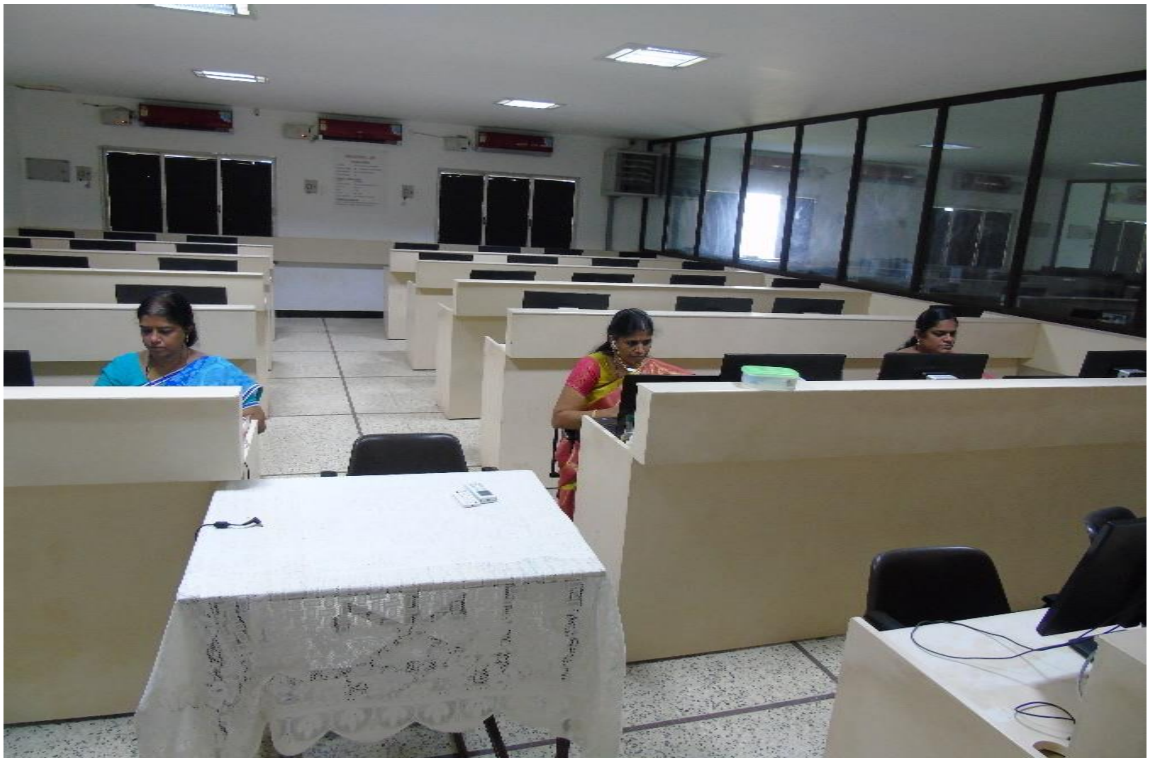

REC
Dhurga Devi is presenting
Dilip R7 and 15 more
11:48
meet.google.com/mty-hfyd-obx
Internet of Things
• IoT is internet working of vehicles, physical devices and other items such as actuators, software, electronics, network these objects to gather and exchange data
• The IoT permits objects to be controlled and sensed remotely across the network infrastructure, generating opportunities for more direct incorporation of the physical world into computer oriented systems and ensuring and enhanced accuracy, effectiveness and financial benefits
Dr.M.V.Suganyadevi EEE
Mr.Venugopal EEE Depar...
Kannan G
06-11-2020

Track 2 (FN)

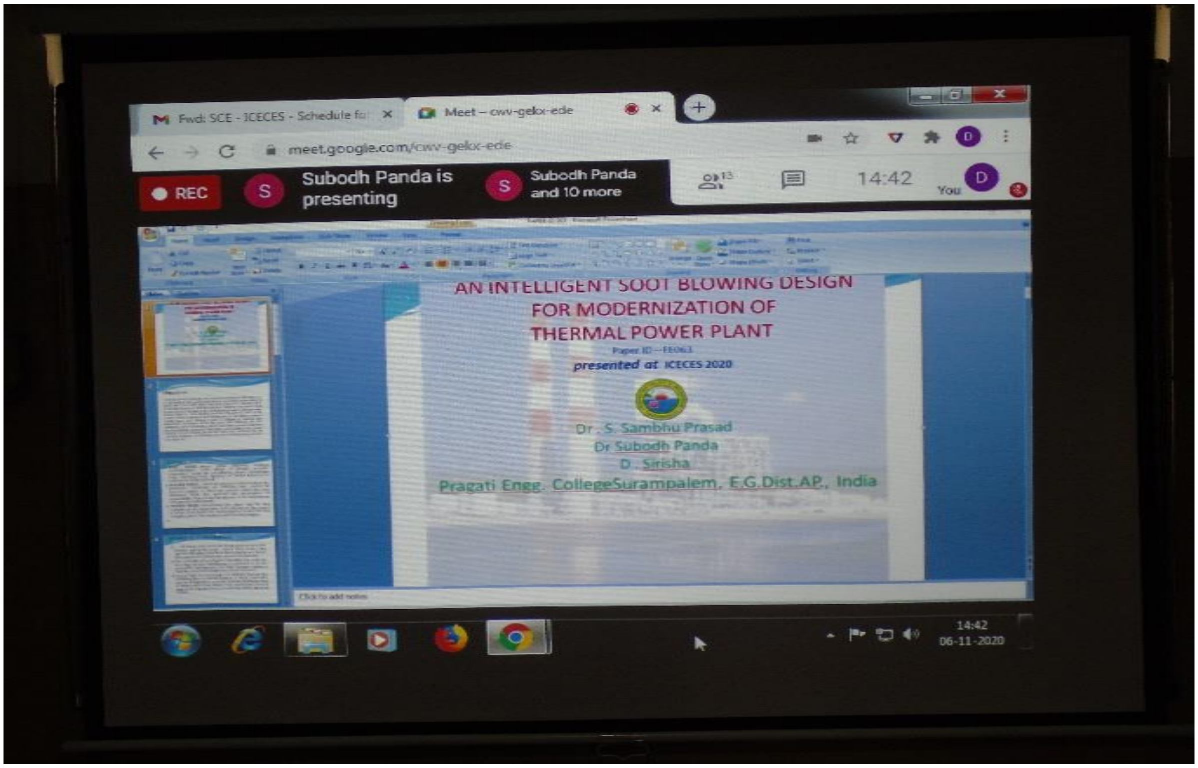

PERFORMANCE COMPARSION WITH PREVIOUS WORK
S.NO
TITLE
YEAR
TECHNIQUES
CLASSIFICATION ACCURACY
1.
Identification of plant leaf diseases using image processing techniques
2017
RGB to HSI
Otsu method
SVM Classification
92.4%
2.
Classification of Cotton Leaf Disease Using Multi-Support Vector Machine
2019
Median filters
K-Means
SVM Classification
93.3%
3.
Analysis and Design of plant leaf disease classification using Support Vector Network
Present Work
RGB to LAB
K-Means
SVM Classification
94% to 98.38%

Track 3 (FN)

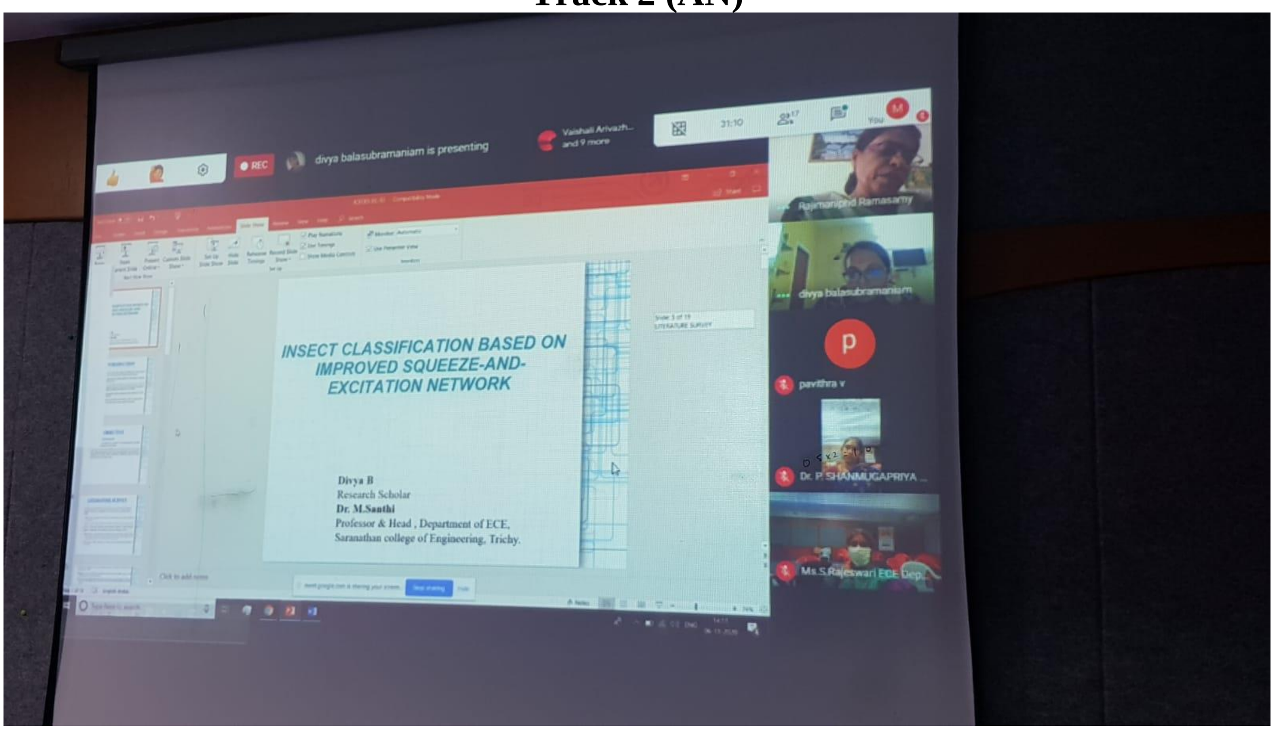




Track 1 (AN)


AN INTELLIGENT SOOT BLOWING DESIGN
FOR MODERNIZATION OF
THERMAL POWER PLANT
presented at ICECES 2020
Dr. S. Sambhu Prasad
Dr Subodh Panda
D. Sirisha
Pragati Engg. CollegeSurampalem, E.G.Dist.AP., India
Subodh Panda is presenting
REC
14:42

Track 2 (AN)


INSECT CLASSIFICATION BASED ON
IMPROVED SQUEEZE-AND-
EXCITATION NETWORK
Divya B
Research Scholar
Dr. M.Santhi
Professor & Head , Department of ECE,
Saranathan college of Engineering, Trichy.
divya balasubramaniam is presenting

Saranathan College of Engineering, Tiruchirappalli – 12

Best paper detail for the e-Conference (ICECES'20)

S. No	Track	Name of the participants	Name of the College	Department	Session	Paper title
1	Track - 1	B. Devi Vighneshwari and Team	The Oxford College of Engineering, Bangalore	EEE	05-11-20 (FN)	An Optimized Detection Classifier Model for Multiple Power Quality Disturbances
2		A.E. Manish and Team	SCE	EEE	05-11-20 (AN)	Design And Fabrication of Power Electronic interface for fixing and removal of bearing and coupling in Mechanical System using induction heating
3		Mohamed Ameenullah H and Team	SCE	EEE	06-11-20 (FN)	Smart Monitoring to be incorporated in Existing Public Toilets – Intelligent Toilets
4		Dr. Lokesh C and Team	Vidyavardhaka College of Engineering, Mysuru, Karnataka, India.	EEE	06-11-20 (AN)	Analysis of different approaches for Dynamic Power Dissipation in Digital Circuit
5	Track – 2	M.Janani and Team	SCE	ECE	05-11-20 (FN)	An Iot Based Staple Food Endowment And Waste Management System For Foster Care Using Arduino And Blockchain
6		A.Ashif Ameer and Team	SCE	ECE	05-11-20 (AN)	Trace and Track Food Supply Chain based on Block chain and EPCIS
7		Kirankumar Manivannan and Team	SCE	ECE	06-11-20 (FN)	A Contemplate Of High Level Data Flow In Reversible Logic Gates
8		V.Pavithra and Team	SCE	ECE	06-11-20 (AN)	Agricultural Skid Steering Robot designed for Leaf Disease Detection using Image Processing.

9	Track - 3	S.M. Ajithkumar and Team	SCE	Civil	05-11-20 (FN)	Effect of Web pattern Reinforcement in Slab
10		Rohit Raj and Team	SCE	CSE	06-11-20 (FN)	NVEDU

SARANATHAN
COLLEGE OF ENGINEERING

Approved by AICTE & Affiliated to Anna University, Chennai
Venkateswara Nagar, Panjappur, Trichy - 620 012.

Department of Electrical and Electronics Engineering
(Accredited by NBA)
Department of Electronics and Communication Engineering
(Accredited by NBA)

AICTE SPONSORED INTERNATIONAL E-CONFERENCE ON CUTTING EDGE TECHNOLOGIES IN ELECTRICAL, COMMUNICATION, EMBEDDED SYSTEM AND SOFT COMPUTING TECHNIQUES (ICECES '20)

Certificate

This is to certify that **Mr.R N Krishnakumar** of **KAS research labs** has participated and presented a paper entitled **Linear codes do not achieve the capacity of asymmetric three-input discrete memoryless channels** in the **International E-Conference on Cutting Edge Technologies in Electrical, Communication, Embedded System and Soft Computing Techniqes (ICECES'20)** held on **05.11.2020 & 06.11.2020** organised by Department of EEE and Department of ECE, Saranathan college of Engineering, Tiruchirapalli, **Under the Sponsorship of AICTE, New Delhi.**

Dr.S.VIJAYALAKSHMI	**Dr.C.KRISHNAKUMAR**	**Dr.D.VALAVAN**
PROGRAMME COORDINATOR	CONVENER	PRINCIPAL

SUVC
SAUR URJA VEHICLE CHALLENGE

RSTE
Refrangible Society of Technophile Engineers

Certificate ID: 21032021/290

Printed on : 21/03/2021 17:17:41

CERTIFICATE OF PARTICIPATION

presented to

R. Prajeeth Chander

SHARIK 4.O - SARANATHAN COLLEGE OF ENGINEERING

for participatig in national level solar electric vehicle competition

SAUR URJA VEHICLE CHALLENGE 2021 - OVPR

*managed under **RSTE society***

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CERTIFICATE OF PARTICIPATION

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for participatig in national level solar electric vehicle competition

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Certificate ID: 21032021/291

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CERTIFICATE OF PARTICIPATION

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R. Sudharsan

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Certificate ID: 21032021/293

Printed on : 21/03/2021 17:17:47

CERTIFICATE OF PARTICIPATION

presented to

R. Vasanth

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SUVC
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RSTE
Refrangible Society of Technophile Engineers

Certificate ID: 21032021/285

Printed on : 21/03/2021 17:17:31

CERTIFICATE OF PARTICIPATION

presented to

A. Veron lobo

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for participatig in national level solar electric vehicle competition

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SUVC
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RSTE
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Best AWARD

Certificate ID: 21032021/284

Printed on : 21/03/2021 17:17:29

CERTIFICATE OF PARTICIPATION

presented to

M.Yogeshwaran

SHARIK 4.O - SARANATHAN COLLEGE OF ENGINEERING

for participatig in national level solar electric vehicle competition

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SUVC - HEAD

RSTE - V.P.

SCAN ME

CERTIFICATE

OF APPRECIATION

THIS CERTIFICATE IS PROUDLY PRESENTED TO

J. Vasanthakumar

From Electrical Engineering in Saranathan College of Engineering
has qualified for Best Participant Team Grand Finale in 1st Edition Youthzest Virtual Engineering Project Contest organised by Indian Institute of Projects Technology 2021

Serial No. **20210420**

01.05.2021

DATE

MD & Founder
Mr. Sushant Shinde

IIPT
Indian Institute of Projects Technology

CERTIFICATE

OF APPRECIATION

THIS CERTIFICATE IS PROUDLY PRESENTED TO

ISO 9001 QUALITY APPROVED

S. Thirumoorthi

From Electrical Engineering in Saranathan College of Engineering has qualified for Best Participant Team Grand Finale in 1st Edition Youthzest Virtual Engineering Project Contest organised by Indian Institute of Projects Technology 2021

Serial No. **20210575**

01.05.2021

DATE

MD & Founder
Mr. Sushant Shinde

IIPT
Indian Institute of Projects Technology

CERTIFICATE

OF PARTICIPATION

THIS CERTIFICATE IS PROUDLY PRESENTED TO

QUALITY APPROVED ISO 9001

M. Yogeshwaran

From Electrical Engineering in Saranathan College of Engineering has qualified for Best Participant Team Grand Finale in 1 st Edition Youthzest Virtual Engineering Project Contest organised by Indian Institute of Projects Technology 2021

Serial No. **20210421**

01.05.2021
DATE

MD &Founder
Mr. Sushant Shinde

SARANATHAN COLLEGE OF ENGINEERING
TIRUCHIRAPALLI - 620 012.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Accredited by NBA

Date: 01 /03/2021

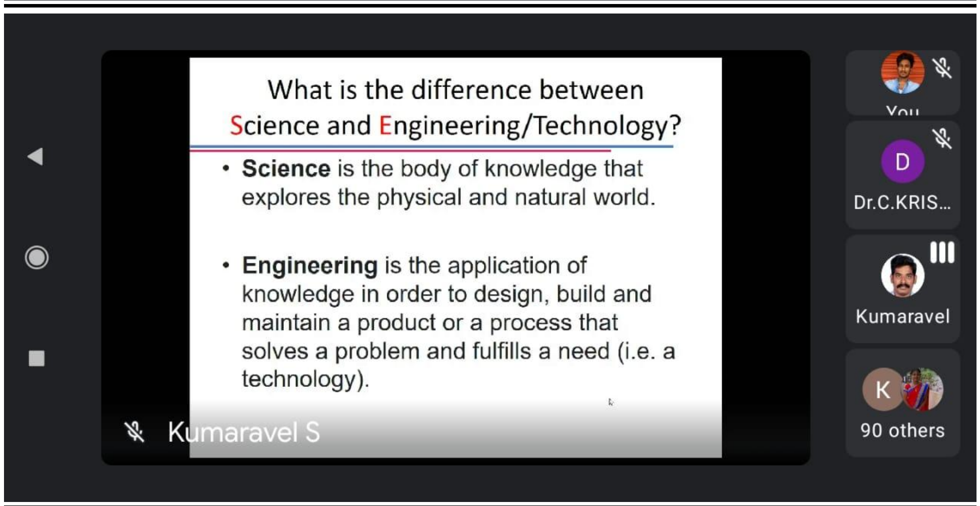
A brief report on an online webinar on "Advances in E-mobility systems" as part of National Science Day Celebration organized by department of EEE

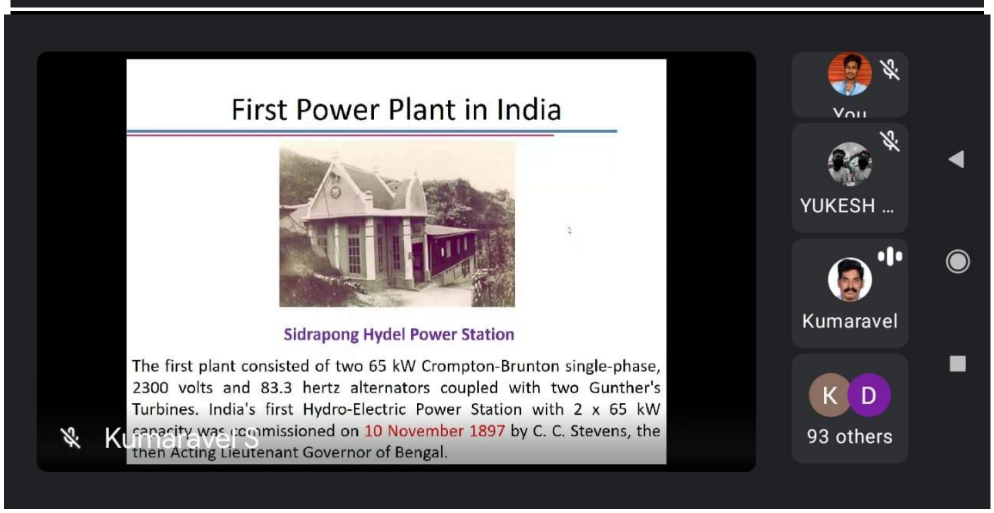
It was planned and proposed to conduct online webinar on **"Advances in E-mobility system"** as part of National Science Day Celebration on 01.03.2021 (10.00AM-11.30AM).

The resource person for this online webinar was Dr.S.Kumaravel, working as Associate Professor in the Department of Electrical Engineering, National Institute of Technology Calicut, Kerala since December 2008. His major areas of research are design and development of DC-DC converters, stability enhancement of microgrid, solid state transformers, etc

The main objective of this online webinar is to inculcate the knowledge on the latest advancements and technical challenges in electric vehicles. Totally 93 students of Second year EEE have benefited by attending this online webinar

The resource person delivered the webinar on the evolution of electric vehicle, recent challenges and technological development in the field of E mobility systems. He also added few notes on smart micro grid





Glimpse of the online webinar on **"Advances in E-mobility systems"** as part of National Science Day Celebration on 01.03.2021

SARANATHAN
COLLEGE OF ENGINEERING

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Venkateswara Nagar, Panjappur, Tiruchirapalli - 620012

WEBINAR

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

(Accredited by NBA)

Organizes an Online Webinar on

Advances in E-Mobility Systems

for II Year EEE Students

as part of National Science Day celebrations

Resource Person

Dr. S. Kumaravel

Associate Professor

Department of EEE

NIT Calicut

01.03.2021

10 A.M

Join us at

wqy-kbyu-mtg

www.saranathan.ac.in

Dr.C.Krishnakumar	Dr.D.Valavan	Shri.S.Ravindran
HoD / EEE	Principal	Secretary

Sri Kannapiran Mills Limited
Unit : Eshwara Mills
Onapalayam, Deenampalayam, Coimbatore - 641 109
Ph : (+91) 7373713931, 7373713937

08.03.2021

TO

Dr.S.M.GiriRajkumar
Head Training & Placement
Saranathan College of Engineering,Trichy

Subject : Textile Apprenticeship Program for Engineers (TAPE)

Sir,
Greetings!

We are happpy to inform you that your students have been selected for Textile apprenticeship program in our organisation. The duration of apprenticeship will be one year.
The outline of the program is as follows

1. 3000 ₹ stipend per month for the apprentice
2. Minimum mandatory 3 months apprentice program and the company will provide certificate after completion of the 3 months program
3. After that the student willing can continue for another 3 months
4. At the end of 6 months an evaluation will be conducted if the Student wants to continue the company will pay ₹ 6000
5. At the end of 12 months of students want to continue the company will pay ₹ 12000.

Stay and food is free for the first 6 months

NOTE : At the end of 3 months, Best performers will be evaluated and may be promote in different pay structures with the designation.

I have enclosed the students date of appointment.

Cogratulations and welcome!

Thanks with regards,

Manivasagam.M
HR
Sri Kannapiran Mills Ltd.(KG GROUPS)
Eshwara mills
Coimbatore- 641109
9952833003
9362266241.

Sri Kannapiran Mills Limited
Unit : Eshwara Mills
Onapalayam, Deenampalayam, Coimbatore - 641 109
Ph : (+91) 7373713931, 7373713937

S.NO	NAME	INSTITUTE NAME	DEPT	DATE OF APPOINTMENT
1	ABINESH. R	Saranathan College of Engineering	EEE	15.03.2021
2	ARUL. S	Saranathan College of Engineering	EEE	15.03.2021
3	DHARUN. M	Saranathan College of Engineering	EEE	15.03.2021
4	GOKUL. E	Saranathan College of Engineering	EEE	15.03.2021
5	HARIHARAN. V	Saranathan College of Engineering	EEE	15.03.2021
6	HARIPRASATH. S	Saranathan College of Engineering	EEE	15.03.2021
7	KARUNAKARAN. G	Saranathan College of Engineering	EEE	15.03.2021
8	MAKESHWARAN. B	Saranathan College of Engineering	EEE	15.03.2021
9	MOHAMED IRFAN. N	Saranathan College of Engineering	EEE	15.03.2021
10	MURUGAN. E	Saranathan College of Engineering	EEE	15.03.2021
11	PASHITH. H	Saranathan College of Engineering	EEE	15.03.2021
12	SAKTHI RAJA. V	Saranathan College of Engineering	EEE	15.03.2021
13	ARUN. A	Saranathan College of Engineering	MECH.,	15.03.2021

14	BALAGURU.N	Saranathan College of Engineering	MECH.,	15.03.2021
15	DIWAKAR. K	Saranathan College of Engineering	MECH.,	15.03.2021
16	PUSHPARAJ. P	Saranathan College of Engineering	MECH.,	15.03.2021
17	RAHAVENDRAN. A	Saranathan College of Engineering	MECH.,	15.03.2021
18	RAMA PRASATH. L.G	Saranathan College of Engineering	MECH.,	15.03.2021
19	SARAN. R	Saranathan College of Engineering	MECH.,	15.03.2021
20	SUBASH. A	Saranathan College of Engineering	MECH.,	15.03.2021
21	VENKATA KRISHNAN. S	Saranathan College of Engineering	MECH.,	15.03.2021
22	VETRI. N	Saranathan College of Engineering	MECH.,	15.03.2021
23	VINOTH. M	Saranathan College of Engineering	MECH.,	15.03.2021
24	VISHNU. R	Saranathan College of Engineering	MECH.,	15.03.2021
25	SIVABALARAJAN. G	Saranathan College of Engineering	MECH.,	15.03.2021
26	KALKI. K	Saranathan College of Engineering	ICE	15.03.2021
27	YAZHINI. C	Saranathan College of Engineering	ICE	15.03.2021

93A GKD Nagar P.N.Palayam Coimbatore – 641037
Prabhu N D – 99946 75750
www.sixphrase.com | sixphrase@gmail.com

LETTER OF INTERNSHIP

Date: 15 March, 2021

Name: S.ISHWARYA ,
Address:3/59,west street
Kizhapalaiyur,Manjakkudi, way,
Kudavasal taluk,
Thiruvarur district,612610,
Email: siswarya31@gmail.com ,
Contact: 9080261847.

Dear S.ISHWARYA,

Sub: Provisional Offer Letter

We are pleased to welcome you on board - Six Phrase - The Finishing School.

After careful consideration, Six Phrase - The Finishing School has decided to offer you Internship in our firm. You will be designated "Junior Intern - Trainer".

The employment is subject to the following conditions:

1) **This offer letter will be valid only if you join our organization before March 15th,2021. This offer will not hold good if you failed to join our organization before March 15th,2021.**
2) You will be required to serve a probation period of 6 months. Upon feedback from the institutions and based on your work performance you will be confirmed into our rolls after 6 months. Confirmation is purely based on your work performance.
3) Your Salary during the probation period will be Rs.10,000 per month (Cost to Company).The salary will be incremented to Rs.14,500 CTC after three months. Based on your performance the salary will be incremented to Rs.21,500 CTC after six months.
4) Further increments in your salary will be purely based on your Performance.
5) You will be eligible for PF and ESI deductions as per statutory norms.
6) You Salary will be revised after the Internship period based on the Internship Exit Exam Scores and Feedback from Institutions.

7) Your individual remuneration is purely a fact between you and the company, and has been arrived on the merit of your education, experience, your professional achievements and the company's prevailing compensation guidelines. In that context we would sincerely request you to maintain this information and any changes hereafter, as strictly personal and confidential.
8) The salary will be paid on or before the 10th of every month.
9) Your responsibilities will include Training and Assessment at various colleges and corporate, preparation of Training Material, Business Development for Training, Collection of Payment, Work related to marketing and promotion, preparation of promotional material, general administration work and other activities that the company requires.
10) Your base Job Location will be in **Coimbatore or Chennai** (based on your choice) and you will be required to travel to places outside of your **base location** also. Six Phrase will take care of your Travel and Accommodation for Training programs outside of your base location. Within the base location you will be required to take care of your Travel and Accommodation.
11) Maximum of two 1 hour permissions can be taken in a month. This permission can be availed at any time of the day but the duration should not exceed 1 hour and the maximum number of times cannot exceed 2 times in a month.
12) Maximum of 1 day paid leave can be availed every month. Leave exceeding 1 day a month will be on Loss of Pay.
13) Should you require being absent from work for reasons of sickness, injury or any other reason your must either personally or through another person notify Six Phrase immediately of this and also of when you expect to be able to return to work. In case of leave exceeding more than 2 days you will be entitled to submit necessary documents pertaining to the reason for leave.
14) In case you wish to resign / leave the service of the company, you will be required to give **three month** notice in writing failing which SIX PHRASE is entitled to recover amount equal to 3 months salary by way of agreed liquidated damages. The company at its sole discretion may accept one month's salary, or part thereof, in lieu of the notice. The company reserves the right to terminate you from operations without giving any notice during the contract period.
15) Please bring along the below listed documents / details on your day of joining

✓2 passport size and 1 stamp size color photographs.

✓Proof of Identity - Passport / Driver's license / Bank Account Statement. (Photocopy)

✓Proof of address - Ration Card / Passport / Voters ID (Photocopy)

Yours truly,

For SIX PHRASE FINISHING SCHOOL

Offer of Employment Accepted:

I have read the terms and conditions set out in this Appointment Letter. I confirm having fully understood the same. I also declare that all the certificates and documents provided by me to SIX PHRASE - FINISHING SCHOOL are true, genuine and correct.

____

Signed

S.ISHWARYA

PROCEEDINGS OF AICTE SPONSORED

Two-day International e-Conference

On

Cutting Edge Technologies in Electrical, Communication, Embedded System and Soft Computing Techniques (ICECES'20)

(5^{th}& 6^{th} November 2020)

Organized by

Department of Electrical and Electronics Engineering

(Accredited by NBA) &

Department of Electronics and Communication Engineering

(Accredited by NBA)

SARANATHAN COLLEGE OF ENGINEERING

Venkateswara Nagar, Panjappur,

Tiruchirappalli – 620012, Tamilnadu, India

PROCEEDINGS OF AICTE SPONSORED

Two-day International e-Conference

On

Cutting Edge Technologies in Electrical, Communication, Embedded System and Soft Computing Techniques (ICECES-20)

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SARANATHAN COLLEGE OF ENGINEERING

Venkateswara Nagar, Panjappur,

Tiruchirappalli - 620012

Shri. S. Ravindran
Secretary

I am given to understand that the Departments of ECE and EEE are jointly organizing an International e- Conference titled “Cutting Edge Technologies in Electrical, Communication Embedded System and Soft Computing Techniques” and that it is being organized on 5th and 6th of November 2020. Post Covid the focus of the Government is likely to be on their slogan - “Be Vocal, Buy Local”. In light of this the organization of such an e-conference assumes enormous importance. As “buying local” increases the need for manufacturing will also exponentially increase. Newer and better methods of manufacturing of products that meet international quality expectations will have to be found. That would mean innovations have to happen in the fields of Electrical and Electronic Engineering coupled with soft computing techniques.

The necessary raw materials by way of men, materials and money are all available. What needs to be done is, addition of another essential raw material in the form of management to create the right environment for innovation. Given the right environment, the young minds of India WILL come up with socially relevant optimal usage of technology.

It is very gratifying to be briefed that quite a few researchers from different premier institutes across the globe have contributed their papers to this conference. An open and objective brainstorming on those papers would surely result in development of disruptive technological solutions.

I take this opportunity to welcome all the participants to this e-conference and to wish the participants, organizers and committee members all success in their endeavor.

All the best! May God Bless you all!

Prof. Dr. Y. Venkataramani

Dean (R&D)

I am pleased to offer my felicitations to the organisers of the e-conference for having conducted with great success, the first e-conference in Saranathan College of Engineering. The conference provided a forum for researchers, in various areas, to highlight their research work and also understand the work being done by other researchers. I am sure, the interaction among the delegates, will lead to lot of new collaborative projects. My congratulations to the EEE and ECE departments for the meticulous planning and conduct of the Conference

Prof. Dr. D. Valavan

Principal

I'm glad to know that an International e- Conference titled "Cutting Edge Technologies in Electrical, Communication and Soft Computing Techniques" isbeing jointly organized on 5^{th} and 6^{th} of November 2020 by the Departments of ECE and EEE. The theme of the Conference is very appropriate to the current times. With the focus on local manufacturing under "Atmanirbharta Abhiyan" any discussion on research and innovation in any field has assumed immense importance – in the fields of Electrical and Electronics Engineering more so.

*"**Change is a certainty and Innovation is the best way to address that change**"*

Innovation is learning to do tasks differently but more efficiently. Since it is essentially doing a task it will have to be only hands-on. Given the right challenging ambience, young minds will come up with new and disruptive technological ideas. This platform must serve that purpose and create the right challenging ambience. Any research or innovation can be termed successful ONLY when that innovation brings about social betterment.

I'm glad to know the researchers from different premier institutes across the globe have contributed their papers to this conference. I hope those papers would generate objective interactions that would result in disruptive technological solutions.

I welcome all the participants to this e-conference. Wishing the organizers and committee members Godspeed! Have a great e-conference!!

Prof. Dr. C. Krishna Kumar

HoD / EEE

Convener

I am extremely glad to present the proceedings of the International e-Conference on Cutting Edge Technologies in Electrical, Communication, Embedded systems and Soft Computing Techniques (ICECES '2020) held on 5th& 6th November, 2020. This conference is an accomplishment of the Electrical and Electronics Engineering department& Electronics and Communication Engineering department of Saranathan College of Engineering, Trichy. The conference is organised with the support of All India Council for Technical Education, and diligent efforts from the faculty members and students. The objective of this conference is to bring together research scholars, scientists, engineers, and students to exchange and share their new ideas and research findings about all aspects of main themes and tracks. After the rigorous peer-review process, the submitted papers were selected on the basis of novelty, importance, and clarity for the purpose of the conference. I extend my sincere thanks to all those who have contributed to the success of ICECES '2020, especially all the authors and the participants who responded to our call for papers.

I congratulate the Conference Technical Programme Committee Members for their efforts and dedication, who made this event possible.

Prof. Dr. M. Santhi
HoD / ECE
Convener

It is my great pleasure to welcome you all to our 1st AICTE Sponsored International e-Conference on Cutting Edge Technologies in Electrical, Communication, Embedded Systems and Soft Computing Techniques (ICECES'20), held during 5th and 6th of November, 2020 in Saranathan College of Engineering, Tiruchirappalli. The objective of this e-Conference is to bring all the researchers, Academicians, industrialists and students at one platform, and also to inculcate the research culture among the entire fraternity of Education in the country.

I hope that this conference would certainly induce innovative ideas among the participants, paving way for new inventions and technologies in Electrical, Communication, Embedded Systems and Soft Computing Techniques and related fields. We received 150 papers out of which 143 papers were selected for presentation. I would like to thank AICTE and our management for providing financial support to organize this conference.

I am grateful to our Honorable Secretary Shri. S. Ravindran, for his constant support and encouragement to conduct such a prestigious conference in our college. I thank our respected Principal Dr. D. Valavan for his motivation and support to organize this conference. My sincere gratitude goes to our respected Dean R&D Dr. Y. Venkataramani for his fullest guidance towards this conference. Special thanks to the Keynote Speakers, Dr. Seok-Bum Ko, Professor, University of Saskatchewan, Saskatoon, Canada and, Dr. Y. Venkataramani, Dean (R&D) of our college for sharing their knowledge on current research topics. I would like to thank our vibrant faculty members for their un-tired efforts for the successful conduct of this conference. I hope the deliberations from various distinguished speakers and the paper presentations will benefit the participants to update their knowledge.

I extend my best wishes for great success of the conference.

Keynote Speaker

Prof. Dr. Seokbum Ko

University of Saskatchewan, Canada

Seokbum Ko is currently a Professor at the Department of Electrical and Computer Engineering and the Division of Biomedical Engineering, University of Saskatchewan, Canada. He got his PhD degree from the University of Rhode Island, USA in 2002.

His research interests include computer architecture/arithmetic, efficient hardware implementation of compute-intensive applications, deep learning processor architecture and biomedical engineering.

He is a senior member of IEEE circuits and systems society and associate editors of IEEE TCAS I and IEEE Access.

Keynote Speaker

Prof. Dr. Y. Venkataramani

Dean (R&D), Saranathan College of Engineering

Dr.Y.Venkataramani obtained his B.Tech & M.Tech degree from I.I.T Chennai. He was awarded Ph.D. by I.I.T. Kanpur. He has rich academic experience. He served as a faculty for 34 years and later headed the Dept of Electrical Engineering at NIT, Calicut He served as Principal of Saranathan College of Engineering, Trichy from 2001 to 2009 and from 2011 to 2013.

He has authored a book titled “Linear Integrated circuits and applications”. He has guided more than 15 research scholars in various domains. Eight of our staff members have completed their Ph.D. under his able guidance. He has presented many papers in International conferences and refereed Journals.

He has been invited to give key note address in various International conferences and FDPs. In many NITs, he has delivered guest lecturers. At present he is serving as Dean (R & D) in our institution. His areas of interest include Computer Networks, Signal Processing and Network security.

Saranathan College of Engineering, Trichy -12
AICTE Sponsored two-day Internatioal e-conference (ICECES'20)
Schedule

Date	Time	Track 1	Track 2	Track 3
Day – 1 **5th Nov'20**	10.00 AM – 10.45 AM	**Keynote Address by Prof. Dr.Seok-Bum Ko,** **Professor, University of Saskatchewan, Canada**		
	10.45 AM – 11.00 AM	Break		
	11.00 AM – 2.00 PM (Session – 1)	**Judges :** **Dr.A. Nazar Ali,** Associate Professor/EEE, Rajalakshmi Engineering College, Chennai, TN **Prof. C. Pearline kamalini**, Assistant Professor/EEE, Saranathan College of Engineering, Trichy, TN **Prof.R. Vijay**, Assistant Prof/EEE, Saranathan College of Engineering, Trichy, TN	**Judges :** **Dr.J.Manikandan**, Professor, Crucible of Research and Innovation (CORI), PES University, Bangalore, KA **Dr.V.Mohan**, Associate Professor /ECE, Saranathan College of Engineering, Trichy, TN **Dr.M.BarithaBegum**, Assistant Professor, Saranathan College of Engineering, Trichy, TN	**Judges :** **Dr.L.Saikala** Associate Professor/Civil NIT, Trichy, TN **Dr.G. Dhanalakshmi**, Prof & Head/Civil Saranathan College of Engineering, Trichy, TN **Mr.A.Anandraj**, Assistant Professor/Civil Saranathan College of Engineering, Trichy, TN
	1.00PM – 4.00 PM (Session – 2)	**Judges :** Dr.K.Dhayalini, Professor & Head/EEE, K.Ramakrishna College of Engineering, Trichy, TN **Prof. B.Paranthagan**, Associate Professor/EEE, Saranathan College of Engineering, Trichy, TN **Prof.P.Ramesh babu**, Assistant Professor/EEE, Saranathan College of Engineering, Trichy, TN	**Judges :** Dr.K.Swaminathan, Head-FPGA Design Team, Jiva sciences Pvt Ltd, Bangalore, Karnataka. **Dr.M.Santhi**, Professor & HOD/ECE, Saranathan College of Engineering, Trichy, TN **Dr.S.A. Arunmozhi**, Associate Professor / ECE, Saranathan College of Engineering, Trichy, TN	--

Date	Time	Track 1	Track 2	Track 3
Day – 2 6th Nov'20	10.00 AM – 10.45 AM	**Keynote Address by Prof.Dr.Y.Venkataramani, Dean (R&D), Saranathan College of Engineering, Trichy, Tamilnadu**		
	10.45 AM – 11.00 AM	Break		
	11.00 AM – 2.00 PM (Session – 1)	**Judges :** **Dr.G.Kannan**, Associate Professor/ECE, B.S.Abdur Rahman Crescent Institute of Science & Technology, Chennai, TN **Prof.S.Ramprasath,** Assistant Prof/EEE, Saranathan College of Engineering, Trichy, TN **Prof.R.Venugopal**, Assistant Professor/EEE, Saranathan College of Engineering, Trichy, TN	**Judges :** **Dr.M.Maheswari**, Professor & Head/ECE, K.Ramakrishna College of Engineering, Trichy, TN **Dr.C.Vennila,** Professor /ECE, Saranathan College of Engineering, Trichy, TN **Dr.M.Padmaa,** Prof/ECE, Saranathan College of Engineering, Trichy, TN	**Judges :** **Dr. Jasmine Beulah Gnanadurai**, Professor, Kristu Jayanthi College Bangalore **Dr.V.Punitha** Associate Professor/CES Saranathan College of Engineering, TN **Dr.R.Senthamil selvi** Assistant Prof/CES, Saranathan College of Engineeing, TN
	1.00 PM – 4.00 PM (Session – 2)	**Judges :** **Dr.R.Shenbagalakshmi,** Professor/EEE, SKN Sinhgad Institute of Technology & Science, Lonavala, MH **Dr.S.Vijayalakshmi,** Associate Professor/EEE, Saranathan College of Engineering, Trichy, TN **Prof.M.Marimuthu**, Assistant Professor/EEE, Saranathan College of Engineering, Trichy, TN	**Judges :** **Dr.R.Rajeswari**, Professor/ECE, Rajalakshmi Institute of Technology, Chennai, TN **Dr.S.Rajeswari**, Associate Professor / ECE, Saranathan College of ngineering, Trichy, TN **Dr.P.Shanmugapriya**, Associate Professor /ECE, Saranathan College of ngineering, Trichy, TN	

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DESIGN OF MULTISTAGE CASCADED DC-DC BOOST CONVERTER

Ayisha Banu.A.P[1], Marimuthu.M[2]

[1]PG Scholar, [2]Assistant Professor, EEE, Saranathan College of Engineering, Trichy, India

Abstract: Staggered cascaded DC-DC support converter to reap a high voltage gain for applications which are backing by sustainable sources. The nonconventional source like PV yield low yield voltage. This bring the analysis direct consideration on converters to efficient it for high voltage gain. In this, a multilevel cascaded help converter is plotted for a convenient solution. This conjoin the fundamental cascaded and a staggered support converter to depend high voltage gain. The proposed conspire develop with cascaded help converter and voltage multiplier cell which proceed as an addition augmentation cell. The aim of this undertaking is to proffer a converter which has low current pressure and high voltage gain when contrasted and accessible non isolated converters for PV order. The intrigue and tenacious state examination of the proposed converter and mimeograph have been performed using MatLAB/Simulink.

WIRELESS BATTERY MONITORING SYSTEM WITH LIVE TRACKING FOR AN e-VEHICLE

Devi sri.J[1], Indhu.R, Kowsalya.S[2],Madhumita.S[3],S.Ramprasath[4]

[1,2,3]Student, [4]Assistant Professor, Department of Electrical and Electronics Engineering, Saranathan College of Engineering

[1]devikeerthi12@gmail.com

Abstract: In focus towards e-vehicle the major sector to be concentrated is battery. To examine the battery and its related parameters, a flexible and compact system is build. Battery plays a major role in the operation of the e-vehicle, it is essential to govern the battery parameters and expand the life time of a battery. The quest to increase the span of an e-vehicle can be solved by governing the battery parameters related to voltage and current. To process the same, we need an interfacing medium which transmits the information to our smart phone. Blynk is the interfacing app which facilitates interfacing between the Arduino platform and smart phone. This app must be installed in our mobile phone to get the voltage and current parameters along with the live location of our vehicle. In battery monitoring system we are about to implement a

system that monitors the discharging voltage of the battery, current of the battery, live tracking of our car and temperature of our battery. GPS module is implemented to get the live location of our car and thereby executing live tracking. So, the system provides theft protection for our e-vehicle. Sensors are used to sense the parameters like current, voltage and temperature. By monitoring the battery parameters and maintaining it within safe limit. Thus, the battery of the electric vehicle can be protected from the undesired problems and thus its life span can be increased. The most important feature of our system is that we can monitor the battery is under load and also during running and helps the driver to maintain the parameters within the safe limit. As a whole, the life span of the battery can be increased with an added advantage of guiding the people with good platform. Cell balancing, Malfunction indication, status indication can also be maintained.

THE DETERMINATION AND CURING OF VARICOSE VEIN USING RASPBERRY PI

Dr. S.Vijayalakshmi[1], Arulraja K[2], Ganeshkumar V[3], Guhan R[4], Gokulnath A J[5]

[1]Associate Professor, [2,3,4,5]UG Scholar, Department of Electrical and Electronics Engineering, Saranathan College of Engineering

[1]vijayalakshmi-eee@saranathan.ac.in

Abstract: Varicose veins are an early manifestation of chronic venous insufficiency. Although the risk factors associated with varicose veins are well described, the basic pathophysiology leading to venous valvular incompetence, and thus, varicosities are less well known. The idleness becomes major factor that leads to varicose veins in lower part of the body. When the varicose veins clots, it is called as the superficial thrombophlebitis and it is usually very painful. The survey is conducted across all over the world to overcome this disease. The data are collected to programming the dataset algorithm respectively. The positional data of the person is recorded. Raspberry pi using Artificial intelligence decision tree algorithm is used. The preventive action is taken by processor through deep learning. The preventive measures as blood flow are normalized by using the vibration motor and Peltier module. The predetermined data's are analysed and the actions are taken by the processor. The determination process is done using the sensors. The prevention modules are activated by the relays interconnected to the raspberry pi.

DESIGN AND DEVELOPMENT OF THREE LEVEL CONVERTER

J. Anitha[1], M. Monica[2], Dr.S.Vijayalakshmi[3]
[1,2,]Student, [3]Associate Professor, Department of Electrical and Electronics Engineering, Saranathan College of Engineering

Abstract: The first part of this paper introduces a novel three level converter topology. It is shown that a floating capacitor connected across the clamping diodes of a conventional three level converter with PWM schemes. The proposed control scheme is based on a look up table instead of the conventional complex algorithm. In order to improve the power quality in the single phase rectifier, a ROM based control scheme, based on hysteresis current comparator, region detector, and capacitor compensator is used to achieve a sinusoidal line current with low current distortion and high power factor and to reduce the voltage stress of power switches.

DESIGN AND IMPLEMENTATION OF CLOUD BASED DIGITAL ENERGY METER USING ESP8266

P. Ramesh Babu[1], A.Pradeep[2], P. Rajendra prasath[3], R. Rishikesh kumar[4], J.Sharvin[5]
[1]Assistant Professor, [2,3,4,5]UG Scholar, Department of Electrical and Electronics Engineering, Saranathan College of Engineering
[1]ramnira@gmail.com

Abstract: Structured use of energy becomes more pivotal when increase in the cost of energy is observed. Management of energy is required to know the amount of consumed energy in a specific period, utilization of Energy Meters is essential. It is attainable to measure the consumed energy by using a traditional energy meter but sometimes the limited functionality of these meters restrict their area of application, especially in inaccessible areas or in the situations where visibility of the energy meter is poor and the main drawback is the person has to take reading by area by area and take reading of every house and institute make it not possible to use such application. A possible solution is an IOT based Wireless Energy Meter[1] which is able to send its data via wireless communication (cloud computing) to a PC or mobile phones in the form of E-mails and mobile application notification or through web page where surveillance and analysis of the data will be made easily. This computation system is focused to be used in measuring energy related quantities of transformers and high voltage towers at remote locations, industries, domestic area, institutions.

SARANATHAN COLLEGE OF ENGINEERING

TIRUCHIRAPPALLI - 12

INTERNSHIP DETAILS

Branch: EEE **Academic year: 2020-21**

S. No.	REG. No.	YEAR	Sec	BATCH No.	NAME OF THE STUDENT	NAME OF THE COMPANY	DURATION IN MONTSH/DAYS	STARTING FROM	STIPEND DETAILS
1	813817105005	IV	A	203005	ABINESH. R	Sri Kannapiran Mills	3 months	15.03.2021	3000
2	813817105008	IV	A	203008	ARUL. S	Sri Kannapiran Mills	3 months	15.03.2021	3000
3	813817105018	IV	A	203018	DHARUN. M	Sri Kannapiran Mills	3 months	15.03.2021	3000
4	813817105025	IV	A	203025	GOKUL. E	Sri Kannapiran Mills	3 months	15.03.2021	3000
5	813817105026	IV	A	203026	HARIHARAN. V	Sri Kannapiran Mills	3 months	15.03.2021	3000
6	813817105028	IV	A	203028	HARIPRASATH. S	Sri Kannapiran Mills	3 months	15.03.2021	3000
7	813817105039	IV	A	203039	KARUNAKARAN. G	Sri Kannapiran Mills	3 months	15.03.2021	3000
8	813817105048	IV	A	203048	MAKESHWARAN. B	Sri Kannapiran Mills	3 months	15.03.2021	3000
9	813817105052	IV	A	203052	MOHAMED IRFAN. N	Sri Kannapiran Mills	3 months	15.03.2021	3000
10	813817105057	IV	A	203057	MURUGAN. E	Sri Kannapiran Mills	3 months	15.03.2021	3000
11	813817105032	IV	A	203032	ISHWARYA. S	Six Phrase	6 months	15.03.2021	10000

SARANATHAN COLLEGE OF ENGINEERING
DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING
TIRUCHIRAPALLI - 620 012.

Date: 17-07-2020

Ref No: SCE/ICE/2020-21/01

Report on 3 days workshop on 'Latest Innovation Techniques in Engineering'

The department of Instrumentation and Control Engineering conductedonline workshop on 'Latest InnovativeTechniques in Engineering' during (15 - 17) Jul. 2020. The speakers are from reputed central institutions and 4/6 speakers are from other state (2 IITs, 4 NITs).The workshop started with the addressing by Dr. S. M. Girirajkumar, Head of the Department, Department of Instrumentation and Control Engineering, Saranathan College of Engineering, Tiruchirappalli. The participants are from India, China and Ethiopia. Out of 207 registrations, 89 faculty members from various institutes and industries were short listed for the workshop.

15 July forenoon session of the workshop was about'Sensing based on electro wetting principle' by Dr. Karabi Biswas, Associate Professor, Electrical Engineering Department, IIT Kharagpur, West Bengal. The application of electro wetting principle was explained with its advantages and limitations.

The second session was on 15 Jul. 2020 AN. The topic of presentation was'Identification and control of multivariable systems' by Dr. M. Chidambaram, Visiting Professor - Chemical Engineering Department, NIT Warangal, Former Director, NITT, Professor, IITM. The multiple input and multiple output system with the real time modeling was explained.

The third session of the workshop was on FN session of 16 Jul. 2020. Dr. Ashis Kumar Sen, Associate Professor,Dept. of Mechanical Engineering, IITM, Chennai handled the session about the topic 'Microfluidics'. He introduced about the basics of microfluidics with its advantages and limitations. He addressed about acousto microfluidics which deals with blood plasma separation. He also enlightened with early diagnosis of sepsis, isolation of CTCs based on acoustic impedance and challenges in isolation for breast cancer. He addressed about acoustic coalescence of drop with stream, surface acoustic waves and droplet microfluidics

Dr. Seshagiri Rao Ambatti, Associate Professor, Dept. Chemical Engineering, NIT, Warangal, Telangana handled the fourth session on 16Jul. 2020 AN. He addressed about 'The rise of digital water: How digital technology will transform the water and wastewater utilities'.He started with some facts about water challenges both positive and negative.He addressed about the decision support in water sector, water eco system with digital solutions, water collection, treatment and distribution. He made the session interesting with the real time application of water treatment of COD, POD, and many other suspended particles. Process optimization for reducing operating cost, threat for safety issues, 3 scales of water innovation was dealt with.He suggested about waking up of Artificial Intelligence in water industry to reduce operating expenditure and minimize cost. The application of Model predictive control and Fuzzy logic control for the Prediction error method in Matlab to detect unknown parameters of water treatment was dealt with.

The fifth session was on 17 Jul. 2020 FN. Dr. Abraham T. Mathew Professor, Dept. Electrical Engineering, NIT Calicut. He addressed about Kalman Filter, Extended KF and Unscented Kalman Filter. The requirement of state model and measurement model for Kalman filter and the importance of filtering for non linear model was dealt with.

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DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING
TIRUCHIRAPALLI - 620 012.

Date: 17-07-2020

Ref No: SCE/ICE/2020-21/01

The last topic of the workshop was about 'Industrial automation' by Dr. M. Sivakumaran, Professor, Dept. Instrumentation and Control Engineering, NIT Trichy. He started the lecture with industrial automation forSISO and MIMO system. Linear and nonlinear system applied with PLC and SCADA was explained. He enlightened with the need for industrial safety system and security issues. He also addressed about sensor fusion, secured automation system with cloud architecture and IoT security considerations.

M Shanmugavalli

Program Co coordinator

HoD/ICE

C 2.2.1 Proof

SARANATHAN COLLEGE OFENGINEERING

TIRUCHIRAPALLI – 620 012

Department of Mechanical Engineering

WEBINAR

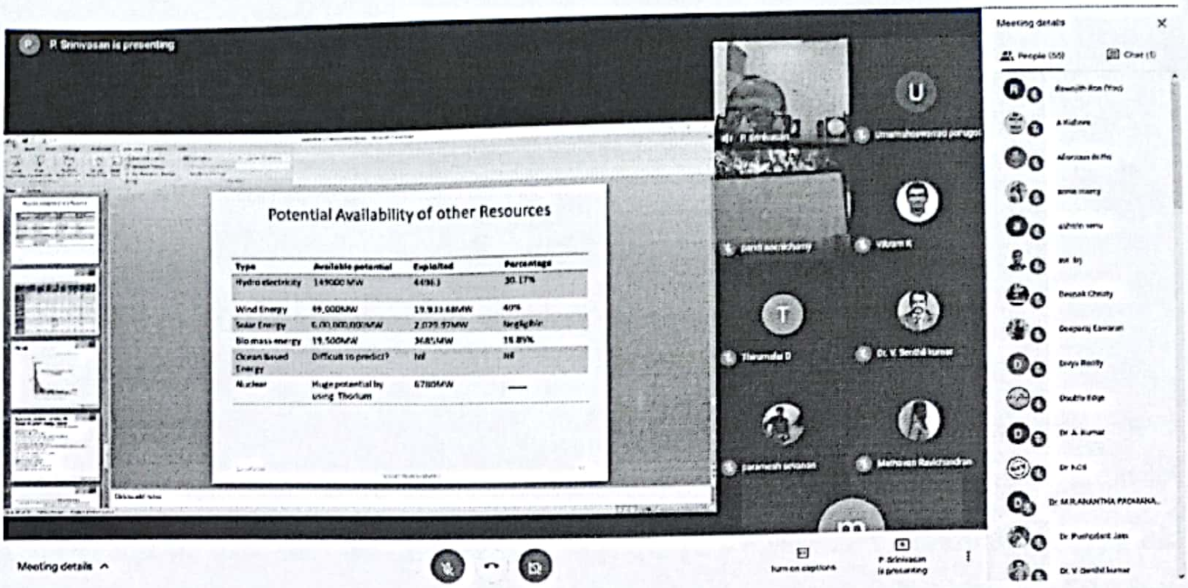
ON

INDIAN POWER SCENARIO, PAST, PRESENT & FUTURE AND ROLE OF ACADEMICIANS

A Report

The Department of Mechanical Engineering organized a webinar on "**Indian Power Scenario, Past, Present & Future and Role of Academiciansson 10th July 2020**. This programme was conducted through **Google Meet** under the auspices of M.E.Thermal Engineering stream. **Dr.P.Srinivasan, Associate Dean, Work Integrated Learning Programme Division(WILPD),BITS Pilani**delivered the invited talk . The guest speaker gave a deep insight into the Indian Power scenario, tracing its growth from its earlier dependence on conventional power sources to its diversification in current times with emphasis on green energy. The technological modifications required to tappingefficient and clean energy from existing power plants in future and the potential of alternate energy sourceswas discussed in an elaborate manner. He also stressed the need for redefining the roles of academicians while teaching subjects on Power Plant Engineering, with better focus on practical relevance. The webinar was attended by 56 participants, constituted by faculty members from various colleges, research scholars and post graduate students. The session recorded a five star feedback from participants, who requested for more such webinars on the topic. The speaker addressed questions from participants at regular intervals.The webinar was hosted **by Dr.G.Jayaprakash, Head, Department of Mechanical Engineering.**

Head of the Department
Mechanical Engineering
Saranathan College of Engineering
Tiruchirappalli - 620 012



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SARANATHAN COLLEGE OFENGINEERING

TIRUCHIRAPALLI – 620 012

Department of Mechanical Engineering

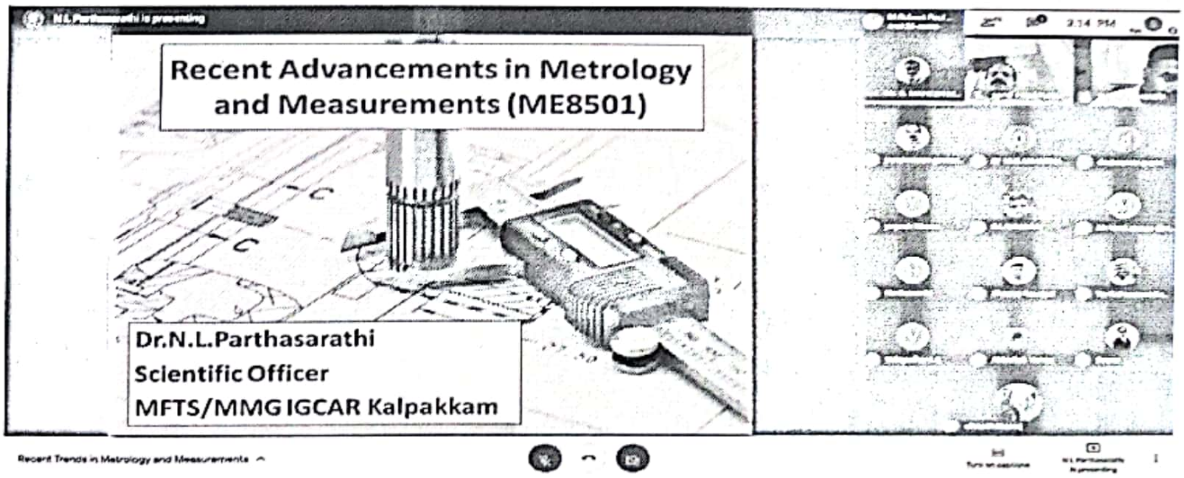
WEBINAR

ON

RECENT ADVANCEMENT IN METROLOGY & MEASUREMENT

A Report

The Department of Mechanical Engineering organized a webinar on **"Recent Advancement in Metrology & Measurement"** on **11th July 2020**. This programme was conducted through **Google Meet** under the auspices of Manufacturing Engineering stream of our department. **Dr.N.L.Parthasarathy, Scientific Officer, MFTS/MMG, IGCAR Kalpakkam** delivered the invited talk. The guest speaker gave a deep insight into various dimensional & geometric measurements using conventional as well as latest methods. He also discussed various state of art measuring instruments available in his organization, used to measure these features and technical specifications of the instruments like range, accuracy, etc. The webinar was attended by 50 participants, constituted by faculty members from various colleges, research scholars and post graduate students. The speaker addressed many questions from participants at the end of the session. The webinar was hosted by **Dr.G.Mahesh, Asst.Prof., Department of Mechanical Engineering**.



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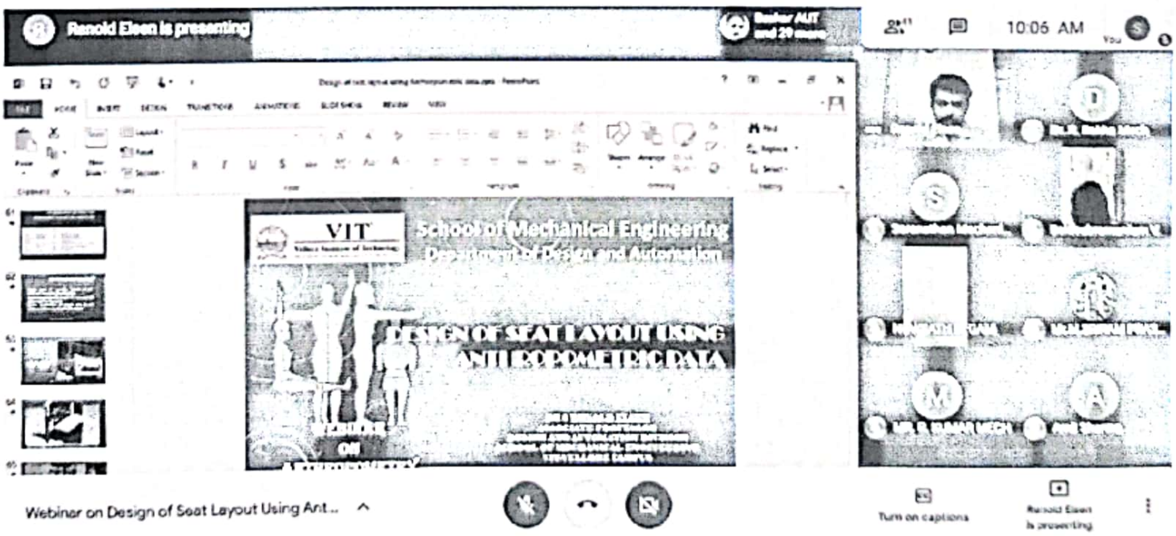
Department of Mechanical Engineering

WEBINAR
ON
DESIGN OF SEAT LAYOUT USING ANTHROPOMETRIC DATA

A Report

The Department of Mechanical Engineering organized a Webinar on "Design of Seat Layout using Anthropometric Data" on 13th July 2020. Dr.S.Renold Elsen, Associate Professor, Department of Design and Automation, School of Mechanical Engineering, VIT Vellore was invited as the resource person. He gave an elaborate presentation on design aspects of seat layout based on anthropometric data. It is an emerging area in the field of research. He explained anthropometry as the science of measurement of the physical geometry, mass properties, and strength capabilities of the human body. He also emphasized that Anthropometric measurements, when considered for designing furniture helps in achieving ergonomics, safety, suitability, reducing musculoskeletal disorders and improving performance. He further explained the concept with case studies and research projects that he had carried out. The participants enthusiastically interacted with him about the research projects in the field of design using Anthropometric Data. The participants gave a positive feedback stating that the session was very informative and interesting. The webinar was attended by 45 participants constituting faculty members and research scholars from various institutions.



Head of the Department
Mechanical Engineering
Saranathan College of Engineering
Tiruchirappalli - 620 012

Request Letter

Date : 02.05.2021

Place: Tiruchirappalli

From

Dr.G. Mahesh,

Associate professor,

Department of Mechanical Engineering,

Saranathan College of Engineering,

To

Dr.G. Jayaprakash,

Head of the Department,

Department of Mechanical Engineering,

Saranathan College of Engineering,

Dear Sir,

Sub: Asking permission for conducting an event.

Our college second year mechanical department students are willing to conduct an online intra department level quiz and project expo competition exclusively for second year students to showcase their talents. Please grand the permission to conduct the event.

Thank you

2/5/21

Yours faithfully,

Dr.G. Mahesh,

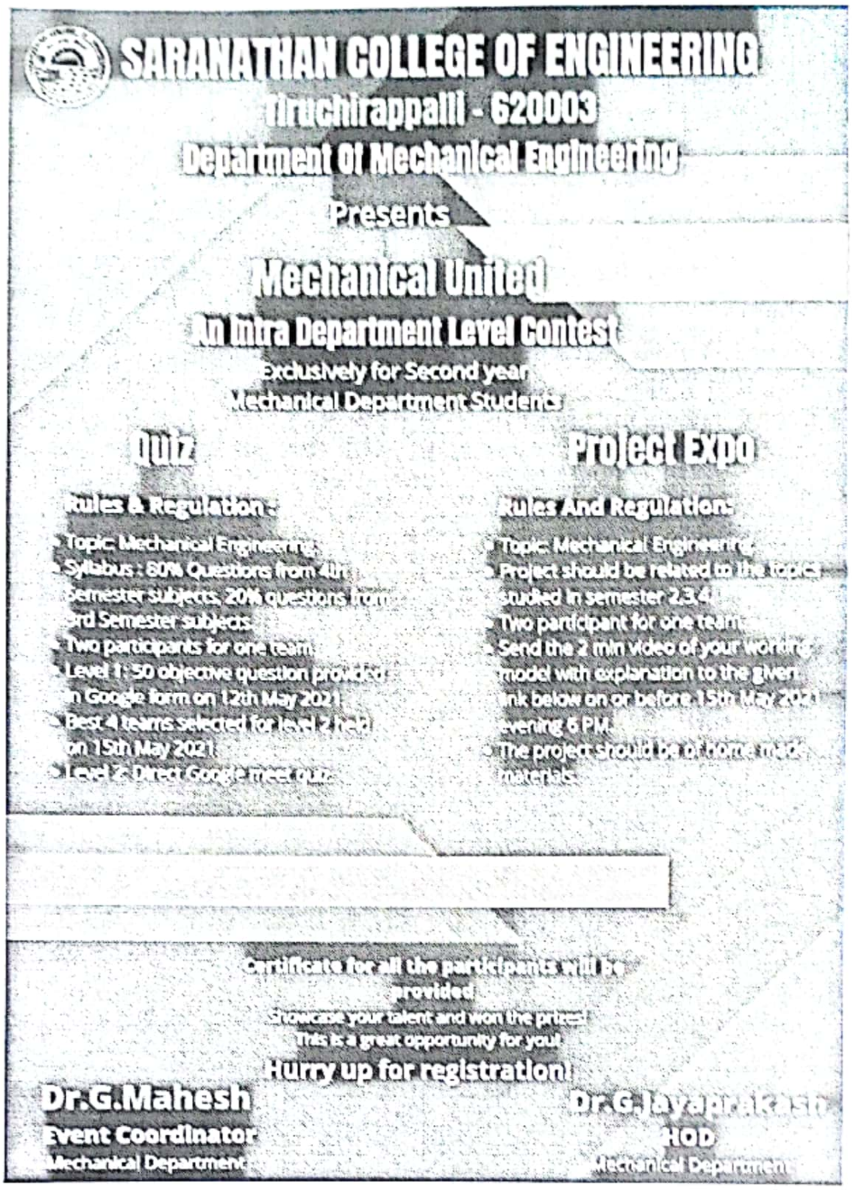
Associate professor.

Date : 02.05.2021

Place: Tiruchirappalli

02/05/2021

Event Poster:



Event Coordinator and Team Details:

- **Dr.G.Mahesh**- event coordinator
- **Mr.MI.Mohamed Ajmal**– Welcome Address
- **Mr.MI.Mohamed Ajmal**– Screen Recording
- **Mr.MI.Mohamed Ajmal**– Vote of Thanks
- **Mr.M.Salman Faris**– Poster Designer

Head of the Department
Mechanical Engineering
Saranathan College of Engineering
Tiruchirappalli - 620 012

Moderator Details:

- **Mr.S.Radhakrishnan** - Emcee

Event description:

This event is mainly conducted for exploring practical knowledge and edutain Mechanical engineering department students.

Targeted audience:

Second year mechanical engineering students of Saranathan college of Engineering, Tiruchirappalli.

Participation details:

Quiz Event: (Level-1)

Totalregistrations: 21 Teams (42 Participants)

Event Total attendees: 19 Teams (38 Participants)

Quiz Event: (Level-2)

Total Qualified from level 1: 4 Teams (8 Participants)

Event Total attendees: 14 members

Faculty participants: 4

Project Expo Event:

Totalregistrations: 9 Teams

Event Total attendees: 7 Teams

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Saranathan College of Engineering
Tiruchirappalli - 620 012

Registration form and responses:

Registration

Quiz Event:

https://docs.google.com/spreadsheets/d/139HL_p4ZfZHkB6_QFdtC9jWIFI2p1Lo-wanslbo67Cs/edit?usp=sharing

Project expo Event:

https://docs.google.com/spreadsheets/d/1J-hZa6bTApzi7sNEJG_W7FfvJSG_vDYCDA1N-FzHRHU/edit?usp=sharing

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Responses

Quiz level-1 results report: https://docs.google.com/spreadsheets/d/1eKVT-BeQcx-QV0zv5FW5jgiecR0MpB7UFCM_zlVJLns/edit?usp=sharing

Project Expo video submitted link:

https://docs.google.com/spreadsheets/d/1sON-5T8xJvkokRboSwfMYFlaQOC33h8toKetXR4zhf8/edit?usp=sharing

Summary (Quiz and Project expo):

- Dr. Mahesh coordinated this event.
- Two different registration form links are provided to the students on 4th May 2021 and registration closed on 8th May 2021.
- In project expo event the participants are requested to upload their project as a 2 minute video with explanation and the due date is given as 15th May 2021.
- Quiz event level-1 is conducted on 12th May 2021 via Google form
- 50 Objective questions are provided and time duration of exam is 1 hour.
- Based on the score in quiz level-1 four teams are qualified to the level -2

Head of the Department
Mechanical Engineering
Saranathan College of Engineering
Tiruchirappalli - 620 012

- Level-2 is conducted on 15th May 2021 via direct Google meet.
- The session started with Welcome speech and Head of the Department Mr. Jayaprakash gave a motivational speech and congratulated the Qualified teams and motivated all the teams to perform well.
- The quiz competition is conducted by splitting it into 4 Rounds.
- Before each round starts some rules and regulations of that round is instructed.
- All the team members are participated well.
- At last the winners are announced by the event coordinator and congratulates them.
- Mr.P.Vigneshwar gave a special guest speech and congratulates the winner and requested to conduct these type of studies related events each and every month.
- Participants shared their feedback about the event and the event ends with the vote of thanks.
- The project expo event videos are collected and the winners are announced.

Standouts (Prize Winners):

Quiz Winners:

1st Prize: Srivardhan C,

Sriram S

2nd Prize: Muthu sai charan V R,

Nithis Kumar P

3rd Prize: Naveen M,

Prasanna R

Project expo Winners:

1st Prize: 1.Sutharsh Krishna K A,

Head of the Department
Mechanical Engineering
Saranathan College of Engineering
Tiruchirapalli - 620 012

2.Sambugesh D

2nd Prize: 1.Muthu sai charan V R

3rd Prize: 1.Srivardhan C,

2.Sriram S &

1.Aravindh S

2. Balaji S

Outcomes:

- Many students come out with their ideas and submitted their ideas as projects and got certificate.
- Many students performed well in quiz event and it reflects their subject knowledge. All the participants got the certificate.Certificate model:

Merit Certificate:

Saranathan College of Engineering
Venkateswara Nagar, Panjappur, Tiruchirappalli-620012
Department of Mechanical Engineering
Presents
"MECHANICAL UNITED"
Certificate of Merit

This is to certify that Mr/Ms. SUTHARSH KRISHNA K A of Saranathan College of Engineering has participated in "Mechanical United" an Intra department level Project expo event and won 1st prize organized by the Department of Mechanical Engineering, Saranathan College of Engineering, Tiruchirappalli on 15th May 2021.

Dr.G.Mahesh, Event Coordinator
Dr.G.Jayaprakash, Head of the Department
Dr.D.Valavan, Principal

Saranathan College of Engineering
Venkateswara Nagar, Panjappur, Tiruchirappalli-620012
Department of Mechanical Engineering
Presents
"MECHANICAL UNITED"
Certificate of Merit

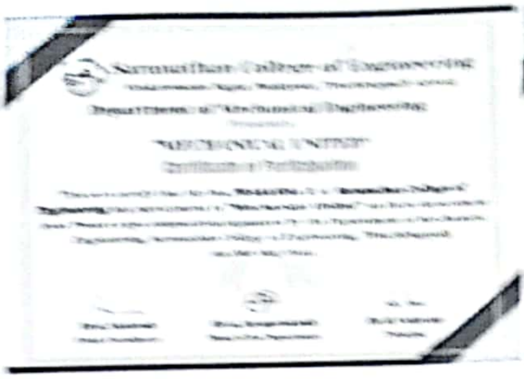
This is to certify that Mr/Ms. SRIVARDHAN C of Saranathan College of Engineering has participated in "Mechanical United" an Intra department level Quiz competition and won 1st prize organized by the Department of Mechanical Engineering, Saranathan College of Engineering, Tiruchirappalli on 15th May 2021.

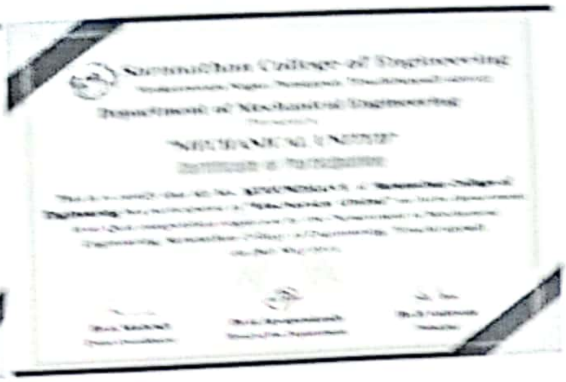
Dr.G Mahesh, Event Coordinator
Dr.G.Jayaprakash, Head of the Department
Dr.D.Valavan, Principal

Project Expo event **Quiz event**

Participation Certificate:

Head of the Department
Mechanical Engineering
Saranathan College of Engineering
Tiruchirappalli - 620 012





Project Expo event

Quiz event

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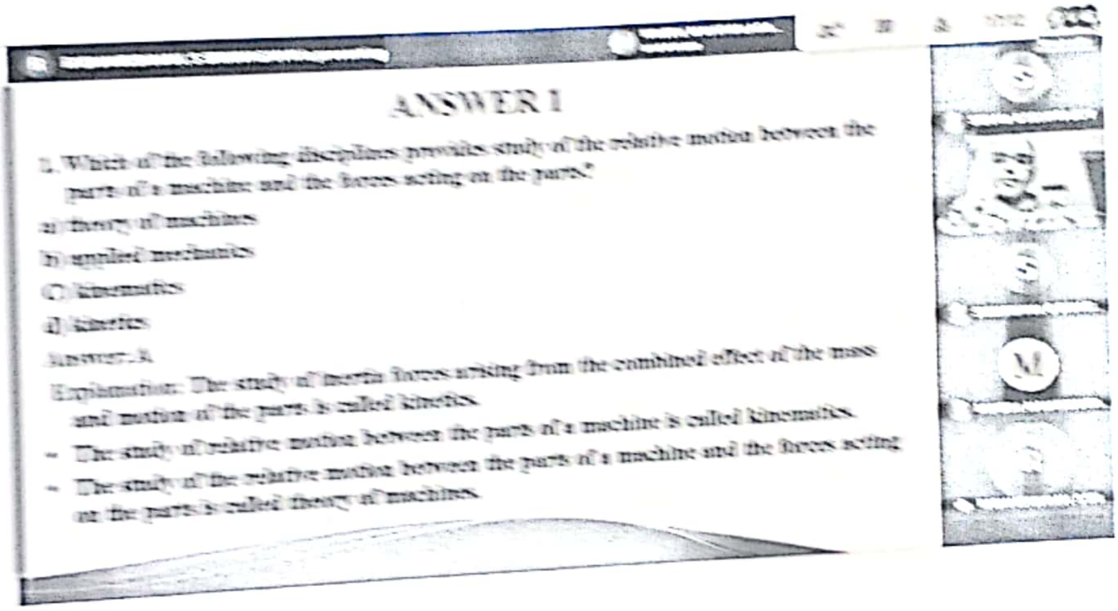

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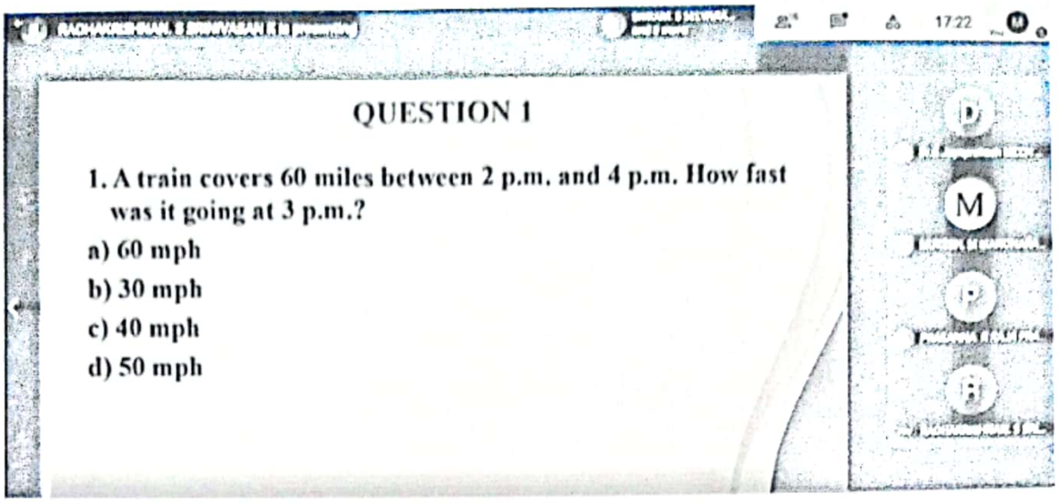

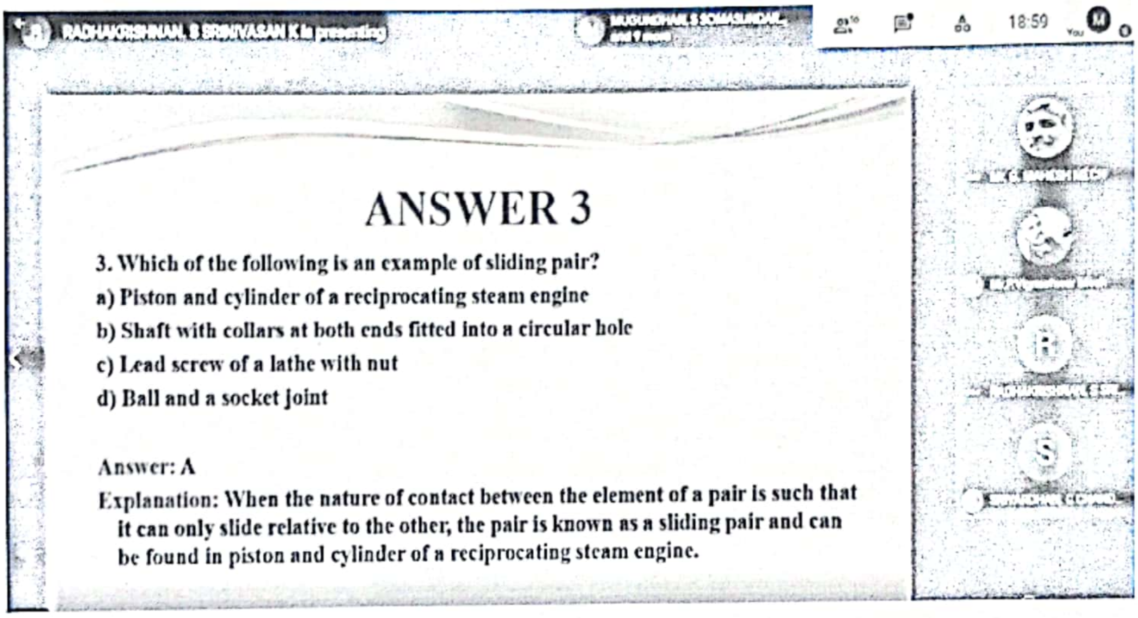

Signature:

Dr.G.Mahesh

Event Coordinator

Dr.G.Jayaprakash

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SARANATHAN COLLEGE OF ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING
LIST OF STUDENTS ATTENDED INDUSTRIAL TRAINING (Internship) (2020-21)

S.No.	Department	Code	Name of the student
1	CIVIL ENGINEERING	103	ABDUL FAZITH. S
2			ABISHEIK. A
3			AKASH. P
4			ANCELIN TEENA. G
5			ARAVINTH. S
6			ARUNKUMAR. K
7			AVINASH. M
8			BHADRIRAMAN. K S
9			CITYBABU. S
10			GOKUL. B
11			GOWTHAMAN. R
12			HARI SRINIVASAN. PA
13			HARIKARAN. T
14			HARIHARASUTHAN. L B
15			HARISH NAGARJUN. K
16			INDHUMATHI. K
17			JAYASUDHA. K
18			KARTHIKEYAN. R
19			KIRUTHIKA. T
20			KRISHNAN. N
21			MANOHARAN. R
22			MATHAN KUMAR. M
23			MOHAMED ANSAR . A S
24			MOHAMMED JAVEED. L
25			NAVEEN. N
26			NAVINCHANDRU. V
27			PARAMESHWARAN. L
28			PRASHANTH. A
29			PRASHANTH. S
30			PRIYA. E
31			RAGUNANDHEN. S
32			RASEENA NILOFAR. K
33			RATHISH BALAJI. B
34			RETHEKA. P
35			RISHI BHARATHI. B
36			SANTHOSH. B
37			SARAN RAJ. M A
38			SARATH KUMAR. M
39			SENTHILKUMAR. A
40			SHANTHANU. P. M
41			SHUBHA. K
42			SIVANESAN. M
43			SRINIVETHITHA. J
44			SRIRAM. V
45			SUNEKA. E
46			SURYA KUMAR. M
47			SURYA. S.J
48			THIRUNAVUKKARASU. N R
49			THIYAGARAJAN. R
50			VAISHALI. R
51			VARNAA. G
52			VELAVAN. B
53			VIDHIYA. V
54			PRAVEEN. S
55			NANDHA BALAN. S
56			IJAZ AHAMED. S
57			IMMANUAL SHARONE. J
58			MATHIYALAGAN.
59			GANESAN. G
60			SUDHARSAN. M S
61			IRUDAYARAJ AMALAN. J
62			SANTHANAKRISHNAN. R
63			DURGA. B
64			KAVIRAJAN. R
65			GOPINATH. T
66			JAYA PRAKASH.
67			SONYA FATHIMA. O

for Class Coordinator

HoD

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SARANATHAN COLLEGE OF ENGINEERING
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LIST OF STUDENTS ATTENDED Survey Camp (Internship) (2020-21)

S.No.	Department	Code	Name of the student
1	Civil Engineering	103	ABISHEK. B
2			AJAY. K
3			ANANTH. R
4			ASRUF NIJAMUDIN MUSTHAFA. S
5			CHANDRU. P
6			CHARULATHA. S
7			DINESH KUMAR. G
8			DINESH. K
9			EZHILARASI. S
10			GOKUL. B
11			GOKUL. T
12			GOVINDARAJ. S
13			HARI HARA SUTHAN. S
14			HARINIVAS. M R
15			HARISH. M
16			HARITHA BALAJI. .
17			IENIYAN. M
18			INBANITHISHKUMAR. M
19			JESHAL SALEEM
20			KRISHNA MOORTHY. N
21			KUMARAGURU. M
22			LOGESWAR. G
23			MAHESHWARAN. S
24			MANI MITHA. V
25			MOHAMED NAWFAL. R
26			MOHAMED THARIK. K
27			MOHAMEDHALITH. M
28			MOHAN KISHOR. S
29			NAVEENKUMAR. R
30			NEERKAMALI. L
31			PALANIKUMAR. M
32			POOVADHARANI. R
33			PRIYADHARSHINI. P
34			ROHAN ARUNACHALAM. G
35			ROOPA LAKSHMI. S
36			SALAI KEERTHI RAJAN . A
37			SANGALPA. OM
38			SANJAY. R
39			SHREERAAM. S
40			SIVAPRASAATH. V
41			SOMESHVARAR. M
42			SOUMIYA. S.S
43			SRINITHI. B
44			SUBASH GURUBARAN. G
45			SUBHIKSHA. S
46			SUDARRMAARI. N
47			SUDHARSHAN. S
48			SUHAIL AHAMED. N
49			SWATHI. M
50			THAUFEEQ JAMAL. A
51			VIJITHRA. R
52			VISHNU PRIYA. G
53			SURIYA PRAKASH. R
54			KARTHEESWARAN. S
55			SOUNDARYA. R
56			DHEIVA RAMNESH. M

Class Coordinator

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EE8691 -EMBEDDED SYSTEMS
VI SEM
QUESTION BANK

UNIT I - INTRODUCTION TO EMBEDDED SYSTEMS

PART A

1. How embedded systems are different from conventional PC?
   - An Embedded system is a specific to a application, whereas a computer system is generic.
   - Though the components are same there is substantial difference in them.
   - A personal computer is not designed to perform a specific function, rather it is able to do many things.
   - The essential difference is that a computer when manufactured is in blank state, the manufacturer does not know what the customer will do with it, while an Embedded system is application specific.
   - An Embedded systems is a component within some large systems.
   - If required each of the embedded systems are connected by a sort of a communication network.
   - Numerous embedded systems make up the computer system

   The difference between an embedded system and a general purpose computer system is one of purpose, and to a much lesser extent, design. While a general purpose system can be used for many things, an embedded system is only meant for one purpose

2. What are the different types of memory used in embedded system design?

   RAM (internal External) ,ROM/PROM/EEPROM/Flash ,Cache memory

3. What are the main components of an embedded system?
   The three main components of an embedded system are
   1. Hardware

   2. Main application software

   3. RTOS

4. What are the various classifications of embedded system?
   Small scale embedded systems ,Medium scale embedded systems ,Sophisticated embedded systems

5. Mention the major challenges in embedded system design.

Hardware needed

Meeting the deadlines

Minimizing the power consumption

Design for upgradeability

6. Which type of memory is suitable for embedded systems? Justify your answer.

Common memory types in Embedded Systems Memory RAM Hybrid ROM DRAM SRAM NVRAM Flash EEPROM EPROM PROM Masked

Types of memory

- Many types of memory devices are available for use in modern embedded systems, the difference between them need to be known to use them effectively.
- Other than the ROM and RAM there is a third kind of memory device called hybrid memory which exhibits some of the characteristics of both.
- Among all the types NVRAM, the non-volatile RAM is fairly common in embedded systems, even after its high cost.

7. List any four Embedded Computory applications.

ACVM

Stepper motor controllers for a robotic

system Washing or cooking system

Multitasking toys

8. What is the need for memory management in Embedded Systems?

□□To provide storage for the software that it will run.

□□To store program variables and the intermediate results

□□Used for storage of information

9. Why does a program reside in ROM in embedded systems?

Final stage software is also called as ROM image .The final implement able software for a product embeds in the ROM as an image at a frame. Bytes at each address must be defined for creating the image.

10. What is the need for watchdog timer?

A watchdog timer resets the microprocessor and starts the software over from the beginning if the software does not restart it periodically. It is used to rescue the system if a fault develops and the program gets stuck.

11. What are embedded Real time systems? Give an example.

In real time system the task in hand must be completed within a bounded time.

Eg.ACVM,

12. What is an embedded system?

An Embedded system is one that has computer hardware with software embedded in it as one of its most important component.

13. What types of hardware parts are typically found in ES? Write in brief.

- Power source
- Clock oscillator circuit
- Timers
- Memory units
- DAC and ADC
- LCD and LED displays
- Keyboard/Keypad

14. List the h/w architecture used in embedded system.

Input,output,CPU,RAM.ROM.Application specific IC

15. What is the difference between Hard RealTime and Soft Real Time systems?

Hard Real Time system is a Real Time system where missing a deadline could cause drastic results that could lead to loss of life and / or property is called a hard real-time system. Examples are aircraft, biomedical instruments (like pacemakers), nuclear reactors etc. SoftReal Time system is a realtime system where a few missed deadlines may not cause any significant inconvenience to the use. Examples are TV, multimedia etc.

16. What do you mean by pre-processing?(or)What are preprocessor macros?

This is the first step in the build process. The preprocessor strips the comments, expands the include files and expands MACRO and replaces symbolic constants

17. What are the steps involved in the build process? The steps involved are

    1. Preprocessing
    2. Compiling
    3. Linking
    4. Locating

18. What is an Editor?

It is software for writing C codes or assembly mnemonics using the keyboard of PC for entering the program. It allows entry, deletion, insert, appending previously written lines or files, merging record and files at specific positions.

19. What is a compiler?

Compiler is a program that creates an object file from the source codes. It checks the language grammar/semantics. For eg: tcc. It converts high level language codes into machine codes.

20. List out the factors to be considered while writing embedded application programs.

The various factors that must be considered while writing embedded application program are:

Throughput
Response
Testability
Debug ability
Reliability

PART B

1. Explain the memory management concepts in embedded system design.(8)Explain how real time systems differ from conventional system? What is the necessity of real time system in embedded applications?(8)
2. (i)With neat block diagram explain the embedded system design process.(8) (ii) Explain the significance of EEPROM and SRAM in an embedded system.(8)
3. List and explain the various hardware units that must be present in the embedded systems.(16)
4. (i) Explain the various form of memories present in an embedded system.(8) (ii)Explain the software tools in designing of an embedded system.(8)
5. Explain in brief about the various steps involved in the Embedded System design process.(10) . Describe the basic block diagram of embedded real time system.(6)
6. Explain the need for memory management .Discuss in detail about the different memory management methods.(10) .Discuss in detail about embedded computory applications.(6).
7. Explain in detail about the different 'Embedded Processors' in a system.(16)
8. Explain the different types of single purpose processors.(8) . Discus the different modules of modern embedded system.(8)
9. Explain the components of embedded system hardware in a cell phone and contact-less smart card.

10. Explain the process of converting high level language application software in to a ROM image for an embedded system .

UNIT II - EMBEDDED SYSTEM ORGANIZATION

PART A

1. Why device drivers are necessary for interfacing a device with a processor?

   A system has number of physical devices. A device may have multiple functions. Each device function requires a driver. A common driver or separate drivers for each device function are required. It plays a key role in most embedded system as these provide software layers between application and devices. Drivers control almost all devices except the memory devices and processors in a system.
2. List the major features of USB bus.

   The Universal Serial Bus has the following features:
   - The computer acts as the **host**.
   - Up to **127 devices** can connect to the host, either directly or by way of USB hubs.
   - A device can be attached, configured and used, reset, reconfigured and used, share the bandwidth with other devices, detached and attached.
   - Individual USB cables can run as long as 5 meters; with hubs, devices can be up to 30 meters (six cables' worth) away from the host.

3. What is I2C?

   I2C is a serial bus for interconnecting ICs .It has a start bit and a stop bit like an UART. It has seven fields for start,7 bit address, defining a read or a write, defining byte as acknowledging byte, data byte, NACK and end
4. What is USB? Where is it used?

   USB is a serial bus for interconnecting a system. It attaches and detaches a device from the network. It uses a root hub. Nodes containing the devices can be organized like a tree structure. It is mostly used in networking the IO devices like scanner in a computer system
5. List the main features of PCI/X bus.

   PCI X offers more speed over PCI.

   30 times more speed than PCI.

6. What are the different modes of DMA transfer? Which one is suitable for embedded system?

   Single transfer at a time and then release of the hold on the system bus.

   Burst transfer at a time and then release of the hold on the system bus. A burst may be of a few kB.

   Bulk transfer and then release of the hold on the system bus after the transfer is completed.
7. Define pipelining?

   A form of computer organization in which successive steps of an instruction sequence are executed in turn by a sequence of modules able to operate concurrently, so that another instruction can be begun before the previous one is finished.

8. What do you mean by device register and device address?

A Device Register is the view any device presents to a programmer. Each programmable bit in the device is presented with a logical address and it appears as a part of a byte in the device registers. Then programming of these bits can be achieved by reading from or writing to these device registers. Most devices have at least these two device registers:

1. Data Register: to which the data to be input/output is read from/written to the device.
2. Control/Status: Which selects/shows the mode of operation of the device.

A device address is a memory location from where a computer component can read data or send data.

9. What is a CAN bus? List the main features of CAN bus.

Controller–area network (CAN or CAN-bus) is a vehicle bus standard designed to allow microcontrollers and devices to communicate with each other within a vehicle without a host computer.

It has fields for bus arbitration bits, control bits for address and data length data bits, CRC check bits, acknowledgement bits and ending bits.

10. How suitable memory will be selected for the design of the embedded system?

Software designer coding is over and the ROM image file is ready, a hardware designer of a system is faced with the a questions, of what type of memory and what to use, how much size of each, should be to used.

Following are the factors that are to be considered while selecting the memory devices,

- Speed
- Data storage size and capacity
- Bus width
- Latency
- Power consumption
- Cost

SRAM's have lower data storage and capacity hence they are suitable for lower end systems where as SDRAM for higher end systems with complex requirements.

11. What are the additional structural units in advanced embedded processor?

Additional structural units in advanced embedded processor which may be used are FLPU (Floating point processor Unit), MMU (Memory Management Unit), PFCU (Prefetch control Unit) etc. It also includes instruction pipelining unit, which improves performance by processing instruction in multiple stages and RISC architecture which executes most instructions in single cycle.

12. State the major function of timer device in an embedded system.

The system clock in configured from a hardware timer. One of the hardware timer ticks from the inputs form the internal clock of the processor and generates the system clock. Using the system clock, number of hardware timers can be driven.

13. What are the advantages of USB bus?

With USB 2.0, the bus has a maximum data rate of **480 megabits per second**.

A USB cable has two wires for power (+5 volts and ground) and a twisted pair of wires to carry the data.

On the power wires, the computer can supply up to 500 milliamps of power at 5 volts.

Low-power devices (such as mice) can draw their power directly from the bus. High-power devices (such as printers) have their own power supplies and draw minimal power from the bus. Hubs can have their own power supplies to provide power to devices connected to the hub.

USB devices are **hot-swappable**, meaning you can plug them into the bus and unplug them any time.

Many USB devices can be put to **sleep** by the host computer when the computer enters a power-saving mode.

The devices connected to a USB port rely on the USB cable to carry power and data. A device can be attached, configured and used, reset, reconfigured and used, share the bandwidth with other devices, detached and reattached.

14. Write the function of One Time Device programmer?

A one-time programmable device can only be programmed once. Once programmed, it cannot be re-programmed. All fuse- and anti-fuse-based devices are one-time programmable. EPROM-based devices in plastic packages are one-time programmable.

15. Give any two uses of timer devices.

Timer devices are needed for a number of uses in a system.

(i) There are can be only a limited number of hardware timers present in the system. The system clock in configured from this. One of the hardware timer ticks from the inputs form the internal clock of the processor and generates the system clock. Using the system clock, number of hardware timers can be driven.

(ii) A software timer is software that executes and increases or decreases a count variable on an interrupt on a timer output or real time clock interrupt. It can also generate interrupt on overflow of count value or finishing value of count variable.

16. What is CAN Bus?

Controller–area network (CAN or CAN-bus) is a vehicle bus standard designed to allow microcontrollers and devices to communicate with each other within a vehicle without a host computer. It is a standard bus in a distributed network. It has a serial line, which is bidirectional. It receives or sends a bit at an instance by operating at a maximum rate of 1 Mbps. It employs twisted pair connection to each node.CAN is a message based protocol, designed specifically for automotive applications but now also used in other areas such as industrial automation and medical equipment.

17. Give any 3 examples of advanced serial high speed buses.

The examples of advanced serial high speed buses are as follows:

1. IEEE 802.3-2000[1 Gbps bandwidth Gigabit Ehternet MAC)
2. IEE P802.3oe draft 4.1[10 Gbps bandwidth Gigabit Ehternet MAC
3. XAUI(10 Gigabit Attachment Unit)
4. XSBI(10 Gigabit Serial Bus Interchange)
5. SONET OC-48
6. SONET OC-192
7. SONET OC-768
8. ATM OC-12/46/192

18. What are the difference between a half & full duplex data transfer?

Half duplex: Transmission occurs in both the direction, but not simultaneously.

Ffull duplex : Transmission occurs in both the direction, simultaneously

19. Justify embedded system design is so complex.

An embedded system has software designed to keep in view three constraints:
(i) available systemmemory,
(ii) available processor speed and (iii) the need to limit power dissipation when running the system continuously in cycles of wait for events, run, stop and wake-up.

20. Define Real Time Clock (RTC)?

Real time clock is a clock which once the system stats does not stop and cant be reset and its count value cant be reloaded.

PART B

1.(i)Draw the CAN data frame format and explain the bus arbitration process in CAN protocol(8)
(ii) Why PCI/X buses are used for high speed data transfer?List the major features of PCI/X bus.(8)

2. (i)Compare the features of timers and counters .List any four embedded application which uses timers.(8) (ii)How to transfer a byte using I^2C.

3. Explain the following parallel communication devices: (16)

(i) ISA bus (ii)PCI and PCI/X

4. Explain the timer and counting devices in an embedded system organization.(16)

5. Discuss in detail the function of major structural units in embedded systems?(16)

6. Explain the functions of device drivers(6).Explain how data is transferred between USB and PCI bus?(10).

7. Explain in detail about the allocation of memory to program segments, blocks and memory map of a system.

8. Explain the features of buses and common modes used for serial communication.

9. Describe the various components of synchronous serial input and output ports.(8).Explain the features and characteristics of asynchronous serial input and output ports.(8)

10. Explain how suitable processor and memory devices are selected for an embedded system design. (8).Explain the function of timing and counting devices in embedded systems(8).

UNIT III PROGRAMMING AND SCHEDULING

PART A

1. What are the advantages and disadvantages of maskable and non-maskable interrupts?

A maskable interrupt may be prevented from executing by setting a bit in a cpu register. A NMI is a hardware thing, and will load the program counter with its execute address regardless of settings

Maskable interrupts : Hardware interrupts that can be enabled and disabled by software. Non-maskable interrupt : It is a computer processor interrupt that can not be ignored by standard interrupt masking techniques in the system.

2. What is context switching? What are the advantages of context switching?

The actual process of changing from one task to another is called a context switch.

3. Define semaphores.

It is special variable used to take note of certain actions to prevent another task or event from proceeding

4. Differentiate preemptive and non-preemptive multitasking.

Non-Preemptive: Non-preemptive algorithms are designed so that once a process enters the running state (is allowed a process), it is not removed from the processor until it has completed its service time (it explicitly yields the processor). ***Preemptive***: Preemptive algorithms are driven by the notion of prioritized computation. The process with the highest priority should always be the one currently using the processor. If a process is currently using the processor and a new process with a higher priority enters, the ready list, the process on the processor should be removed and returned to the ready list until it is once again the highest-priority process in the system.

5. What are non maskable interrupts? State how NMI's are important for embedded systems?

Non-maskable interrupt : It is a computer processor interrupt that cannot be ignored by standard interrupt masking techniques in the system. It is typically used to signal attention for non-recoverable hardware errors.

6. What are the advantages and disadvantages of interrupt driven data transfer?

The advantage of interrupt-driven input or output is that it is efficient. It avoids polling loops and waiting for an I/O transaction to occur. Moreover, it can be turned off (temporarily) to defer to higher interrupt priorities; that is, requests from a keyboard, mouse or printer can be made to defer to interrupt requests from a disk which is a higher-priority device.

Interrupt-driven I/O is slightly more complicated that memory-mapped (i.e., polled) I/O. However, its only real disadvantage is that in a complex system with many I/O devices, it is possible that some low-priority devices may have to wait for a long time before they are serviced

7. Define interrupt latency.

In computing, interrupt latency is the time that elapses from when an interrupt is generated to when the source of the interrupt is serviced. For many operating systems, devices are serviced as soon as the device's interrupt handler is executed. Interrupt latency may be affected by microprocessor design, interrupt controllers, interrupt masking, and the operating system's (OS) interrupt handling methods.

8. What is the importance of disability of interrupts in Embedded System ?

When entering an interrupt handler, we first "disable interrupts" on that cpu. During the time that interrupts are disabled, assume say the user pressed the letter 'a' on the keyboard that would usually cause an interrupt. But since interrupts are disabled, does that mean that: 1. the interrupt handler for 'a' would never be invoked, since interrupts are disabled in the critical section or 2. be handled by the os but delayed, until interrupts are enabled again. Specifically, will the user need to press 'a' again, if the first time he pressed 'a' was at a time when interrupts were disabled .

9. Define Context switching. How it will affect the system performance ?

A context switch is a procedure that a computer's CPU (central processing unit) follows to change from one task (or process) to another while ensuring that the tasks do not conflict. Effective context switching is critical if a computer is to provide user-friendly multitasking. Most modern CPUs perform context switches by means of software (programming). A modern CPU can perform hundreds of context switches per second. Therefore, the user gets the impression that the computer is performing multiple tasks in a parallel fashion, when the CPU actually alternates or rotates between or among the tasks at a high rate of speed.

10. What are the different thread states?

    a. Running

    b. Ready

    c. Waiting

11. List out the various components of process control blocks.

    Process state: new, ready, running, waited, halted, etc.

    Program counter: contents of the PC

    CPU registers: contents of the CPU registers

    Memory

12. Mention the consequences of context switching.

    Time taken for switching from one process to other is pure over head. Because the system does no useful work while switching. So one of the solutions is to go for threading when ever possible.

13. Compare and contrast the binary semaphore and counting semaphore.

    Counting semaphore can range over infinite domain whereas the binary semaphore can range between 0 and 1. Binary semaphore can be used to deal with multiple processes (more than 2).

14. What is a thread?

    A thread is a light weight process and a task can call another task but a thread cannot.

15. Define Synchronization.

    Synchronization refers to one of two distinct but related concepts: synchronization of processes, and synchronization of data. Process synchronization refers to the idea that multiple processes are to join up or handshake at a certain point, so as to reach an

    agreement or commit to a certain sequence of action. Data synchronization refers to the idea of keeping multiple copies of a dataset in coherence with one another, or to maintain data integrity. Process synchronization primitives are commonly used to implement data.

16. Define Inter process communication.

Inter-process communication (IPC) is a set of techniques for the exchange of data among multiple threads in one or more processes. Processes may be running on one or more computers connected by a network. IPC techniques are divided into methods for message passing, synchronization, shared memory, and remote procedure calls (RPC).

17. What is shared data problem?

When several functions share a variable, and at an instant the value of that variable operates and during the operations on it, only a part of the operation is completed and a part remains incomplete and at that moment assume that there is an interrupt. Now, if there is another function that also shares the same variable that also shares the same variable, the value of variable may differ from the one expected if the earlier operation had been completed. The incomplete operation can also occur.

Shared data problem can arise in a system when another high priority task finishes an operation and modifies the data or variable. Disabling interrupt mechanism, using semaphores and using reentrant functions are some solutions.

18. Define Semaphore. What are the uses of semaphores?

A semaphore is a protected variable or abstract data type that provides a simple but useful abstraction for controlling access by multiple processes to a common resource in a parallel programming environment. It records the number of units of a particular resource are available, coupled with operations to *safely* (i.e. without race conditions) adjust that record as units are required or become free, and if necessary wait until a unit of the resource becomes available.

Semaphores are a useful tool in the prevention of race conditions and deadlocks, however their use is by no means a guarantee that a program is free from these problems. Semaphores which allow an arbitrary resource count are called counting semaphores, whilst semaphores which are restricted to the values 0 and 1 (or locked/unlocked, unavailable/available) are called binary semaphores.

19. Distinguish between process and task.

A process is a code that has its independent program counter values and an independent stack. It is a computational unit that processes on a CPU under the control of a scheduling kernel of an operating system

It is a computational unit or a set of codes, actions or functions that processes on a CPU under the control of a scheduling kernel of an operating system. Every task has a TCB.

20. Define multithreading.

The process by which one threads forks out many threads and a job is assigned to each thread.

PART B

1. (i)What is shared data problem? How to prevent shared data problem?Explain with an example (ii)Give an example to justify the necessity of preemptive and non-preemptive multitasking in an embedded system.(16)

2. What is interrupt latency? How to prevent interrupt overrun and disable interrupts?(8)Explain multithreaded programming with an example.(8)

3. (i) Explain the critical section operation by a pre-emptive scheduler.(8) (ii) Explain any one real time scheduling mechanism.(8)

4. Explain what is interrupt overrun? Describe how to prevent the interrupt overrun. Discuss about multithreaded programming.(16)

5. Explain the principle of preemptive and non preemptive multitasking. Discuss about the scheduling algorithms suitable to these two types of multitasking.(16)

6. Explain in detail about the interrupt servicing mechanism in embedded real time systems.(16)

7. Explain in detail about the use of semaphores for the critical sections of a task with necessary diagram.(16)

8. Discuss about the Intel I/O instructions. Explain the effect of synchronization and data transfer rate on I/O operations.(16)

9. Describe the interrupt driven I/O operations. Explain different types of interrupts.

10. Discuss the following:

a. Non Maskable Interrupts (6)
b. Prevention of Interrupt overrun(5)
c. Interrupt driven I/O (5)

UNIT IV REAL-TIME OPERATING SYSTEMS

PART A

1. Compare the difference between RTOS and Operating System.

   A regular OS focuses on computing throughput while an RTOS focuses on very fast response time. OS are used in a wide variety of applications while RTOSes are generally embedded in devices that require real time response

   OS use a time sharing design to allow for multi-tasking while RTOSes either use a time sharing design or an even driven design. The coding of an RTOS is stricter compared to a standard OS

2. List any four commercial RTOS.

   VxWorks

   QNX

   µCos

   RTLinux

3. What is active task in the context of Vx works?

   Active task means that it is in one of the three states, ready, running, or waiting.

4. Name some benchmarks related to RTOS.

   Cooperative context switching

   Preemptive context switching

   Interrupt processing

   Interrupt processing with preemption Message passing

   Semaphore processing

   Memory allocation and deallocation .

5. State the significant features of QNX.

   QNX is a product from QNX Software System Ltd. QNX Neutrino offers POSIX-compliant APIs and is implemented using microkernel architecture.

   Because of the fine grained scalability of the micro- kernel architecture, it can be configured to a very small size – a critical advantage in high volume evices, where even a 1% reduction in memory costs can return millions of dollars in profit

6. List the functions of kernel.

- Process management
- Process creation to deletion
- Processing resource requests
- Scheduling
- IPC
- Memory management
- I/O management
- Device management

7. What are the functions performed by Realtime OS in an embedded system?

Task Functions:

- OSTaskCreate --- Creates a new task
- OSSimpleTaskCreate --- A macro that sets up the stack and starts the task at the proper priority
- OSTaskDelete --- Deletes a task
- OSChangePrio --- Changes a tasks priority

Time Delay Functions:

- OSTimeDly --- Delay or sleep for a fixed interval
- OSChangeTaskDly --- Changes the interval for a waiting task

Task Locking Routines:

- OSLock --- Locks the OS and prevents task switches
- OSUnlock --- Unlocks the OS
- OSLockObj --- A C++ class to make task locking easy

Semaphore Routines:

- OSSemInit --- Initializes an OS_SEM structure
- OSSemPost --- Post to a semaphore
- OSSemPend --- Pend on a semaphore
- OSSemPendNoWait --- Pend on a semaphore without waiting

8. Mention the features of RT Linux.
Scheduling.

Resource Allocation.
Interrupt Handling.

Other issues like kernel size.

9. What are the goals of operating system? The goals of OS are

- Facilitating easy sharing of resources as per schedule and allocations.
- Facilitating easy implementation of application software
- Optimally scheduling the processes on one or more CPUs if available by providing appropriate context switching mechanism
- Providing management functions for the processes, memory and I/Os and for other functions for which it is designed.

10. What are the two structures modes of OS?

The two structure modes of OS are User mode and supervisor mode.

11. What are the structural units of an OS?

The structural units are

a. Application software
b. API
c. System software
d. Hardware-OS
e. Interface Hardware

12. What is the need for a well tested and debugged RTOS?

A readily available RTOS package provides an advantage that the previously tested and debugged RTOS functions and error and exception handling functions can be ported directly as these are already well tested by thousands of users. Tools for the source code engineering, testing, simulating and debugging may also be available with an RTOS package.

13. When is an RTOS necessary and when it is not necessary in an embedded system?

An RTOS becomes essential when there is processing and servicing of multiple devices and therefore of multiple tasks with real time constraints in a sophisticated application. Two essential services of RTOS are inter-process communication and scheduling in addition to other OS services.

14. What is POSIX? List its main features.

POSIX stands for Portable Operating System Interface. Its main features are the family of standards specified by the IEEE for maintaining compatibility between operating systems.

POSIX defines the application programming interface (API), along with command line shells and utility interfaces, for software compatible with variants of Unix and other operating systems.

- Open Software which includes interoperability and portability
- Defines the interfaces to OS
- Defines the semantics of different system calls
  Specifies the system calls that an OS need to support

15. List few memory allocation related functions.

malloc()

calloc()

realloc()

free()

16. Write the advantages of mail boxes in RTOS.

A message mailbox is an IPC queue that can be used only by a single destined task.

17. What are the features of Vx WORKS?

The uses of VxWORKS are the following.

- Multitasking Environment
- Inter-process Communication
- Synchronization using event flag, mutually exclusive access using resource key(mutex) and counting mechanism using three types of semaphores in the tasks and ISRs.
- Synchronization using POSIX standard semaphore and other IPCs
- Watchdog Timers
- Virtual I/O devices using pipes
- Virtual memory management functions

18. What are the task service functions supported by MUCOS?

void OSInit (void)

void OSStart(void)

voidOSTickInit(void)

void OSIntEnter(void)

void OSIntExit(void)

19. What is RPC?

Remote procedure call is method used for connecting two remotely placed methods by first using a protocol for connecting the processes. It is used in the case of distributed tasks.

20. What are the three methods by which an RTOS responds to a hardware source call on interrupt?

 Direct call to ISR by an interrupt source

 Direct call to RTOS by an interrupt source and temporary suspension of a scheduled task.

 Direct call to RTOS by an interrupt source and scheduling of tasks as well as ISRs by the RTOS

PART B

1. List the major features of Windows RTOS. What is the significance of benchmarking real time systems? How Vx works is different from μc OS-II?(16)

2. (i)Explain the goals of operating system services.(8) (ii) Explain the three alternative systems in RTOS for responding a hardware source call with a neat sketch.(8)

3. (i)Explain the features of Vx works RTOS.(8) (ii) Explain the case study of an embedded system for a smart card.(8)

4. Explain the services of UNIX based real time operating systems. Compare its features with Windows based real time operating systems(16)

5. Discuss in detail the contemporary real time operating systems VxWorks, Linux and PSOS.(16)

6. Explain the features of windows based RTOS(8).Explain interrupt handling in POSIX RTOS(8)

7. Describe the features of various Contemporary Real Time Operating Systems.(16).

8. Describe the basic concepts of RTOS.What are the different types of RTOS? Explain the features of Micro OS-II (16).

9. Explain interrupt handling in RTOS environment(8).Discuss about the services of Unix based RTOS(8).

10. Explain the 3 co-operative scheduling mechanisms used by RTOS schedulers.(16)

UNIT V PIC MICROCONTROLLER BASED EMBEDDED SYSTEM DESIGN

PART A

1. **Compare CISC and RISC architectures. Give an example for each architecture.** CISC instructions utilize more cycles than RISC

   CISC has way more complex instructions than RISC

   CISC typically has fewer instructions than RISC

   CISC implementations tend to be slower than RISC implementations

   Computers typically use CISC while tablets, smartphones and other devices use RISC

2. List any four embedded applications where PIC is used as a major hardware part.

   Digital watches, elevators, automobile engines, thermostats & instruments that are driven by microcontrollers and their software.

3. Why we need Flash memory?.

   Flash memory is for porting the program very fastely in the targeted hardware.

4. What is a preprocessor directive?

   A preprocessor directive starts with '#' sign. The following are the types of preprocessor directives: 1. Preprocessor global variables

   2. Preprocessor constants

5. What are the major structural units in PIC Microcontroller? Processing engine, Program memory, data memory and Input/Output.

6. What is the function of MBASIC compiler?

   MBasic compiler is a professional version software in which we are having assembler, debugger, compiler and all the development tools integrated in an IDE.

7. What is a cross compiler?

   A cross compiler is a compiler capable of creating executable code for a platform other than the one on which the compiler is running. For example, a compiler that runs on a Windows 7 PC but generates code that runs on Android smartphone is a cross compiler.

8. List any three applications of PIC based embedded system.

   HVAC,VCRs,digital watches, elevators, automobile engines, thermostats & instruments that are driven by microcontrollers and their software.

9. Specify the size of memory supported by PIC Microcontroller

   PIC16F887 Microcontroller- 8K ROM memory in FLASH technology, 256 bytes EEPROM memory , 368 bytes RAM memory.

10. Mention the major components on PIC Microcontroller based development board.

In-circuit debugger

Free integrated development environment (IDE)

Free Assembler and Simulator

11. List the features which make PIC microcontroller suitable for embedded system.

In fact a PIC microcontroller is an amazingly powerful fully featured processor with internal RAM, EEROM FLASH memory and peripherals.

12. Mention the three components of MBASIC

compiler. MBasic compiler comprises of three main

elements. MBasic compiler software

The computer requires an RS232 port for connection to ISP-PRO programmer board. A second RS232 port is useful to capture any serial information from the program developing.

ISP-PRO programmer

MBasic after the assembly stage completes generates Microchip compatible standard Hex file that must be loaded into PIC. Basic Micro offers a programmer ISP-PRO integrated with the MBASIC compiler that automatically loads HEX code file.

Development Board

Basic Micro offers plug board style development boards and solder-in prototype boards for 8 pin, 18-, 28- and 40 pin PICs. These boards have an RJ11 connector for the ISP-PRO connection and an RS232 port that may be used by PIC for communications to the outside world.

13. What is the difference between a compiler and interpreter?

The interpreter takes one statement then translates it and executes it and then takes another statement. While the compiler translates the entire program in one go and then executes it.

· Compiler generates the error report after the translation of the entire page while an interpreter will stop the translation after it gets the first error.

· Compiler takes a larger amount of time in analyzing and processing the high level language code comparatively interpreter takes lesser time in the same process.

· Besides the processing and analyzing time the overall execution time of a code is faster for compiler relative to the interpreter.

14. List the naming rule for constants, variables and subroutine names for the MBasic :

MBasic permits variables and constants to have names upto 1024 long.
Reserved words should not be used.
All names are case insensitive

15. Write the various addressing modes of PIC micro controller.

Direct Addressing
Indirect Addressing

16. List some I/O ports of PIC microcontroller.

Port is medium through which controller communicates with the outside orld. Pic microcontroller has 5 I/O ports.

17. List the temperature ranges of PIC microcontroller.

C-Commercial 0^{0}C to 85^{0}C
Industrial -40^{0}C to 85^{0}C
E-Extended -40^{0}C to125^{0}C

18. What is the family number available in PIC icrocontroller? Pic12, Pic14, Pic16, Pic18 are the family members.

19. Explain "E" in PIC microcontroller?

It is the temperature range designator, E-Extended -40^{0}C to125^{0}C

20. Explain Harvard Architecture?

PICs use the Harvard Architecture, Used mostly in RISC CPUs Separate program bus and data bus: can be different widths! For example, PICs use:Data memory (RAM): a small number of 8 bit registers.Program memory (ROM): 12bit, 14bit or 16bit wide (in EPROM, FLASH, or ROM)

PART B

1. Draw the functional block diagram of PIC microcontroller and explain the function of each block.(16)
2. How to generate PWM using PIC Microcontroller? Explain it with an example. Explain how to interface keyboard and LED's with PIC microcontroller (16)

3. Explain MBasic compiler related to PIC microcontroller.(16)

4. Explain any one embedded application with PIC based microcontroller.(16)

5. a. Explain the architecture of PIC Microcontroller and describe the function of its structural units. (10) b. Discuss about the applications of PIC Microcontroller based Embedded Systems. (6)

6. Discuss about MBasic compiler features and functions.(8) .Describe the Basic output and digital input.(8)

7. Explain benefits of using Vx work for the development of ES with appropriate diagram.(16)

8. Explain the PIC microcontroller based embedded system design(16).

9. Explain the use of microcontroller based embedded development boards(10).Write a short note on basic output and digital input system(6).

10. (i) Explain the elements of MBasic compiler.(6) (ii) Write the pseudo code version of the program.(5) (iii) Draw the flow diagram of program compilation.(5).

SARANATHAN COLLEGE OF ENGINEERING

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING

TIRUCHIRAPALLI - 620 012.

EE8451-LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

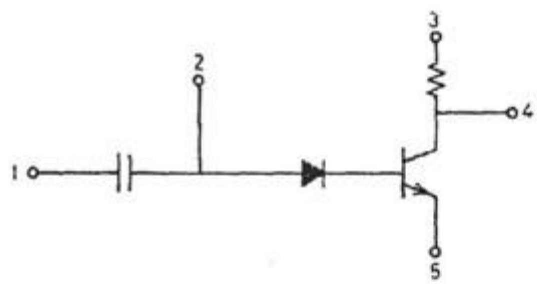
UNIT I IC FABRICATION

Part – A- Two marks questions

1. Give the difference between monolithic and hybrid ICs.
2. Classify IC.
3. What is lithography?
4. What are the advantages of integrated circuits over discrete circuits?
5. What is the difference between diffusion and ion implantation?
6. What is the purpose of oxidation process in IC Fabrication?
7. What are the advantages of integrated circuits over discrete circuits?
8. What is meant by ion implantation?
9. Write the basic chemical reaction in the epitaxial growth process of pure silicon
10. List the basic process used in IC fabrication
11. What is parasitic capacitance?
12. What are the popular IC packages available?
13. What is meant by dielectric isolation in I.C Fabrication?
14. How surface layer of SiO_2 is formed?
15. What is meant by substantial diffusion?

Part – B 16 marks questions

1. Explain the basic Process used in silicon planar technology with neat diagram. (16)
2. With respect to BJT based circuit given below, explain the various steps to implement the circuit into a monolithic IC. (16)



3. Briefly explain the various types of IC packages. Mention the criteria for selecting an IC package.
4. Write short notes on classification of IC.
5. With neat sketches explain the fabrication of diodes capacitors
6. Explain the various methods used for fabricating IC resistors and compare their performance
7. Explain about MOSFET fabrication
8. Write a note on CMOS technology.

UNIT II CHARACTERISTICS OF OPAMP

Part – A- Two marks questions

1. List out the ideal characteristics of OP AMP?
2. Define CMRR of an amp?
3. Define slew rate. What causes it?
4. List the methods used to provide the external frequency compensation.
5. Mention some of liner applications of OP AMP.
6. Why is RCOMP not needed in differential amplifier?
7. What are the merits and demerits of Dominant pole compensation method?
8. What happens when the common terminal of V+ and V- sources are not grounded?
9. What is meant by differential amplifier?
10. What is frequency compensation.
11. Design an amplifier with a gain of -10 and input resistance of 10k.
12. An input of 3v is fed to the non-inverting terminal of an op-amp. The amplifier has a Ri of 10KΩ and Rf of 10KΩ .Find the output voltage
13. What is voltage follower?
14. In practical op-amps, what is the effect of high frequency on its performance?
15. What is an opamp?

16. Part – B 16 marks questions

1. Explain the following terms in an OP-AMP.
   Bias current (4)
   Thermal drift (4)
   Input offset voltage and current (4)
   Thermal drift (4)
2. a. Draw the circuit of differential amplifier and derive the expression for output voltage in it. (8)
   b. With neat diagram explain the working of an OP-AMP base integrator. (8)
4. With neat circuit diagram explain the operation of a OP-AMP differentiator and derive and expression for the output of a practical differentiator. (16)
5. Explain the frequency compensation techniques of OP-AMP. (16)
6. Draw the circuit of a symmetrical emitter coupled differential amplifier and derive for CMRR. (16)
7. Show the help of circuit diagram an OP-AMP used as
   a. i)Summer (8)
   b. II) Integrator and explain their operation. (8)

8. (a) Design an op-amp differentiator that will differentiate an input signal with fmax = 100 Hz. (8)
9. (b) Draw the output waveform for a sine wave of 1v peak at 100 Hz applied to the differentiator. (4)
10. (c) Repeat part (b) for a square wave input. (4)

UNIT III APPLICATIONS OF OPAMP

Part – A- Two marks questions

1. What is meant by cut off frequency of a high pass filter and how it is found out in a first order high pass filter?
2. What is meant by resolution of an ADC?
3. What are the applications of peak detectors?
4. Why active filters are preferred?
5. Draw the circuits of I to V converter using op-amp.
6. Define monotonicity with respect to Data converters.
7. Give any 4 applications of a comparator.
8. What is a zero crossing detector?
9. Mention the types of DACs Techniques?
10. Where do we use successive approximating type ADC?
11. Draw a peak detector using op-amp
12. Draw the circuit diagram of sample and hold circuit.
13. Mention the applications of an instrumentation amplifier.
14. An 8 bit DAC has a resolution of 20mV/bit. What is the analog output voltage for the digital For
15. Which is the fastest ADC? Why?

Part – B 16 marks questions

1. Explain the working principle of RC phase shift sine wave generator using OP-AMP and derive the expression for 'f'. (16)
2. With an example and diagrams explain the working principle of successive approximating type ADC and also explain the important DAC specifications. (16)
3. Draw the circuit of instrumentation amplifier and derive the expression for output voltage for in it. Also write the advantages of instrumentation amplifier. (16)
4. With neat diagram, explain the working principle of
   (a) R-2R ladder type DAC (8)
   (b) Weighted resistor DAC (8)
5. (a)Explain the operation of Schmitt trigger. (8)
   (a) (b)Write a note on V/I and I/V converter. (8)
6. (a)Draw the circuit of a second order Butterworth low pass filter and derive its transfer function. (16)
7. (a) Explain the operation of dual slope ADC. (10)
8. A dual slope ADC uses a 16-bit counter and a 4MHz clock rate. The maximum input voltage is +10v. The maximum integrator output voltage should be -8v when the counter has cycled

through 2^n counts. The capacitor used in the integrator is 0.1 µF. Find the value of the resistor R of the integrator. (6)

9. (a) Design a low pass filter with a cut off frequency of 1 kHz and with a pass band gain of 2. (8)

10. Determine the order of a low-pass Butterworth filter that is to provide 40 dB attenuation at $\omega/\omega_h = 2$. (8)

UNIT IV SPECIAL ICs

Part – A- Two marks questions

1. In what way VCO is different from other oscillators.
2. Mention any two application of 555 Timer in Mono stable mode.
3. What is meant by capture range in a PLL ?
4. If the supply voltage (Vcc) to 555 timer is 10V, find the minimum and maximum value of the voltage across the capacitor connected to trigger input, when it is configured in Astable mode.
5. What are the different stages of operation in a PLL ?,
6. In an astable multivibrator using 555 timer R_A=6.8 KΩ, R_B=3.3 KΩ, C=01µF. Calculate the free running frequency.
7. Why V_{co} is called voltage to frequency converter?
8. With reference to a VCO, define voltage to frequency conversion factor K_v .
9. Define: lock range
10. State why the phase detector output in a PLL should be followed by a low pass filter.
11. List the applications of NE565.
12. Draw the relation between the capture range and lock range relationship in a PLL.
13. Draw the pin diagram of IC 555 timer.
14. Mention any two applications of multiplier IC.
15. What are one, two and four quadrant multipliers?

Part – B 16 marks questions

1. Explain the operation of 555 Timer in astable mode with neat circuit and wave forms. Derive the expression for frequency of output voltage in it. (16)
2. Describe the application of PLL for frequency multiplication and amplitude modulation detector with neat diagrams. (16)
3. Explain schematic how PLL can be used as
   a. frequency multiplier (8)
   b. frequency translator. (8)
4. Design and draw the wave forms of 1KHZ square wave form generator using 555 Timer for duty cycle i) D=25% ii) D=50% (16)
5. Perform the closed loop analysis of PLL. Explain any two application of PLL. (16)

6. Explain the Astable operation a 555 Timer IC with application. (16)

7. Explain the voltage controlled oscillator with a neat block diagram. Give its typical connection diagram and its output waveforms. (16)
8. Explain the asbable and bistable operation of IC 555 with necessary waveforms. (16)

UNIT V APPLICATION ICs

Part – A- Two marks questions

1. Differentiate between linear and switching regulator.
2. Write the expression for output voltage in LM317.
3. What is an opto coupler? Mention any one of its application.
4. Why do switching regulators have better efficiency then the series regulator?
5. What is an isolation amplifier?
6. Name the various protection circuits used for voltage regulators.
7. Name two application of isolation amplifier.
8. What is the need for voltage regulation?
9. List the characteristics of opto coupler.
10. Define ripple rejection with respect to voltage regulators.

Part – B 16 marks questions

1. Explain the internal structure of voltage regulator IC 723. Also draw a low voltage regulator circuit using IC 723 and explain its operation. (16)
2. Explain the construction and working principle of function generator IC ICL 8038. (16)
3. Draw and explain the functional block diagram of a 723 voltage regulator and how this IC can be used as High voltage regulator. (16)
4. Write an explanatory note an:
   a. Power amplifier (8)
   b. Isolation amplifiers (8)
5. Write short notes on:
   a. Opto couplers. (8)
   b. Switching regular. (8)
6. Briefly explain the working principle of switch mode power supply with necessary circuit diagrams and wave forms. (16)

EI8553-PROCESS

CONTROL

QUESTION BANK

UNIT – I (PART A)

1 Distinguish between batch process and continuous process.

Batch process	Continuous process
1. A process in which the materials or work are stationary at one physical location while being treated. Eg. Thermal type process.	A process in which the materials or work flows more or less continuously through a plant apparatus while being treated. Eg. Storage vessel control.
2. This is suitable for different kinds for product	Suitable for one or two products
3. The quantity of product is less	Quantity of product is large
4. The control system is simple.	The control system is complicated.
5. The Process variables are lumped	The pv is distributed over the entire system.

2 Define degrees of freedom.

The Degree of freedom is defined as the number of independent variable that must be specified in order to define the process completely. The number of degree of freedom can be found by the equation

$f = V - E$ Where

V = Number of independent variable describing a process

E - Number of independent equation physically relating the V variables.

3 What are the different mathematical models used in process control?

Experimental approach: In this case the physical equipment of the chemical process is available and the various values of input (disturbance, manipulated variable) are change and through appropriate measuring devices the outputs of process change with time. Such a procedure is time and effort consuming and it is usually quite costly because a large number of such experiments have to be performed.

Theoretical approach:

This is given in terms of mathematical equations (differential, algebraic) whose solution yields the dynamic or static behavior of the chemical process that is examined.

4 What is meant by self-regulation?

Self regulation of a process is defined as the process is one in which either inflow and outflow is dependent to the controlled variable. Most of the causes the flow is self regulating because of its steady state is increased by increasing the outflow.

5 What is non-self regulation? Give an example.

A non-self regulating process is one in which both inflow and outflows are independent of the controlled variable this type of process has no steady state gain. The example of the non self process is a simple liquid level system with constant outflow.

6 Distinguish between servo and regulator operation of control system.

Servo problem	Regulator problem

The set point is variable and load disturbance are kept constant. This method is desired by operator. Tracking of missiles and automatic machining are examples of this type.	the load disturbance is variable and set point is kept constant this may happen any time in the system controlling of temperature and flow rate are examples of the type.

. 7 Write any two characteristics of first order process

- Capacity to store material, energy or momentum.
- The resistance associated with the flow of mass, energy or momentum in reaching the capacity

8 List any four objectives of process control.

i.) Safety
ii.) Product specification.
iii.) Environmental regulations.
iv.) Operational constraints
v.) Economics.

9 Define interacting system and give an example.

The term interacting is often referred as loading. When two tanks are connected at same datum level if level of any one tank increases simultaneously another tank head also increase. Example: Two tank systems connected in series

10 A tank operating at 10 ft head, 5 lpm outflow through a valve and has a cross section area of 10 sq. ft. calculate the time constant.

Given h = 10 ft. Q = 5 lpm, A = 10 ft^2. Time constant T = AR but R = h / q = 10 / 5 = 2

T = 10 x 2 = 20 min.

11 Define non interacting system and give an example

The dynamic behavior one tank is affected by the other, but the reverse isn't true, then it is non-interacting system. Here the liquid heads are independent of each other Example: Two tanks one below the other.

12 What is the need for mathematical model?

- To optimize process design and operating condition
- To design a control strategy

To understand the behavior of a process, mathematical representation of physical and chemical phenomenon taking place in it is essential

13 What is a second order system? Write its general form of transfer function.

A second order system is one in which output is described by a second order differential Equation

$$a_2 \frac{d^2y}{dt^2} + a_1 \frac{dy}{dt} + a_0 y = b f(t)$$

$b, a_0, a_1, a_2 \rightarrow$ constant.

14 What is the need for process automation?

Process automation is employed to maintain a controlled variable at a desired value. The main advantage of automatic control is that a machine can perform the task more rapidly and consistently than a human being. It requires closed loop of action and reaction without human intervention.

15 A Self regulatory system doesn't require a controller. True/False. Justify the answer.

True. It doesn't need any external intervention for its stabilization

16 What is the significance of "degree of freedom"?

17 What is the need for servo operation?

To make the process follow changes in the set point as closely as possible,servo operation is necessary. Example: normally in batch process changes in load variables such as temperature and pressure causes large errors than the set point change, in that case servo operation is necessary.

18 How the mathematical modeling of higher order process obtained?

The mathematical modeling of higher order process are obtained in three ways

a. N first order processes in series
b. Processes with dead time
c. Processes with inverse response.

19. *Define process variable, load variable and manipulated variable.*

Process variable: It is the quantity or condition of the control system which is directly measured and controlled.

Load variable: the load variables of a process are all other independent variables except the control variable and manipulated variable.

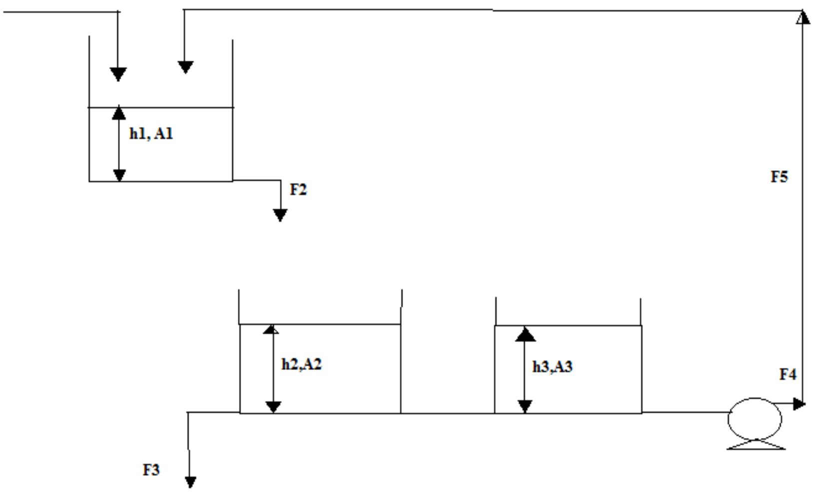
Manipulated variable: it is the quantity or condition which is varied by the automatic controller so as to affect the value of control variable.

20 Name different sets of test inputs that can be given to a process.

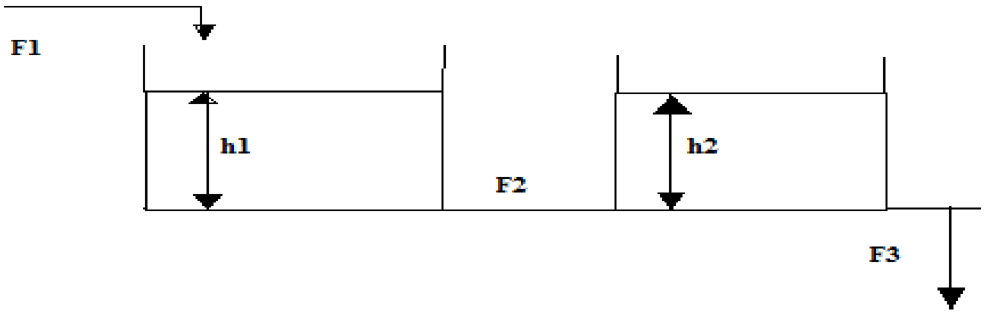
Step, Ramp, Impulse, Parabolic, Sinusoidal input

PART-B

1. Describe a simple thermal system in which incoming liquid is heated by the heater in the tank and going out with higher temperature. Develop first order transfer function of the thermal process(NOV/DEC 2012) .
2. Develop a mathematical model for the system shown in fig below. What are the states for his system? All the flowrates are volumetric and the cross sectional areas of the tanks are A_1, A_2 and A_3 (ft^2), respectively. The flow rate F_5 is constant and does not depend on h_3, while all other effluent rates are proportional to corresponding hydrostatic liquid pressures the cause the flow. (NOV/DEC 2012) .



3. Consider the system shown in fig. Develop a mathematical model for the system. Assume that the effluent stream from a tank is proportional to the hydrostatic liquid pressure that causes the flow



4. (a) Derive a mathematical model of a first order thermal process.
   (b) What is the inverse response? Explain the inverse response noticed in the level control of feed water in the boiler.(MAY/JUNE 2012).

5. (a) Differentiate servo and regulatory operation with the help of suitable example.

   (b) Explain with suitable examples, the difference between the interacting and non- interacting processes.(NOV/DEC 2010).

6. (a) bring out the difference between the continues and batch process with the help of neat diagrams.

   (b) List the merits and demerits of the continues and batch process (APR/MAY 2010).

7. (a) derive the mathematical model of a thermal process from fundamentals.

   (b) Explain with suitable examples, the difference between the interacting and non- interacting processes.(APR/MAY 2010).

8. (a) what are the dynamic components of the loop that may exhibit significant time delays In their response?

   (b) How are the effects of dead time compensated? What are the important features of dead time compensators? (MAY/JUNE 2009).

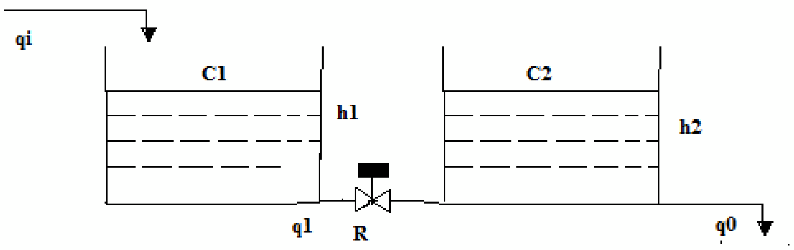
9. (a) what is the inverse response? Explain its behaviour with dynamic system.

   (b) What is the need for mathematical modeling for process control? Explain the mathematical model for the first order thermal process(MAY/JUNE 2009).

10. (a) distinguish between servo and regulator operation.

(b) explain the self regulation process with an example(NOV/DEC 2013)

11. derive the mathematical model for the given process (NOV/DEC 2013)



UNIT 2

PART A

1. What are the basic control actions in process control?

The basic control actions used in process control is

a).On – off control b) Proportional control c).Proportional – Integral control
d).Proportional - Integral - Derivative control

2 Define proportional band.

Proportional band (PB) is defined as the error (expressed as a percentage of the range of measured variable) required to move the valve from fully closed to fully open. The Pb and Proportional gain (K_p) is given by PB = 100 / K_p.

3 Define reset time

The time required for the output of a proportional – Integral controller to change an amount equal to the amount of proportional response provided by a step change of actuating signal.

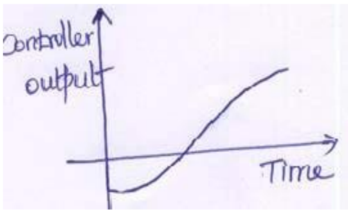
4 Define differential gap. Why is it introduced in a process?

A differential gap in two-position control causes the manipulated variable to maintain its previous value until the controlled variables has moved slightly beyond the set point. In actual operation it is the same as hysteresis. A differential gap is caused in the two-position controller if small friction exists at the bearing on the float arm.

5 Identify two parameters of ON-OFF controller

- Cycling: when control variable does not remain at set point(SP) value it keeps oscillating around SP.
- Differential gap: to overcome cycling

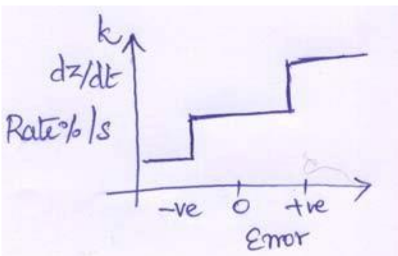
6 Draw the open loop response of an inverse response process when excited with unit step input



7. What is meant by neutral zone in ON-OFF controller?

It is known as differential gap. A small range of value through which control variable must pass in order to change from maximum to minimum or vice verse

8. Sketch the input, output characteristics of single speed floating controller



9. *Define integral windup and Anti reset windup.*

Windup occurs when PID system has constant error. The difference between set point and control variable never gets to zero; the integral term grows to a very large number. This is called integral windup.

10 *What are the advantages and disadvantages of PI control?*

Advantages:

1. It removes or reduces the steady state error without the need for manual reset.
2. It removes or reduces the steady state error without the need for manual reset.

Disadvantages:

1. It may lead to oscillatory response of increasing or decreasing amplitude which is undesirable and the system may become unstable.
2. Constant steady state error.

11 *What is meant by single speed floating control?*

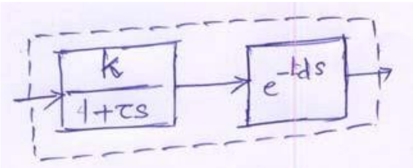
The output will not change but remains (floats) at whatever previous setting it is, when the error goes to zero. The output of the control element changes at a fixed rate when the error exceed the neutral zone

12 *Derivative controls cannot be used alone. Justify your answer.*

When the error is constant the derivative action is zero. The derivative action Anticipates future errors and introduces appropriate Action. When the process has noise the derivative control amplifies the noise and makes the noisy one. It introduces a stabilizing effect on the Closed –loop control response of a process

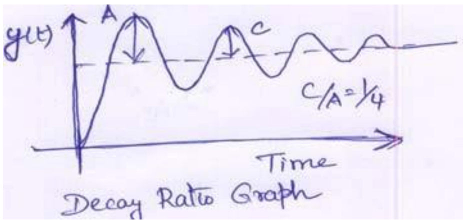
13 *What is dead time?*

Dead time is a fixed interval of time between the change of an input to an element and the beginning of response to the input.



14 *Define ¼ decay ratio.*

The ratio of the amounts above the ultimate value of two successive peaks is called as decay ratio. The decay ratio is expressed as, **Decay ratio: C/A= exp (-2ζπ / √ 1 – ζ^2). If C/A=1 then it is called ¼ decay ratio.**



15 What are the advantages and disadvantages of 2-position control?

Advantages: Easy to design, Low cost

Disadvantages: Cycling behavior of the control valve, FCE is subjected to high frequency of oscillation if neutral zone is not used

16. *Why derivative mode of control is not recommended for a noisy process?*

17. *What are the advantages, disadvantages and applications of PD controller?*

Advantages: Offset can be reduced without reducing settling time.

Disadvantages: Offset is not eliminated. At steady state PD acts as a P controller (i.e.) Steady state error is not eliminated

18. *What is meant by differential gap? What are its effects? Is it a desirable factor?*

A differential gap in two-position control causes the manipulated variable to maintain its previous value until the controlled variables has moved slightly beyond the set point. In actual operation it is the same as hysteresis. A differential gap is caused in the two-position controller if small friction exists at the bearing on the float arm.

19. *Design an electronic p-controller with a proportional gain 5.*

Given: $k_p = 5$

$K_p = r_2/r_1$

$5 = r_2/r_1$

Ans: $r_2 = 10k\Omega$ and $r_1 = 2K\omega$

20. *What are the advantages and disadvantages of PID control* actions?

P-control

Adv: it amplifies the error signal which increases the loop gain. This improves the steady state tracking accuracy, disturbance signal rejection and relative stability. It makes the system less sensitive to parameter variations.

Disadv: constant steady state error. I-control.

Adv: it removes or reduces the steady state error without the need for manual reset. *Disadv:* it may lead to oscillatory response of increasing or decreasing amplitude which is undesirable and the system may become unstable.

D-control.

Adv: controller gives 90 degree phase shift.

Settling time decreases.

Disadv: No control action for steady error.

Not suitable for noisy processes.

PART B

1. With neat schematic diagram explain the single speed floating control.(nov13)

2. With neat sketch explain the of P+I pneumatic controller.(nov13)

3. Explain with neat diagram the working of electronic PID controller.(nov13)

4. When an on-off controller is recommended? How its performance affected by process dead time.(may12)

5. A pi controller has 20% and integral time of 10sec.for a constant error of 5%.determine the controller output after 10sec.the controller offset is 25%.(may12)

6. Compare the features of ON & OFF,P,I,D control modes and draw their characteristics.(nov10)

7. Explain the procedure for tuning pi controller using zielger Nicholas method.(nov10)

8. What is cycling in the process output in which control mode it occurs.(may10)

9. A second order process with the transfer function of g(s)=5/(10s+1)(3s+1) is controlled by a proportional controller. Find the value of kp required offset due to unit step change in set point is 5% of steady state value of controlled variable.(may10)

10. Various steps involved in process reaction curve method of tuning off controllers.(may09)

UNIT 3

PART A

1. *How tuning is done in process control?*

To adjust the controller parameters is referred as tuning. The controller may tune using the simple criteria such as ¼ decay ratio, minimum setting time, and minimum error. Using time integral performance such as ISE, IAE, ITAE the controller may tune. The popular method of controller tuning is Process reaction curve and Z-N method.

2. *What is a process reaction curve?*

This is a plot drawn between the measurement output and time when the closed loop system is disconnected between the controller and final control element and is manually operated with step change.

3 *State the relation between maximum overshoot and decay ratio.*

The relation between maximum overshoot and decay ratio is, **decay ratio = (overshoot)** ^{2}

4 *What do you meant by controller tuning?*

A procedure of finding the optimum controller setting by conducting a simple experimental test. It means adjusting the controller parameters.

5 Give an example for Discontinuous and Continuous mode of controller.

Discontinuous-ON-OFF controller.

Continuous – Proportional Controller

6 How to choose evaluation criteria for an application

ISE- to suppress large errors

IAE- to suppress small errors

ITAE- to suppress long time errors

7 *What is ITAE and when to go for it?*

ITAE is integral of the time weighted Absolute error and it is defined as ITAE = $\int t\,|e(t)|\,dt$.To suppress errors that persist for long times, the ITAE criterion will tune the controllers better because the presence of large t amplifies the effect of even small errors in the value of the integral.

8 Write Ziegler Nichols tuning formulae.

	Kc	τ_I (min)	τ_D (min)
P only	$K_u / 2$		
P-I	$K_u / 2$	$P_u / 1.2$	
P-I-D	$K_u / 2$	$P_u / 2$	$P_u / 8$

where K_u = ultimate gain, P_u = ultimate period of oscillation

9 *Why is it necessary to choose controller settings that satisfy both gain margin and phase margin?*

It is necessary to choose controller settings that satisfy both gain margin &phase margin in order to avoid unstable behavior by the closed loop of a process. The stability of the system is decided by the appropriate gain and phase margins

It's the tuning of parameters of the controller so as to obtain a step change in the load (error).The response gives decay ratio of ¼.it is defined as the ratio of successive amplitude of the peaks decay ratio=C/A.

11 *Write the Cohen – Coon controller settings PID controller.*

For the PID controllers the parameters are,

$K_c = \tau / K t_d (4/3 + t_d / 4 \tau)$
$\tau_I = t_d ((32 + 6t_d)/ \tau / (13 + 8t_d/\tau)$ $\tau_D = 4t_d /$
$(11 + 2t_d / \tau)$

where τ ratio of steady state output and slope of the sigmoidal response K = ratio of steady state output to the steady state in t_d – time elapsed until the system responded.

12 *When do you go Process reaction curve method for controller tuning.*

- For the multi capacity processes whose response is sigmoid
- Process with very short time delay
- The process whose response is over damped
-

13 *What is cycling?*

An important mode of dynamic variable error is the oscillation of an error about zero. This means the variables is cycling above or below zero set point.

14 *Briefly explain about Damped oscillation method*

Using only proportional action and starting with low gain adjust the gain adjusted until the transient response of the closed loop shows a decay ratio of 1 / 4. The optimum setting of damped oscillation method is more accurate than ultimate method

15 Write two limitations of derivative controller?

- For a response with constant non zero error it gives no control action as the controller output goes to zero
- For a noisy response with almost zero error it can compute large derivatives and thus yield large control action, although it is not needed

16 Explain the function of a controller

Controller is the most important part of the process control which generates a control signal to the final control element based on the deviation of set point variable and process variable.

17 What are the parameters required to design a best controller?

- Keep the maximum errors as small as possible.
- Achieve short settling time.
- Minimize integral of errors until the process has settled to set point value

18 Define time constant of a process
It is a measure of the time necessary for the process to adjust to a change in its input

19 Write any two significance of gain margin
If gain is slightly greater than 1 at 180 shift system becomes unstable
When the phase lag is 180 and if gain is slightly less than 1 system is stable.

20 Write *the Cohen – Coon controller settings PI controller.*
For the PI controllers the parameters are,
$K_c = \tau / K t_d (0.9 + t_d / 12\tau)$
$\tau_I = t_d ((30 + 3t_d / \tau) / (9 + 20t_d/\tau)$

PART B

1. What are the principles that arise during the design of feedback controller. Discuss them on the basis of physical example.(nov04)

2. What is cascade control? Explain need for cascade control with an example. When do you prefer cascade control mode (may09)

3. What is the need for inferential control? Explain the method finding the estimate for a process needs interferential control.(may09)

4. Explain the design of cascade scheme for a system of our choice from the fundamental. What are the precaution taken to tuning of cascade control loop.(may10)

5. Explain the block diagram of cascade control and adaptive control. List the advantages and disadvantages of feed forward control scheme.(dec10)

6. With the block diagram explain the operation of split range control scheme.(dec10)

7. Explain the feed forward control with an example. Compare this with feedback control. Also bring out this merits and demerits.(may12)

8. Discuss the procedure for setting controller parameters using frequency response method.(nov12)

9. Explain the method of process reaction curve and damped oscillations for tuning the controllers.(nov12)

10. Explain how to find the controller settings using process reaction curve.(nov13)

UNIT 4

PART A

1.Draw the block diagram of inferential control scheme?

Pg-439(stephanopoulous)

2.List the precautions to be taken while tuning the cascade control scheme?

i.determine the settings for the secondary controller using one of the methods(cohen-coon,Ziegler-Nichols or others employing time integral criteria or phase and gain margin considerations)

3. What is ratio control? Where is it needed?

Ratio control is special type of feed forward control where two disturbances are measured and held in a constant ratio to each other. It is used to control the flow rates of the two streams

4.What are the advantages and disadvantages of feedback and feed forward controllers?

Advantages : 1. Acts before the effect of a disturbance has been felt by a system.
2. Good for slow systems.
3. Does not introduce instability in closed loop response.

Disadvantages:1. Requires identification of all possible disturbances and their direct measurement
2. Cannot cope with unmeasured disturbance.
3. Sensitive to process parameter variations.
4. Requires good knowledge of the process model**.**

5.What are the advantages and disadvantages of cascade control?

The Cascade control is useful in reducing the effect of a load disturbance that moves through the control system slowly. This type of control gives very high performances than conventional control. the draw back of this type of control is the two loop should be tuned properly with fine tuning methods.

6. Define and explain the concept of feed forward control.

Feed forward control configuration measures the disturbance directly and takes control action to eliminate its impact on the process output. Therefore; feed forward controllers have the theoretical potential for perfect control.

7.Briefly explain about multivariable control.

When many inputs (manipulated variables) and many controlled variable (measured outputs) are present in a loop the multi variable control is suitable. The variables may be interacting, interconnecting and decoupling. This may be controlled by this method.

8.State the conditions for the cascade control to be effective.

Cascade control is useful in reducing the effect of a load disturbance that moves through the control system slowly since the inner loop has the effect of reducing the lag in the outer loop with the result that the cascade system results more quickly with a higher frequency of response. For cascade control process of the inner loop should be faster than the outer loop. For cascade control to be effective the control action of the inner loop is often proportional with the gain set to a high value. The action of the primary controller is generally PI or PID**.**

9.Give the applications of cascade control.

10. What is meant by auctioneering control?

Such control configurations select among several measurements the onewith the highest value and feed it to the controller. Thus it is a selective controllerwhich possesses several measured outputs and only one manipulated input.

11..What is the advantage of cascade control over conventional control?

The cascade control has two loops. When any load changes the inner loop corrected before they affected the primary loop. This control gives high performance when the load is frequency changes. The tuning of the control is easy compared to conventional feedback control.

12. What are decouplers?

The special element introduced in a system with two strongly interactingloops to cancel the interaction effect between the two loops and thus render two non-interacting control loops is called decoupler.

13.What are the differences between Feed Forward and Feedback controllers?

Feed forward control	Feed forward control
1) It is useful for slow process.	It is unsatisfactory for slow processes
2) It does not introduce instability in the closed loop response.	It may create instability in the closed loop response
3) It requires identification of all possible disturbances and their direct measurement.	It does not require identification and measurement of any disturbance.
	It is insensitive to parameter changes
4) It is sensitive to process parameters	

14.State any two conditions under which the cascade control is much effective?

The cascade control is recommended whenever high performance is mandatory in the face of frequent load changes, where the secondary part of the process contains an undue amount of phase lag or non-linearity.

14. Differentiate between feedback and feedforward control.

Feed Back control: It is useful for slow process.
It does not introduce instability in the closed loop response.
It requires identification of all possible disturbances and their direct measurement.
It is sensitive to process parameters.

Feed forward control: It does not require identification and measurement of any disturbance. It may create instability in the closed loop response.
It is unsatisfactory for slow processes It is insensitive to parameter changes.

15.When the split range control is needed in a process?

In a split –range control we can control a single Process output by coordinating the actions of several Manipulated variables, all of which have the same effect on the controlled output. The split range control are used, when the additional safety and operational optimality whenever necessary.

16..What is inferential control? Give an example:

Inferential control uses secondary measurements to adjust the PV, as CV cannot be measured. An estimator in the inferential control computes the estimate of values of unmeasured cv from material and energy balance and the measured outputs.
Eg. Distillation column fig 2.2c pg. 17 Stephanopoulos

10 *What is tuning a controller based on quarter – decay ratio?*

17. Describe split-range controller with an example.

In a split –range control we can control a single Process output by coordinating the actions of several Manipulated variables, all of which have the same effect on the controlled output. Eg: in a split range control of the pressure in a steam Header, several boilers discharge steam in a common Steam header and from there to the process needs .Here instead of controlling the steam flow from each boiler, the firing rate and steam production rate at each boiler is controlled .The control objective is to maintain constant pressure in steam header when steam demand at various processing units increase.

18. What is distillation?

Distillation separates a mixture on the basis of a difference in composition between a liquid and the vapor formed from the liquid. In the process industry, distillation is widely used to isolate and purify volatile materials.

19.List some of the variables which can be manipulated when controlling a distillation column.

a. Column pressure
b. Feed flow rate
c. Feed composition(or feed quality)
d. Heat added(boil-up)
e. Bottom product flow rate
f. Heat removed(reflux)
g. Distillate product flow rate

20. Why are fuel and air sent at a specified ratio into a combustion chamber?

Fuel & air are sent at a specified ratio into a combustion chamber in order to obtain complete combustion. (i.e., if the inflow increases the air ratio also increases & hence the input is min. & o/p is max).

PART B

1. What are the main advantages and disadvantage of cascade control for what kind of process can you employ cascade control.(nov 04)

2. What is split range control? Describe a situation when you could use split range control.(nov 04)

3. Explain feed forward control with an example from distillation column.(apr 06)

4. Justify the cascade control can give better performance then feedback controller(may 06).

5.. Describe an application which needs cascade control.(may 06).

6. Explain the difficulties involved in controlling multivariable system with example from distillation column.(may 06)

7. Explain the feed forward control with an example .compare feed forward controller with fed back controller. Also bring out its merits and demerits.(may 12)

8. A cascade control system is shown in fig. Calculate the maximum gain and critical frequency of the primary controller? Eliminating the inner loop compare these valves the single loop system. Use bode plot technique.(may 12).

9. Explain the concept of ratio control with an example.(nov 12)

10. Explain the application of feed forward control and cascade control in distillation column.(nov 12)

UNIT 5

PART A

1. Why are the installed characteristics of control valve differ from its inherent characteristics?

Inherent Characteristics (ideal):

The control valve acts like an orifice and the position of the plug decides the area of opening of the orifice. The flow rate through an orifice can be expressed in terms of the upstream & downstream static pressure heads as:

$$Q=k1a\,(2g(h1-h2))^{1/2}$$

Q=flow rate in m3/sec
K1=flow coefficient
A=area of the control valve opening in m2
H1=upstream static head of the fluid in m
H2= downstream static head of the fluid in m

Installed Characteristics (Effective):

When valve are installed with pumps,piping and fitting,and other process equipment,the Pressure drop across valve will vary as the plug moves through its travel.

2.What is the function of valve positioner?

The valve positioner are use to minimize the effect of lag in large-capacity actuators, stem friction due to tight stuffing boxes, friction due to viscous or gummy fluids, process line in pressure changes.

3.What is the function of an actuator? What are the different types of actuators?

An Actuator is used to translate the output signal of the automatic controller into a position of a member exerting large power and often it is employed as a power amplifying mechanism. Different types of actuators used in control valve are pneumatic actuators, hydraulic actuators, electro-pneumatic actuators, and electric motor actuators.

4. What are the advantages and disadvantages of pneumatic actuator over other actuators?

The pneumatic actuator is used in wide range of pressure. The pneumatic signal is easily available which can transmit quite long distance without and transmission losses. No wear and tear problem is needed as in hydraulic actuators. The main drawback in pneumatic actuators is it requires signal conversion when the process is automated. This type of actuators is dependable and difficult in construction.

5.Define range-ability of a control valve.

The range ability of a control valve is the ratio of maximum controllable flow to minimum controllable flow.

6. What are the advantages and disadvantages of rotary type motion valves over linear stem motion type valves?

The rotary type stem motion valve is providing high capacity flow with minimum pressure drop. They are used to handle slurries or fibrous materials. They require minimum space for installation and they are used in low pressure services. The rotating type valves have low leakage tendency and the range ability is limited.

7. What are the different types of process parameters to be considered in selection of control valves?

Different types of process parameters to be considered in selection of control valves are the pressure drop across the value, range ability, flow rate coefficient, control valve size and etc.

8.What are the different types of factors to be considered in control valve sizing?

The proper sizing of the control valve is important because of the effect on the operation of automatic controllers. if the control valve is oversize, for eg, the valve must operate at low lift and the minimum controllable flow is too large. In addition, the lower part of the flow-lift characteristics is most likely to be non-uniform in shape. On the other hand if the control valve is undersize, the maximum flow desired for a process may not be provided.

9.Differentiate flashing and cavitations in a control valve.

In a control valve when the pressure at venacontracta goes below the vapour pressure and also at the pressure is below the liquid vapour pressure. So the fluid enters the port as a liquid & comes out as a vapour. This phenomenon is called Flashing. It occurs in a valve when the pressure drop across the orifice first results in the pressure is being lowered to below the liquid's vapour pressure and then recovering to above vapour pressure. This pressure recovery causes on implosion or collapse of the vapour bubbles formed at the venacontracta. This Phenomenon is called Cavitation.

10.What are the different types of flow-characteristics of a control valve?

The flow lift characteristics of a control valve fall into three approximate categories

a. Decreasing sensitivity type
b. Linear type
c. Increasing sensitivity type.

11.What do you mean by Flashing?

In a control valve when the pressure at venacontracta goes below the vapour pressure and also at the pressure is below the liquid vapour pressure. So the fluid enters the port as a liquid and Comes out as a vapour. This phenomenon is called Flashing

12.When a Butterfly valve is used?

The butterfly valve is most often used in sizes from 4 to 60 inch for the control of air and gas. It is also used for liquid flow if the pressure differential is not large.

13. Relate valve flow coefficient and liquid flow rate.

For control valve the flow rate is given by **$m = K_a \sqrt{2g(h1 - h2)}$**

where m – flw rate ft^3 / sec
K_1 – a flow coefficient
a – area of control valve port, ft^2.
g = acceleration sue to gravity, ft/ sec^2.

h_1 – upstream static head of flowing fluid, ft
h2 – downstream static head of flowing fluid, ft

14. Mention the two distinct characteristics of an equal percentage valve.

The equal %valve has increasing sensitivity and linear Characteristics. When the valve pressure drop is small or when the process gain decreases with increasing flow this valve can be used.

15. What is the function of the spring in a control valve?

The spring is used to bring back the actuator in static position. The spring develop Inertia and static force which may use to get the force balance in control valve.

16. What are I/P and P/I converter? State the stand and valves for P and I in instrumentation practice.

I/P and P/I converter are signal converters which are use to convert current to pneumatic and vise versa in process system. The standard Pneumatic value is 3 – 15 psi and the current is 4 – 20 mA DC.

17. What is meant by cavitation in a control valve?

It occurs in a valve when the pressure drop across the orifice first results in the pressure being lowered to below the liquid's vapour pressure and then recovering to above vapour pressure. This pressure recovery causes on implosion or collapse of the vapour bubbles formed at the venacontracta. This Phenomena is called Cavitation

18. Why is equal % valve mostly used in process industries?

The equal %valve has increasing sensitivity and linear Characteristics. When the valve pressure drop is small or when the process gain decreases with increasing flow this valve can be used.

19.What is meant by cavitation and flashing in a control valve?

Flashing: In a control valve when the pressure at venacontracta goes below the liquid vapour pressure the fluid enters the port as a liquid & comes out as a vapour. **Cavitation**: It occurs in a valve when the pressure drop across the orifice first results in the pressure is being lowered to below the liquid's vapour pressure and then recovering to above vapour pressure. This pressure re y causes on implosion or collapse of the vapour bubbles formed at the venacontracta.

20.List the merits and demerits of using a positioner in a control valve?

Merits: Hysteresis is reduced and linearity is improved, Actuator can handle higher static forces and speed of response is improved.

Demerits: Does not improve the ability of actuator to handle inertia or thrust forces. Requires maintenance.

PART B

1. Write the flow equation of a equal percentage valve and sketch its inherent valve characteristics (may 12)
2. With necessary diagram, explain the characteristics of control valves.(nov 13)
3. Explain the procedure for control valve sizing for a flow control system.(nov 13)
4. Explain the principles of working and construction of I/P converter.(nov 12)

5. Explain in detail the various control schemes used for binary distillation column(may 10)
6.. With the help of the neat diagram describe the operation of

A. Heat exchanger

B.drying process

7. Draw a neat sketch of pneumatic actuated control valve with positioned and explain its working.(dec 10)

8. Explain cavitations and flashing effect. (apr 06)

9. Explain the principle of direct and reverse acting pneumatic actuators with a neat sketch.(may 09)

10. Write short notes on the following. (may 10 &dec 10)

a.) valve sizing

b.) cavitations and flashing c.)I/P converter.

SARANATHAN COLLEGE OF ENGINEERING

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING

TIRUCHIRAPALLI - 620 012.

IC8451– CONTROL SYSTEMS

UNIT – I SYSTEMS AND THEIR REPRESENTATIONS

Part – A- Two marks questions

1. Distinguish between open loop and closed loop system
2. Why negative feedback is invariably preferred in closed loop system?
3. Define transfer function.
4. Write Masons Gain formula.
5. Write the advantage of signal flow graph.
6. What are the basic elements used for modeling mechanical translational, rotational & electrical system?
7. What is servomechanism & synchros?
8. What is control system?
9. What is block diagram? What is the basis for framing the rules of block diagram reduction technique?
10. Write the electrical analogy of mechanical translational & rotational systems.
11. What are the components of feedback control system?
12. What is stepper motor & servo motor?
13. Define open loop and closed loop system.
14. Write the force balance equations for the basic elements of mechanical systems.
15. Write the voltage – current equations for the basic elements of electrical systems.

Part – B 16 marks questions

1. a. Derive the transfer function of armature controlled DC Motor (6 Marks)

b. Write the differential equations governing the mechanical system shown in diagram, draw the force – voltage and force – current electrical analogous circuits and verify by writing mesh and node equations. (10 Marks)

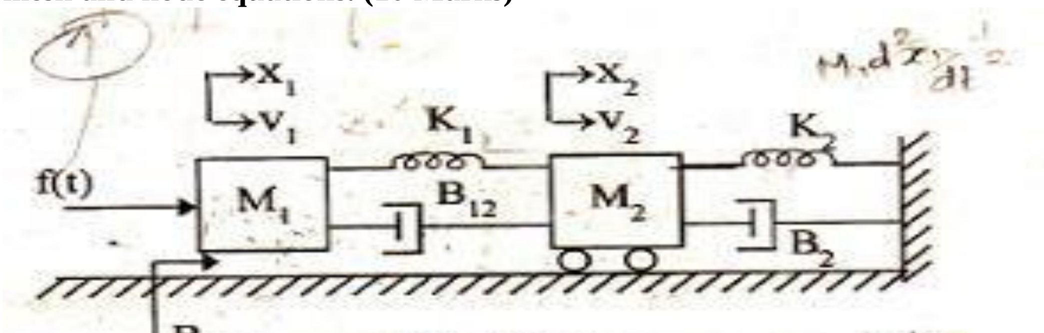


Fig 1.8.1

2. a. **Write the differential equations governing the mechanical system shown in diagram, draw the force – voltage and force – current electrical analogous circuits and verify by writing mesh and node equations. (10 Marks)**

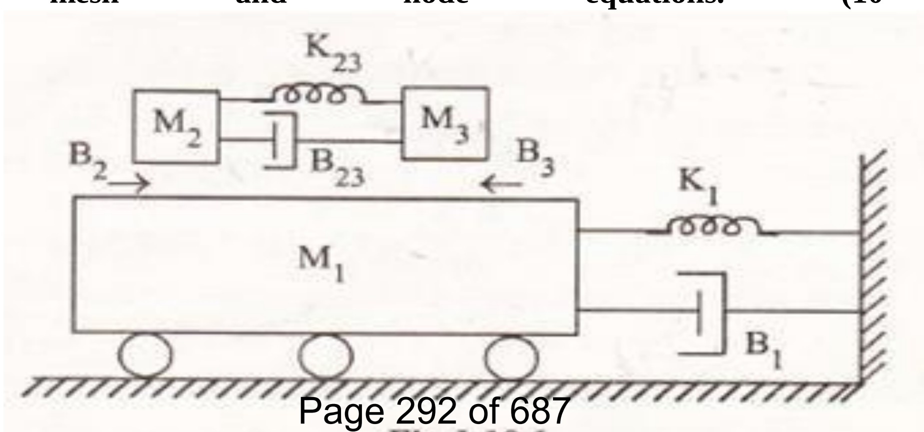


Fig 1.10.1

2. b. Derive the transfer function of armature controlled DC Motor (6 Marks)

3. a. **Write the differential equations governing the mechanical system shown in diagram, draw the torque – voltage and torque – current electrical analogous circuits and verify by writing mesh and node equations. (10 Marks)**

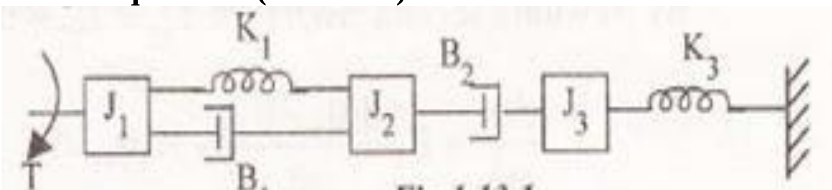
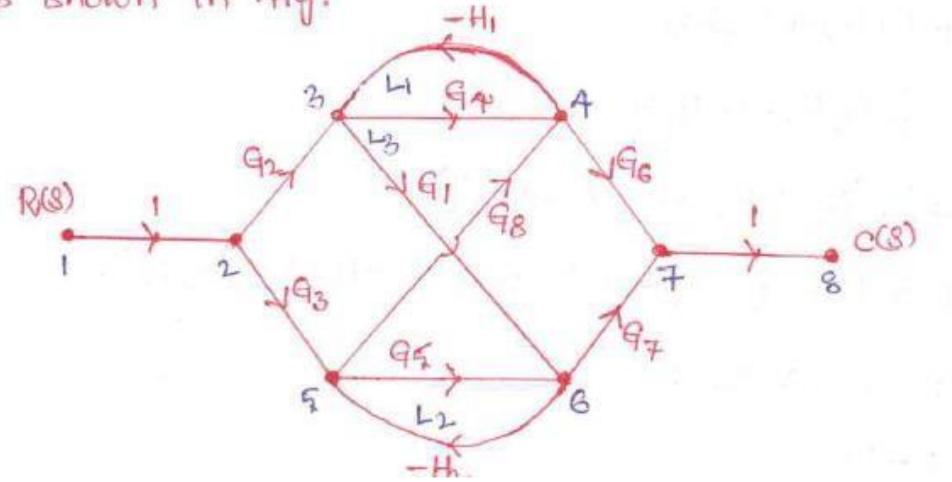


Fig 1.13.1

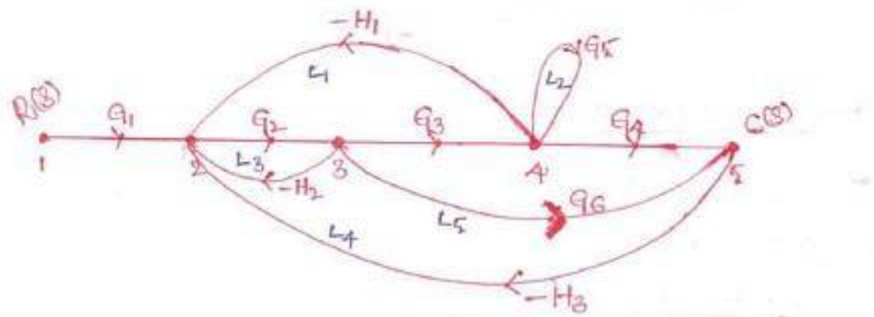
3. b. (6 Marks)

Find the overall gain of the system whose signal flow graph is shown in fig.



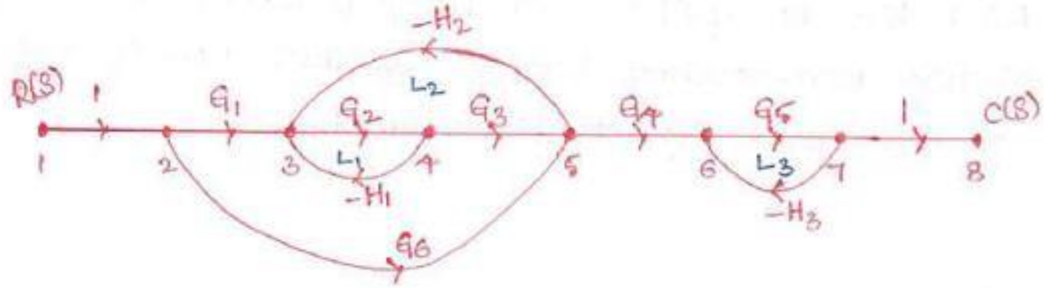
4. a. (6 Marks)

→ Find the overall gain $\frac{C(S)}{R(S)}$ for the signal flow graph shown in fig.



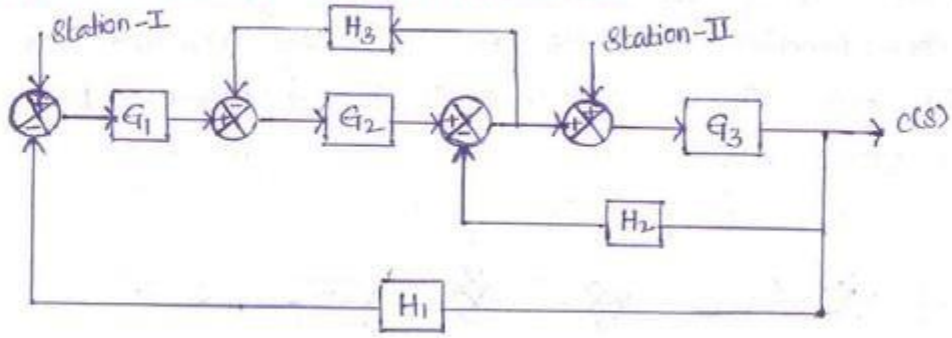
4. b. (6 Marks)

→ Find the T/F for the given signal flow graph?

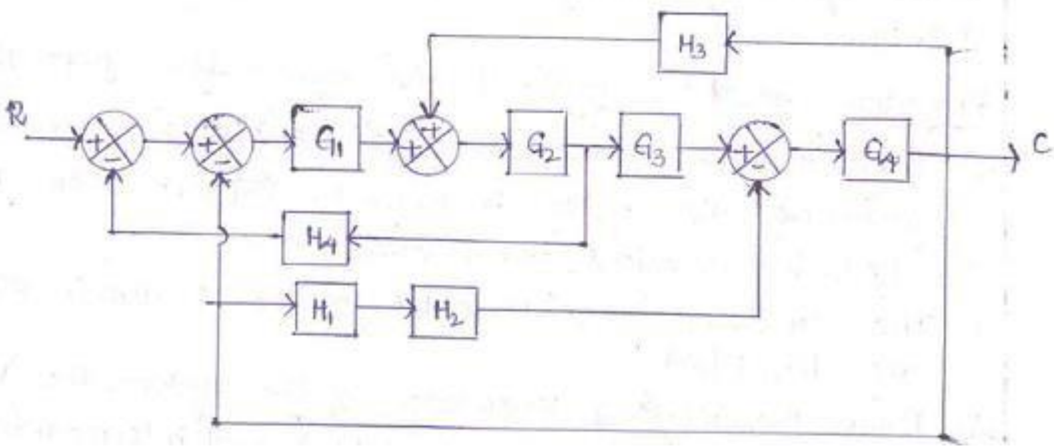


4. c. Write notes on synchros. (4 Marks)

5. a. Write notes on A.C. Servomotor. (4 Marks)
5. b. (6 Marks)
Evaluate the closed loop transfer function when the input R is (i) at Station – I (ii) at Station – II

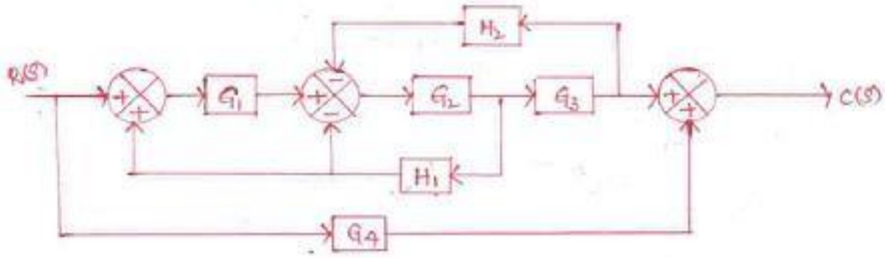


5. c. (6 Marks)
→ Using block diagram reduction technique find the transfer function $\frac{C(S)}{R(S)}$ for the system shown in fig.



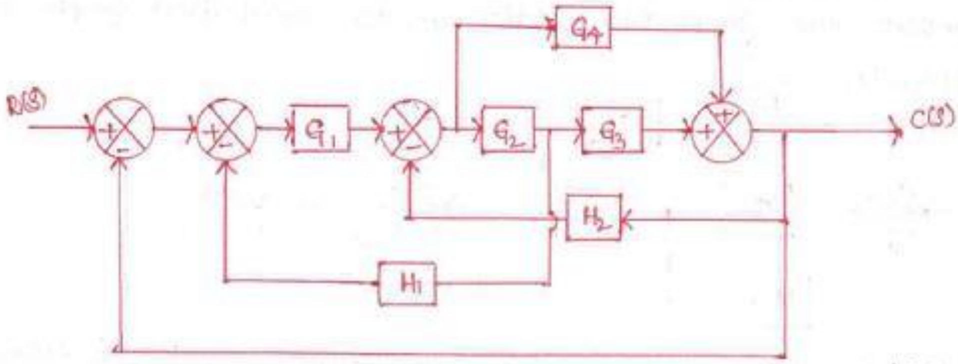
6. a. (8 Marks)

→ Convert the block diagram to signal flow graph and determine the T/F using Mason's gain formula.



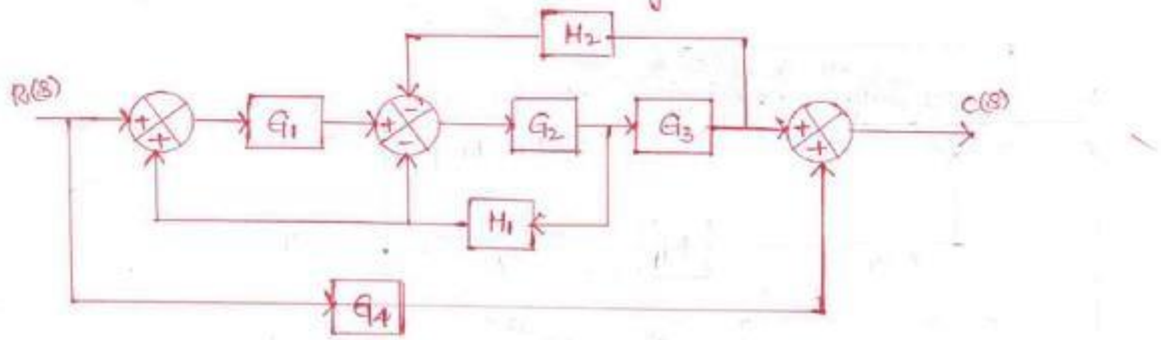
6. b. (8 Marks)

→ Convert the block diagram to signal flow graph and determine the transfer function using Mason's gain formula.



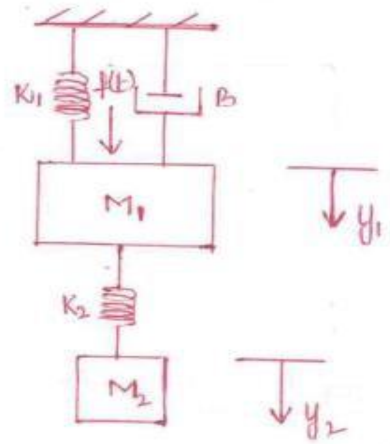
7. a. (8 Marks)

→ obtain the closed loop T/F $\frac{C(s)}{R(s)}$ of the system whose block diagram is as shown in fig



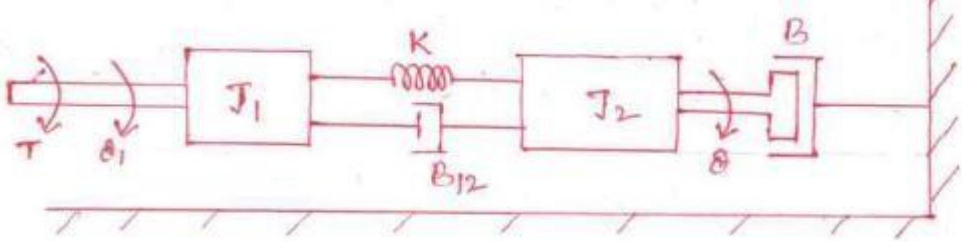
7. b. (8 Marks)

Determine the Transfer function $\frac{Y_2(s)}{F(s)}$ of the system shown in fig

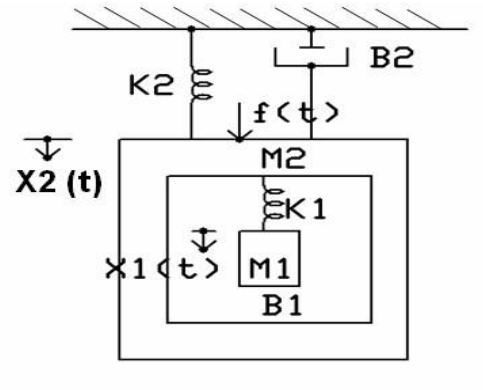


8. a. (8 Marks)

Determine the T/F $\theta(s)/T(s)$ for the system given below.



8. b. Write the governing differential equations of the mechanical system shown in figure. (8 Marks)



UNIT 2 UNIT II TIME RESPONSE

Part – A- Two marks questions

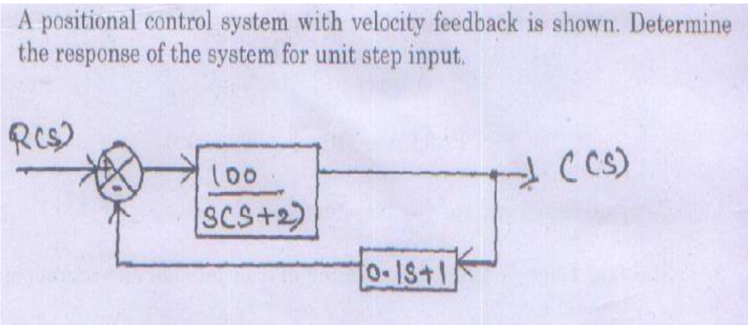
1. List the test signals used in control system.
2. Define transient response and steady state response.
3. What is an order and type number of a system?
4. What is the effect of PD & PI controller on system performance?
5. What is steady state error? What are the three constants associated with a steady state error?
6. What is the drawback of static coefficients? What are the main advantages of generalized error co-efficient?
7. List the time domain specifications.
8. Define delay time, rise time & delay time.
9. Define peak time & peak overshoot.
10. What is the significance of integral controller? Why derivative controller is not used in control systems?
11. What is the need for a controller? What are the different types of controllers?
12. What is P, PI, PD controller?
13. Define Pole & Zero.
14. Sketch the response of a second order under damped systems. Give the frequency of damped oscillation.

15. What are generalized error coefficients? Give the relation between generalized and static error coefficients.

Part – B 16 marks questions

1. a.Derive an expression for the time response of second order system subjected to unit step input, for all the four cases and plot the response. (12 Marks)
   b. Derive an expression for the time response of first order system subjected to a unit step input and plot the response. (4 Marks)
2. .a. Plot the response of a under damped second order system and mark the time domain specifications in it. Define rise time, peak time, peak overshoot and settling time and derive the expressions for the same.(10 Marks)
   b. A unity feedback system has the forward transfer function $G(s) = K_1(2s + 1) / s(5s+1)(1 + s)^2$ Input $r(t) = 1+ 6t$ is applied to the system. Determine the minimum value of K_1 if the steady state error is to be less than 0.1. (6 Marks)
3. a. Write short notes on P, PI, PD, PID Controllers. (6 Marks)
   b. Discuss the effects of P, PI, PD, PID Controllers. (10 Marks)

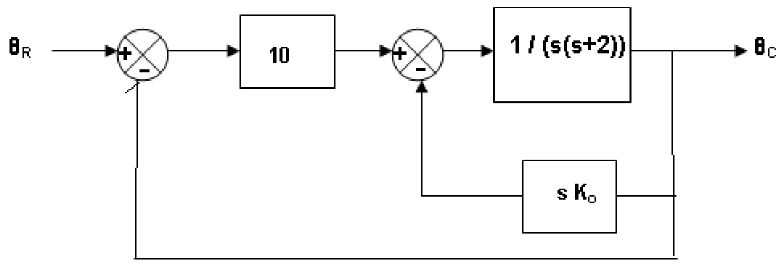
4. 4.a. (6 Marks)


A positional control system with velocity feedback is shown. Determine the response of the system for unit step input.

   b. A unity feedback control system has an open loop transfer function, $G(s) = 10 / s(s+2)$. Find the rise time, percentage overshoot, peak time and settling time for a step input of 12 units.(6 Marks)
   c. A unity feedback system is characterized by an open loop transfer function $G(s) = K / s(s+10)$. Determine the gain K, so that the system will have a damping ratio of 0.5 for this value of K. Determine settling time, peak overshoot for a unit step input.(4 Marks)
5. a. Explain about the concept of steady state error, static & dynamic error constants. (8 Marks)
   b. A unity feedback system has $G(s) = 1 /s(s+1)$. The input to the system is described by $r(t) = 4+6t+2t^3$. Find the generalized error coefficients and steady state error.(8 Marks)
6. a. For a unity feedback control system the open loop transfer function $G(s) = 10(s+2) / s^2(s+1)$. Find (a) the position, velocity and acceleration error constants, (b) the steady state error when the input is R(s) , where $R(s) = 3/s – 2/s^2 + 1/3s^3$(8 Marks)
   b. Obtain the unit step response and unit impulse response of the following system $C(s) / R(s) = 10 / s^2+2s+10$(8 Marks)
7. Measurements are conducted on a servomechanism show the system response to be $C(t) = 1 + 0.2 e^{-60t} – 1.2 e^{-10t}$ when subjected to a unit step input. Obtain the expression for the closed loop transfer function. Determine the undamped natural frequency and damping ratio of the system. (8 Marks)

8. a. For a unity feedback second order system, the open loop transfer function is $G(s) = \omega_n^2 / s(s^2+2\varepsilon\omega_n)$ calculate the generalized error coefficients and find error series.(6 Marks)

   b. Determine the damping factor and natural frequency of the system when $K_0 = 0$. What is the steady state error resulting from unit ramp input?
9. Determine the derivative feedback constant K_0 which will increase the damping factor of the system to 0.6. What is the steady state error to unit ramp input with this setting? (10 Marks)



UNIT III FREQUENCY RESPONSE

Part – A- Two marks questions

1. What is frequency response & give its advantages?
2. List out the different frequency domain specifications.
3. Define –resonant peak (μ_r) & resonant frequency (f_r).
4. Define cut-off rate & bandwidth.
5. Define gain margin & phase margin.
6. Define phase cross over& gain cross over frequency.
7. What is Bode plot? What are the main advantages of Bode plot?
8. Define corner frequency. What is polar plot?
9. Define phase lag and phase lead.
10. How closed loop frequency response is determined from open loop frequency response?
11. What are M & N circles?
12. What is Nichols chart? What are the advantages of Nichols chart?
13. What is minimum phase & non minimum phase system?
14. Draw the appropriate polar plot for the functions.
    $G(s)\,H(s) = 1/\,(1+T_1s)\,(1+T_2s)$
    $GH(s)= 1/s^2\,(1+sT)$
15. Draw the polar plot for $G(s) = 10 / [s^2(1+s)(s+2)]$

Part – B 16 marks questions

1. Sketch bode plot for the following transfer function and determine the system gain K for the gain cross over frequency to be 5 rad / sec.
   $G(s) = Ks^2 / (1+0.2s)\,(1+0.02s)$ (16 Marks)
2. Given $G(s) = Ke^{-0.2s} / s\,(s+2)\,(s+8)$ using Bode plot find K so that the system is stable with (a) gain margin equal to 2db, (b) Phase margin equal to 45 (16 Marks)

3. Consider a unity feedback system having an open loop transfer function G(s) = K / s (1+0.2s) (1+0.5s). sketch polar plot and determine the value of K so that (i) gain margin is 18db (ii)phase margin is 60 (16 Marks)
4. The open loop transfer function of a unity feedback system is given by G(s) = (1+0.2s) (1+0.025s) / s^3 (1+0.005s) (1+0.001s). Sketch the polar plot and determine the phase margin. (16 Marks)
5. Sketch the polar plot for the following transfer function and determine the gain and phase margin. G(s) = $e^{-0.1s}$ / s(s+1)(s+5) (16 Marks)
6. a. Sketch the Bode plot for the following transfer function and determine the gain and phase margin. G(s) =10 / s(1+0.4s)(1+0.1s) (8 Marks)
   b. Draw the polar plot for the open loop transfer function.
   G(s) = 500 / s(s+6) (s+9). (8 Marks)
7. Sketch the Bode plot for the following transfer function and determine the gain and phase margin. G(s) = 75(1+0.2s) / s(s^2+16s+100) (16 Marks)
8. a. Draw the Bode plot for the open loop transfer function.
   G(s) = 200(s+10) / s(s+5) (s+20). (8 Marks)
   b. Sketch the polar plot for the following transfer function and determine the gain and phase margin. G(s) = 1/ [s^2 (1+s) (1+2s)]. (8 Marks)

UNIT IV STABILITY OF CONTROL SYSTEM

Part – A- Two marks questions

1. What is Nyquist contour?
2. State Nyquist stability criterion.
3. What are the two segments of Nyquist contour?
4. State magnitude criterion.
5. State angle criterion.
6. Define BIBO stability.
7. What is the necessary condition for stability?
8. What is the necessary and sufficient condition for stability?
9. What is quadrant symmetry?
10. What is limitedly stable system?
11. Define relative stability
12. What are root loci?
13. What is a dominant pole?
14. What are the effects of adding a zero to a system?
15. What are the main significances of root locus?

Part – B 16 marks questions

1. (a) Given the characteristics equation, $G(s) = s^6 + 4s^5 + 3s^4 + 2s^3 + s^2 + 4s + 4$, Is the system stable? Check using Routh criteria.

2. The open loop transfer function of a unity feedback system is given by
   a. ***G(s) = K (s+1) / [s (s - 1) (s + 6)]***.
3. By applying Routh criterion, discuss the stability of the closed loop system as a function of K. Determine K which will cause sustained oscillations in the system. What are the corresponding oscillation frequencies?

4. Construct the root locus for the function ***G(s) H(s) = K/ [s (s + 4) (s² + 4s + 20)]*** and discuss about the stability of the system.

5. Sketch the Nyquist plot for a system with the open loop transfer function

a. G(s) H(s) = 1 / s (s^2+s+1)

6. ***Additional sums for practice: Construct the root locus for the function G(s) = K / s (s+3) (s^2 + 2s + 2)*** **OR**
G(s) = K/ s (s+1) (s^2 + 2s + 2) OR G(s) H(s) = K (s+2) / s (s+1) (s+5)
For Nyquist Criteria: G(s) H(s) = K / s (s+2) (s+10) OR G(s) = (1+4s) / s^2 (1+s) (1+2s)

7. For Routh Criteria :

$$(i)G(s) = s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 \,\&\, (ii)G(s) = \frac{K}{(s+2)(s+4)(s^2+6s+25)}$$

UNIT -5

Part – A- Two marks questions

1. What is a compensator?
2. What are the two types of compensation?
3. What are the three types of compensators?
4. What are the uses of lead compensator?
5. What is the use of lag compensator?
6. When is lag lead compensator required?

Part – B 16 marks questions

1. Design a phase lead compensator for the system $G_p(s)$ = 1 / s (s +2) **steady-state error <5% for a ramp input and phase margin > 45 ^{0}**
2. Design a phase lag compensator so that the system G(s) H(s) = 100 / [s (s + 1)] will have phase margin of 15^0.
3. Design a phase lead compensator for a system with open loop transfer function G(s) H(s) = K / (s (s + 2)) so that the velocity error constant is 20 sec^{-1}, phase margin is at least 50^0 and gain margin is at least 10 dB.

SARANATHAN COLLEGE OF ENGINEERING
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Details of slow learners Students

S.no	Batch.no	Reg.no	Name	Branch	Year	Sec
1	225039	813819112039	SURYA. M	ICE	2	A
2	225015	813819112015	JAYALAKSHMI. R	ICE	2	A
3	225007	813819112007	DEEPAK. B	ICE	2	A
4	225040	813819112040	SWATHI. A	ICE	2	A
5	225031	813819112031	SAKTHIGANESH. K	ICE	2	A
6	225012	813819112012	HARISH. R	ICE	2	A
7	225027	813819112027	RAGAVANTIRAN. G	ICE	2	A
8	225030	813819112030	REGENA ARSHNI. S	ICE	2	A
9	225001	813819112001	ABARNA. R	ICE	2	A
10	225044	813819112044	THANGASABARI . S	ICE	2	A
11	225010	813819112011	HARI KRISHNA. M	ICE	2	A
12	225017	813819112017	KRISHNA KUMARAN. K	ICE	2	A

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2	215028	813818112028	PRANAV SAJESH. S	ICE	3	A
3	215026	813818112026	POOJAVARDHINI. B	ICE	3	A
4	215017	813818112017	LOKESH. S	ICE	3	A
5	215016	813818112016	LOKESH. R	ICE	3	A
6	215015	813818112015	KUMARAGURU. K	ICE	3	A
7	215032	813818112032	SELVAKUMAR. B	ICE	3	A
8	215037	813818112037	SWETHA. R	ICE	3	A
9	215038	813818112038	VASUNDRA. R	ICE	3	A
10	215010	813818112010	GEETHA RANJANI. G	ICE	3	A
11	215012	813818112012	HARINI BANUMATHI. N	ICE	3	A
12	215008	813818112008	BHAVADHARANI. M B	ICE	3	A

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2	205035	813817112034	MOHAMED NOORDEEN. J	ICE	4	A
3	205006	813817112006	ARAWINTHAN. R	ICE	4	A
4	205015	813817112015	GOWRI. K	ICE	4	A
5	205016	813817112016	HARIHARAN. P	ICE	4	A
6	205062	813817112037	NIRMAL KUMAR. D	ICE	4	A
7	205061	813817112059	YAZHINI. C	ICE	4	A
8	205028	813817112027	LAKKSHMI PRIYA. S	ICE	4	A
9	205039	813817112039	PRATHEEP. M	ICE	4	A
10	205054	813817112053	SNEKA. C	ICE	4	A
11	205021	813817112020	KALKI. K	ICE	4	A
12	205063	813817112302	SIVA PERUMAL. R	ICE	4	A

HoD/ICE

Name : Swetha . R

class : III rd ICE

RegNo : 215037

Assignment - 1

CS8391 - DATA STRUCTURE

(i) convert infix to polish and reverse polish expressions

	Expression	Polish	Reverse Polish
i)	a+b*c	a+*bc +a*bc	a+bc* abc*+
ii)	a*(b/c)-d	a*/bc-d *a/bc-d -*a/bcd	a*bc/d abc/*-d abc/*d-
iii)	(a/(b-c+d))*(e-f)*g	(a/(b-+cd))*-ef*g (a/-b+cd)*-ef*g (/a-b+cd)+-ef*g *(/a-b+cd)*-efg **/a-b+cd-efg	(a/(b-cd+))+ef*g (a/bcd+-)*ef-g* (abcd+-/)*ef-g* abcd+-/ef-g**
iv)	(a*b)/(c*d)+(e/f)*g+h	*ab/*cd+(/ef)*g+h /*ab*cd+*/efg+h /*ab*cd++*/efgh *+/*ab*cd+*/efgh	(ab*)/cd*+(ef/)*g+h ab*cd*/+ef/g*+h ab*cd*/ef/g*+h ab+cd*/ef/g*+h+

②. Consider the following infix Expression to be Converted to Postfix expression Using Stack.

i) (((P+Q) * (R+S))/T) + (A * (B+C))

INPUT	Stack	Output
(	(	
(	((	
(	(((	
P	(((	P
+	(((+	P
Q	(((+	PQ
)	(((+)	PQ+
*	((*	PQ+
(	((*(	PQ+
R	((*(	PQ+R
+	((*(+	PQ+R
S	((*(+	PQ+RS
)	((*(+)	PQ+RS+
)	((*)	PQ+RS+*

/	(/	PQ+RS+*
T	(/	PQ+RS+*T
)	(/)	PQ+RS+*T/
+	+	PQ+RS+*T/
(	+(	PQ+RS+*T/
A	+(	PQ+RS+T/A
*	+(*	PQ+RS+*T/A
(	+(*(	PQ+RS+*T/A
B	+(*(	PQ+RS+*T/AB
+	+(*(+	PQ+RS+*T/AB
C	+(*(+	PQ+RS+*T/ABC
)	+(*(+)	PQ+RS+*T/ABC+
)	+(*)	PQ+RS+*T/ABC+**

Postfix: PQ+RS+*T/ABC+*+

(iii) A + (B * C - (D/E ^ F)) * G * H

INPUT	Stack	Output
A		A
+	+	A
(	+(	A
B	+(	AB
*	+(*	AB
C	+(*	ABC
-	+(*-	ABC*
(	+(* -(	ABC*
D	+ (-(/	ABC*D
/	+(-(/	ABC*D
E	+(-(/	ABC*DE
^	+(-(/^	ABC*DE
F	+ (-(/^)	ABC*DEF
)	+(-(/^)	ABC*DEF^/
)	+ (-)	ABC*DEF^/-
*	+ *	ABC*DEF^/-
G	+ *	ABC*DEF^/-G
*	+*+	ABC*DEF^/-G**+

Postfix = ABC* DEF^/-GH**+

3) Evaluate the given Postfix expression Using Stack 4, 5, 4 *, 2,2, + - /.

Postfix	Stack top	Expression
4	4	Top of Stack → 4
5	5	Top of Stack → 5 4
4	4	Top of Stack → 4 5 4
*	4 * 5 = 20	Top of Stack → 20 4
2	2	Top of Stack → 2 20 4
+	2 + 2 = 4	Top of Stack → 4 20 4
-	20 - 4 = 16	Top of Stack → 16 4
/	4/16	0.25

$\boxed{\text{Postfix} = 0.25}$

4). Convert the expression $(A+B)/(C-D)$ into Postfix expression and then evalute for $A = 10$, $B = 20$, $C = 15$, $D = 5$

$(A+B)/(C-d)$

$(AB+)\ /\ (CD\ -)$

$AB\ +CD\ -\ /$

$(10)(20)\ +(15)\ (5)\ -\ /$

Postfix	Stack Top	Expression
10	10	10
20	20	20 10
+	$10 + 20 = 30$	30
15	15	15 30
5	5	5 15 30
-	$5 - 15 = 10$	10 30
/	$30 / 10$	3

$\boxed{\text{Postfix}\quad (A+B)\ /(C-D) = 3}$

5). Check the Following Expression is Balanced (or) not

(i) (a+b) * (c-d)

Character	Stack
(	(
a	(
+	(
b	(
)	
*	
(	(
-	(
d	(
)	

∴ The Stack is empty

Balanced symbols.

(ii) ((a+b)* [c/d] - {{e+f}})

Character	Stack
(	(
(	((
a	((
+	((
b	((
)	(

*	[
[	[[
/	[[
d	[[
]	[
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<table>
<tr><th colspan="4">UNIT I - WEB SITE BASICS AND HTML</th></tr>
<tr><td colspan="4">Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-HTML 5.0.</td></tr>
<tr><th colspan="4">PART – A</th></tr>
<tr><th>Q.No</th><th>Questions</th><th>BT Level</th><th>Competence</th></tr>
<tr><td>1.</td><td>List any four common browsers.</td><td>BTL1</td><td>Remembering</td></tr>
<tr><td>2.</td><td>Define URI.</td><td>BTL1</td><td>Remembering</td></tr>
<tr><td>3.</td><td>State the use of web server logs and list the contents of a message log.</td><td>BTL2</td><td>Understanding</td></tr>
<tr><td>4.</td><td>List the different basic protocols used in Internet.</td><td>BTL1</td><td>Remembering</td></tr>
<tr><td>5.</td><td>What do you mean by Relative URLs?</td><td>BTL1</td><td>Remembering</td></tr>
<tr><td>6.</td><td>Write the functions of a Web Server.</td><td>BTL2</td><td>Understanding</td></tr>
<tr><td>7.</td><td>Explain the way in which a DNS server resolves addresses.</td><td>BTL5</td><td>Evaluating</td></tr>
<tr><td>8.</td><td>State the uses of Internet Protocol.</td><td>BTL2</td><td>Understanding</td></tr>
<tr><td>9.</td><td>Write short notes on basic Internet protocols.</td><td>BTL2</td><td>Understanding</td></tr>
<tr><td>10.</td><td>List and explain the three flavors of HTML.</td><td>BTL1</td><td>Remembering</td></tr>
<tr><td>11.</td><td>State the function of DNS and the protocol used.</td><td>BTL3</td><td>Applying</td></tr>
<tr><td>12.</td><td>List and explain any two HTML elements.</td><td>BTL1</td><td>Remembering</td></tr>
<tr><td>13.</td><td>Create two rows of horizontal frames using HTML frames.</td><td>BTL6</td><td>Creating</td></tr>
<tr><td>14.</td><td>Write HTML code to display an image.</td><td>BTL3</td><td>Applying</td></tr>
<tr><td>15.</td><td>How will you create a password field in a HTML form?</td><td>BTL4</td><td>Analyzing</td></tr>
<tr><td>16.</td><td>Write HTML code to create the following table,<table><tr><td>W</td><td>X</td></tr><tr><td>Y</td><td>Z</td></tr></table></td><td>BTL6</td><td>Creating</td></tr>
<tr><td>17.</td><td>Differentiate HTML and XHTML.</td><td>BTL4</td><td>Analyzing</td></tr>
<tr><td>18.</td><td>What is meant by canvas in HTML?</td><td>BTL5</td><td>Evaluating</td></tr>
</table>

19.	Model the syntax to display the following statement "I am learning **Web** Programming"	BTL3	Applying
20.	Discover how a scripting language differs from HTML?	BTL4	Analyzing
PART – B			
1.	(i) Explain TCP/IP in detail. (7) (ii) Explain the purpose and way of creating lists in HTML documents. (6)	BTL2	Understanding
2.	Recall in detail about Internet and World Wide Web. (13)	BTL1	Remembering
3.	Explain in detail the working of the following Internet Protocols. (i) TCP/IP (7) (ii) HTTP (6)	BTL2	Understanding
4.	(i) List and explain any four HTML elements in detail. (7) (ii) State the types of lists supported by HTML and explain them in detail. (6)	BTL1	Remembering
5.	Create a HTML document for a company home page. (13)	BTL6	Creating
6.	(i) Explain the capabilities of web client and web server. (7) (ii) Write and explain HTTP request message format. (6)	BTL4	Analyzing
7.	Explain the significance of XHTML with the help of a real time application. Write necessary code snippets. (13)	BTL5	Evaluating
8.	How do you create frames? Why do we need them? Develop an application to explain the same. (13)	BTL4	Analyzing
9.	(i) Explain the use of relative URL's with an example. (7) (ii) Explain how tables can be inserted into a HTML document with an example. (6)	BTL3	Applying
10.	(i) List any two differences between HTML respects to elements and XHTML with Also explain about the XHTML DTD. (7) (ii) Discuss on any four HTTP request methods. (6)	BTL1	Remembering
11.	Explain HTML forms in detail along with form elements, attributes and methods. Write an HTML document to provide a form that collect name and telephone numbers. (13)	BTL2	Understanding
12.	Examine the basic XHTML syntax and semantics. (13)	BTL4	Analyzing
13.	(i) Explain in detail the functions of a web server. (7) (ii) Give the structure of HTTP request and response messages. (6)	BTL3	Applying
14.	Define HTML 5.0. List and explain some of the HTML 5.0 tags with examples. (13)	BTL1	Remembering

PART – C			
1.	(i) Give the structure of HTTP request message and explain it in detail. (8) (ii) List and explain the steps involved in a web based client server communication. (7)	BTL5	Evaluating
2.	(i) State and explain any four HTML elements in detail. (8) (ii) Explain the way in which data can be presented in a tabular form using HTML. (7)	BTL5	Evaluating

3.	Develop an interactive web page for student registration using HTML form elements. (15)	BTL6	Creating
4.	Briefly discuss the HTML frame and table tags. (15)	BTL6	Creating

UNIT II - CSS AND CLIENT SIDE SCRIPTING

Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML- Style Rule Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout-Beyond the Normal Flow-CSS3.0. Client-Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

PART - A

Q.No	Questions	BT Level	Competence
1.	Give the syntax of a CSS rule.	BTL2	Understanding
2.	Mention the need for cascading style sheets.	BTL3	Applying
3.	Give example for inline style sheet.	BTL2	Understanding
4.	How will you include CSS in a web site?	BTL4	Analyzing
5.	Give some advantages of using Cascading Style Sheets.	BTL2	Understanding
6.	How external style sheet is useful in web page design?	BTL4	Analyzing
7.	Write short notes on text properties in CSS with suitable example.	BTL1	Remembering
8.	What is Normal Flow Box Layout in CSS?	BTL1	Remembering
9.	List the two forms of style rules with an example.	BTL1	Remembering
10.	What is meant by DHTML?	BTL1	Remembering
11.	List the ways of positioning an element within a browser window.	BTL1	Remembering
12.	What is a JavaScript statement? Give an example.	BTL1	Remembering
13.	Explain array creation in JavaScript with example.	BTL2	Understanding

14.	List the different methods defined in document and window object of JavaScript.	BTL4	Analyzing
15.	List and explain any two JavaScript built in objects.	BTL5	Evaluating
16.	State the types of JavaScript statements with examples.	BTL3	Applying
17.	Write the JavaScript to print "Good Day" using IF-ELSE condition.	BTL5	Evaluating
18.	Write code to return the full URL of a document.	BTL6	Creating
19.	Compile the limitations of CSS.	BTL6	Creating
20.	Apply CSS to a web page with the following requirements (i) Add a background image of a submarine. (ii) Set a color to the span elements (different color for each class)	BTL3	Applying
	PART – B		
1.	(i) Discuss about JavaScript debugging. (7) (ii) Explain in detail CSS border and CSS outline. (6)	BTL4	Analyzing
2.	(i) Explain any eight CSS text properties. (7) (ii) Discuss JavaScript Array object in detail. (6)	BTL1	Remembering
3.	(i) List and explain in detail various selector strings. (7) (ii) Explain the features of cascading style sheets. (6)	BTL2	Understanding
4.	(i) Write a CSS which adds background images and indentation. (7) (ii) Explain external style sheet with an example. (6)	BTL2	Understanding
5.	(i) Explain in detail the CSS Box model in detail. (7) (ii) List and explain the various positioning schemes in detail. (6)	BTL3	Applying
6.	List and describe the CSS Border Style Properties in detail with illustration. (13)	BTL1	Remembering
7.	Apply CSS to a web page with the following requirements (i) Paint the background gray (2) (ii) Paint the sidebar yellow (2) (iii) Set the artist h1 to be only uppercase (2) (iv) Set the title h2 to be uppercase-first letter (2) (v) Set a line spacing between the lines (2) (vi) Set letter spacing between the letters in each span of type instruction (3)	BTL3	Applying

8.	(i) State and explain the types of statements in JavaScript. (6) (ii) Explain how functions can be written in JavaScript with an example. (7)	BTL4	Analyzing
9.	Summarize about debugging in JavaScript. (13)	BTL2	Understanding
10.	What are the various JavaScript objects? Explain each with an example. (13)	BTL1	Remembering
11.	Show in detail about JavaScript variables and operators. (13)	BTL1	Remembering
12.	Write the registration form for the creation of email account with all possible validations using JavaScript. (13)	BTL5	Evaluating
13.	(i) Explain the JavaScript array handling and array methods. (7) (ii) Explain the following JavaScript objects. (6) a. RegExp b. Math	BTL4	Analyzing
14.	(i) Write JavaScript to find sum of first 'n' even numbers and display the result. Get the value of 'n' from user. (7) (ii) Write JavaScript to find factorial of a given number. (6)	BTL6	Creating
	PART – C		
1.	Discuss the various aspects of Normal Flow Box Layout in the context of CSS. (15)	BTL6	Creating
2.	Explain in detail about CSS3. Give the illustration for CSS3 animation. (15)	BTL5	Evaluating
3.	(i) Explain the way in which JavaScript handles arrays with example. (8) (ii) Explain how local and global functions can be written using JavaScript. (7)	BTL5	Evaluating
4.	(i) Discuss how do you use JavaScript for form validation? Develop a complete application that would include information functions to validate the user data. (10) (ii) Write short notes on JavaScript built-in objects. (5)	BTL6	Creating

UNIT III - SERVER SIDE SCRIPTING
Host Objects: Browsers and the DOM-Introduction to the Document Object Model DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-DOM Event Handling-Accommodating Noncompliant Browsers Properties of window. Server-Side Programming: Java Servlets-Architecture -Overview-A Servlet-Generating Dynamic Content-Life Cycle- Parameter Data-Sessions-Cookies-URL Rewriting-Other Capabilities-Data Storage Servlets and Concurrency- Databases and Java Servlets.

PART - A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	Define host objects.	BTL1	Remembering
2.	List the types of event listeners in DOM2.	BTL1	Remembering
3.	Assess Event Bubbling and Event Capturing.	BTL5	Evaluating
4.	What is meant by intrinsic event handling?	BTL1	Remembering
5.	List and explain any four HTML intrinsic event attributes.	BTL2	Understanding
6.	Evaluate the various levels of DOM.	BTL5	Evaluating
7.	Examine the usage of DOM style property.	BTL4	Analyzing
8.	List some of the window object properties.	BTL4	Analyzing
9.	Compose any two mouse events.	BTL6	Creating
10.	Discuss any two keyboard events.	BTL6	Creating
11.	Differentiate Client Side Scripting from Server Side Scripting.	BTL4	Analyzing
12.	Write a short note on java servlet life cycle.	BTL3	Applying
13.	List the different life cycle methods of Java Servlets.	BTL1	Remembering
14.	What is a cookie?	BTL1	Remembering
15.	What is the purpose of cookies?	BTL1	Remembering
16.	Write the purpose of URL rewriting.	BTL2	Understanding
17.	How is session tracking achieved by URL rewriting?	BTL3	Applying
18.	State the use of ServletContext object.	BTL2	Understanding
19.	Explain in brief the interaction between a web server and a servlet.	BTL2	Understanding
20.	Identify the difference between get request and post request type.	BTL3	Applying
PART - B			
1.	Explain in detail DOM event handling. Also explain with an example of creating a context menu. [Note: A context menu is one that that is shown when the user right-clicks anywhere in the document]. (13)	BTL5	Evaluating
2.	(i) Explain about the document tree in detail. (7) (ii) Explain DOM event handling in detail. (6)	BTL2	Understanding

3.	(i) List and explain the various types of document nodes. (7) (ii) Explain in detail about event object and event listeners with an example. (6)	BTL2	Understanding
4.	With a suitable example discuss about event propagation. (13)	BTL1	Remembering
5.	List the properties of mouse events associated with DOM2 with an example. (13)	BTL1	Remembering
6.	What are the various levels of DOM? Explain each of them in detail. (13)	BTL1	Remembering
7.	Make use of some of the style object in DOM to modify the elements' style. (13)	BTL3	Applying
8.	(i) Explain about architecture of servlet. (7) (ii) Explain the purpose of the following DOM method and properties, (6) a. get Element By Id b. create Element c. create Text Node d. append child e. parent Node	BTL4	Analyzing
9.	Write a servlet to illustrate the principle of Cookies and explain. (13)	BTL6	Creating
10.	Explain the Servlet operation in detail with a sample Servlet program. (13)	BTL3	Applying
11.	What is a session? Explain how client state is maintained using session and also explain about session tracking and session management using an example. (13)	BTL1	Remembering
12.	Explain the servlet life cycle with an example. (13)	BTL2	Understanding
13.	Write a Java code for getting the details of the items to be purchased from a client and to update the inventory of the shop after selling. Also bill should be prepared for the client. Maintain the transaction table also just by inserting these purchase item details at the shop use JDBC for transactions. (13)	BTL4	Analyzing
14.	(i) Write a code for creating cookies with name of person and secret code at the server, after getting these details from client using HTML form. How these details at the server side using HTTP servlet are displayed? (7) (ii) Write a code to display the current and yesterday's gold rate using session object. (6)	BTL4	Analyzing
PART - C			
1.	Describe the process of generating dynamic content using servelts. Briefly explain the importance of Document Object Model. (15)	BTL5	Evaluating

2.	With a simple example illustrate how the elements of the HTML document tree structure can be accessed using JavaScript. (15)	BTL6	Creating
3.	Discuss the ways of storing and accessing information using cookies and handling associated issues. (15)	BTL5	Evaluating
4.	Write a Java Servlet to display net salary of employee, use JDBC connectivity to get employee details from database. (15)	BTL6	Creating

UNIT IV - JSP AND XML

Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm- Databases and JSP. Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration-Namespaces- DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers.

PART - A

Q.No	Questions	BT Level	Competence
1.	Give the advantages of using JSP for server side programming.	BTL2	Understanding
2.	Write two basic differences between JSP and servlet.	BTL4	Analyzing
3.	List the types of directives in JSP.	BTL1	Remembering
4.	Explain in brief about Java Scriplet.	BTL2	Understanding
5.	Display current date using Java Scriplet.	BTL6	Creating
6.	What is MVC paradigm?	BTL1	Remembering
7.	Write short notes on some implicit objects in JSP.	BTL3	Applying
8.	Identify the steps involved in JSP.	BTL3	Applying
9.	Assess the JSP elements?	BTL5	Evaluating
10.	Explain JSTL?	BTL5	Evaluating
11.	What is the purpose of namespace?	BTL1	Remembering
12.	What is meant by XML namespace?	BTL1	Remembering
13.	Define DTD.	BTL2	Understanding

14.	What is an XPATH?	BTL1	Remembering
15.	List the advantages of XPATH.	BTL3	Applying
16.	How is XML parsing done with SAX?	BTL4	Analyzing
17.	Compare DOM and SAX in XML processing.	BTL4	Analyzing
18.	What does XSLT mean?	BTL1	Remembering
19.	What is the purpose of XSLT?	BTL2	Understanding

20.	Discuss CDATA and PCDATA.	BTL6	Creating
	PART – B		
1.	State and explain the information in a JSP document in detail. (13)	BTL1	Remembering
2.	(i) Write a client server JSP program to find simple interest and display the result in the client. (7) (ii) Write about the JSP tag libraries. (6)	BTL6	Creating
3.	Identify the objects associated with JSP and highlight the features of each object. Explain the various JSP elements. (13)	BTL3	Applying
4.	Explain in detail the creation, instantiation and usage of java beans objects. (13)	BTL2	Understanding
5.	What is a JavaBeans component? How will you use the JSP language elements for accessing Beans in your JSP pages? (13)	BTL1	Remembering
6.	Discover a JSP code to access a table and records from a student database to obtain the result of a student. (13)	BTL4	Analyzing
7.	Classify the implicit objects involved in JavaScript Expression Language. (13)	BTL4	Analyzing
8.	(i) Explain the role of XML name spaces with examples. (7) (ii) Explain the features of XML path language. (6)	BTL2	Understanding
9.	Discover a XML document to store voter ID, voter name, address and date of birth details and validate the document with the help of DTD. (13)	BTL4	Analyzing
10.	Write XSLT code to display employee details in a Table form which is stored is XML. (13)	BTL3	Applying
11.	(i) Explain XPATH nodes in detail. (7) (ii) Explain about the object that helps AJAX reload parts of a web page without reloading the whole page. (6)	BTL5	Evaluating

12.	(i) List and explain the XML syntax rules in detail. (7) (ii) Explain how a XML document can be displayed on a browser.(6)	BTL1	Remembering
13.	Explain in detail the XML schema, built in and user defined data type detail. (13)	BTL1	Remembering
14.	(i) Explain in detail about XSL. (7) (ii) Explain about DOM based XML processing. (6)	BTL2	Understanding
PART – C			
1	(i) What is the significance of JavaBeans classes in the context of JSP? Discuss. (8) (ii) Explain about MVC architecture in detail. (7)	BTL5	Evaluating
2	Write a Servlet program to display the waiting list status, given the PNR number of a train. Create a JSP to display the information at the client end. (15)	BTL6	Creating
3	Get the students' details like name, register number and mark using form. Generate DTD for this XML document. Name Regno Mark XYZ 1000 90 ABC 1001 80 RST 1002 89 PQR 1003 87 Generate the collected information in the descending order of marks using XSLT. Results should be displayed in the above format. Write a source code and explain the same. (15)	**BTL6**	**Creating**
4	(i) Explain how XSLT transforms the document from one (Word) type to other type (HTML). (8) (ii) Describe the basic java bean classes and JSP tag libraries. (7)	**BTL5**	**Evaluating**

UNIT V - AJAX AND WEB SERVICES			
AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods. Web Services: JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service Client-Describing Web Services: WSDL-Representing Data Types: XML Schema-Communicating Object Data: SOAP Related Technologies-Software Installation-Storing Java Objects as Files.			
PART - A			
Q. No	**Questions**	**BT Level**	**Competence**
1.	Explain AJAX.	BTL5	Evaluating
2.	Identify the advantages of AJAX.	BTL3	Applying
3.	Analyze the disadvantages of AJAX.	BTL4	Analyzing
4.	Identify the technologies used by AJAX.	BTL3	Applying

5.	List all the features of AJAX.	BTL4	Analyzing
6.	Compare AJAX and JavaScript?	BTL5	Evaluating
7.	Analyze where AJAX cannot be used?	BTL4	Analyzing
8.	Create an AJAX object.	BTL6	Creating
9.	What is web service?	BTL1	Remembering
10.	Why do you want to describe a Web Service?	BTL1	Remembering
11.	Mention some of the disadvantages of Web Service.	BTL2	Understanding
12.	List some examples of web services.	BTL1	Remembering
13.	Define serialization.	BTL2	Understanding
14.	List the basic concepts behind JAX-RPC technology.	BTL1	Remembering
15.	What is UDDI?	BTL1	Remembering
16.	Explain the term XML Schema.	BTL2	Understanding
17.	What is the purpose of XML schema?	BTL1	Remembering
18.	Define the need for SOAP.	BTL2	Understanding
19.	State the significance of a WSDL document. Give some uses of WSDL.	BTL3	Applying
20.	Give an example of a web service registry and its function.	BTL6	Creating
PART-B			
1.	(i) Discuss the various aspects of JAX-RPC. (7) (ii) Develop a Java Web Service that would do arithmetic operations. (6)	BTL4	Analyzing
2.	(i) What do you mean by AJAX? Write the advantages of AJAX. (7) (ii) Write short notes on Event-oriented Parsing. (6)	BTL1	Remembering
3.	(i) Discuss AJAX architecture and compare it with DOM and SAX. (7) (ii) What languages are used to represent data in web? Explain any two of them. (6)	BTL1	Remembering
4.	Discover about the development of a web application to illustrate the basics of AJAX. (13)	BTL4	Analyzing
5.	Explain about the XMLHttpRequest Object in detail. (13)	BTL2	Understanding
6.	Brief the Return Document Forms in AJAX. (13)	BTL1	Remembering
7.	Explain why the callback function is written as an anonymous function in the request phase function. (13)	BTL4	Analyzing
8.	(i) Explain in detail the steps involved in writing a web service.(7) (ii) Explain the basic concepts of RPC. (6)	BTL2	Understanding

9.	Describe the significance and working of WSDL with an example. (13)	BTL3	Applying
10.	Describe the major elements of SOAP. (13)	BTL1	Remembering
11.	Explain the role of XML schema in building web services in detail. (13)	BTL2	Understanding
12.	Design a railway reservation system using UDDI and WSDL for the following case study. Railway could register their services into an UDDI directory for checking the train rate and reservation. Travel agencies could then search the UDDI directory to find the railway reservation interface for ticket booking. (13)	BTL6	Creating
13.	Model a web service for calculator application. (13)	BTL3	Applying
14.	(i) Explain the JDBC database access in detail. (7) (ii) Explain the SOAP elements in detail. (6)	BTL5	Evaluating
PART-C			
1.	Explain JAX-RPC concept with suitable example. (15)	BTL5	Evaluating
2.	Discuss the creation of a Java Web Service in detail with examples. (15)	BTL6	Creating
3.	(i) Explain the elements of a SOAP message. (8) (ii) How do you store Java objects? Describe. (7)	BTL5	Evaluating
4.	Formulate the principles of WSDL, XML and SOAP and their interaction between them in web service applications. (15)	BTL6	Creating

SARANATHAN COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

(Accredited by NBA)

REPORT FOR SLOW LEARNERS

Academic Year: 2020-2021 **26.03.21**

Due to the Pandemic situation we have conducted classes through online mode. To enable the Slow Learners we have sent Part-A question & answers for all the five units. Important questions for Part B were sent to the slow learners. Periodically we have conducted the Assessment test for those students. Based on the feedback of the assessment test, we have conducted retest to the slow learners. Important and expected part C questions were taught to those students.

26/3/21

HoD/CSE

Saranathan College of Engineering, Trichy

Department of Civil Engineering

CE8404 – Concrete Technology

2 mark Question with Answers

Unit -1

Constituent Materials

PART –A

1. List the various tests conducted on coarse aggregates. [May/ June 2017]

1. Sieve Analysis
2. Water Absorption
3. Aggregate Impact Value
4. Aggregate Abrasion Value
5. Aggregate Crushing Value

2. What is meant by 53 grade cement? [Nov / Dec 2017]

The compressive strength attained in N/mm^2 at 28 days age when a standard cube of 70.6mmx70.6mmx70.6mm is subjected to standard compressive test is termed as Grade of Cement. The 53 in 53 Grade cement corresponds to the standard compressive strength attained within 28 days.

3. What is meant by grading of aggregates? [Nov / Dec 2016]

Grading of aggregate means particle size distribution of the aggregate. If all the particle of an aggregate were of one size, more voids will be left on the aggregate mass. Properly graded aggregate produces dense concrete and needs smaller quantities of fine aggregate and cement. Grading determines the workability of the mix, which controls segregation, bleeding, water-cement ratio, handling, placing, and other characteristics of the mix.

4. What are bogue's compounds? [April / May 2018]

Bogues compounds are the complex compound formed during the hydration of cement. When water is mixed with cement, the hydration process begins. The ingredients in concrete react each other with the help of water and forms more complex compounds. These compounds are called bogues compounds.

1. Tricalcium silicate (C_3S) – $3CaO.SiO_2$
2. Dicalcium silicate (C_2S) – $2CaO.SiO_2$
3. Tricalcium aluminate (C_3A) – $3CaO.Al_2O_3$
4. Tetracalcium alumino ferrite (C_4AF) – $4CaO.Al_2O_3Fe_2O_3$

5. What is the Chemical Composition of OPC? **[April / May 2016]**

Oxide	Per cent content
CaO	60–67
SiO_2	17–25
Al_2O_3	3.0–8.0
Fe_2O_3	0.5–6.0
MgO	0.1–4.0
Alkalies(K_2O,Na_2O)	0.4–1.3
SO_3	1.3–3.0

6. Write any two advantages of Portland pozzolona cement. **[Nov / Dec 2016]**

1. It is economical as in PPC a part (25%) of costly clinker of OPC is replaced by cheaper pozzolanic material.

2. Reduction in the production of calcium hydroxide as PPC consumes calcium hydroxide. Thus the calcium hydroxide is not produced as much as in the case of ordinary Portland cement.

7. What are the types of cement?

Ordinary Portland cement, rapid hardening cement, low heat cement, blast furnace slag cement, sulphate resistant cement, air entraining cement, white and coloured cement, high alumina cement, pozzolanic cement, super sulphate cement, expansive cement, quick setting cement, water repellant cement, water proofing cement.

8. How do you classify aggregates based on shape and size? **[April / May 2018]**

Classification Based on shape

1. Rounded aggregates.
2. Irregular or partly rounded aggregates.
3. Angular aggregates.
4. Flaky aggregates.
5. Elongated aggregates.

Classification based on size

Aggregates whose size is greater than 4.75 mm are called coarse aggregate and less than 4.75 mm are called fine aggregates

9. What should be the qualities of water to be used in concrete making? [April / May 2016]

The water used for concrete making should have a P_H between 6 to 8. They should be free from oil, acid, alkalis, salts and organic materials. it should be of portable quantity and generally purer than that required for drinking. Permissible limits 1. Chlorides 2000mg/l for PCC and 500 for RCC. Suspended matter 2000mg/l.

10. Write any two advantages of sulphate resistance Cement. [April / May 2017]

1. Complete assurance against Sulphate attack.
2. Very high compressive strength by economic concrete mix design.
3. Very low heat of hydration helps to avoid shrinkage cracks.
4. Improves life and durability of structures under aggressive conditions.
5. Improves corrosion resistance of steel by preventing sulphate attack.

Unit -2

Chemical and Mineral Admixtures

PART –A

1. What is the purpose of adding an air entraining mixture in concrete? [April / May 2018]

The primary purpose of air entrainment is to increase the durability of the hardened concrete, especially in climates subject to freeze-thaw; the secondary purpose is to increase workability of the concrete while in a plastic state. Air-entrained concrete contains billions of microscopic air cells per cubic foot. These air pockets relieve internal pressure on the concrete by providing tiny chambers for water to expand into when it freezes.

2. What are the desirable properties of silica fume? [April / May 2018]

Silica fume , a very fine non crystalline SiO_2 , is a byproduct of ferro silicon industry. it is made at a temperature of approximately 2000°C.Its size is about 0.1 µm (20 -25 m^2 / gm. It acts as an excellent pore filling material. it can be used in proportions 5 – 10 % of the cement content in a mix. The specific gravity of silica fume is generally in the range of 2.2 to 2.3.

3. Define Metakaoline. [April / May 2017]

Metakaolin is an unpurified natural pozzolonic material made on thermally activated ordinary clay and kaolinite clay.

When used to replace cement at levels of 5 to 10% by weight, the concrete produced is generally more cohesive and less likely to bleed. As a result pumping and finishing processes require less effort. The compressive strength of hardened concrete is also increased at this level of replacement.

4. What is meant by Pozzolanic action? [May / June 2016]

The pozzolanic reaction is the chemical reaction that occurs in Portland cement upon the addition of pozzolans. The pozzolanic reaction converts a silica-rich precursor with no cementing properties, to a calcium silicate, with good cementing properties.

5. What are the advantages and limitations of using super plasticizers in concrete?[M/J 16]

The use of super plasticizers will help in making high performance and high strength concrete. It helps in using less water- cement ratio. for a given concrete mix. The main disadvantage of super plasticizer usage is loss of workability as a result of rapid slump loss and incompatibility of cement and super plasticizers.

6. What are admixtures? [Nov / Dec 2017]

Admixtures are ingredients other than cement, fine aggregate and coarse aggregate to improve the quality of concrete. The addition of an admixture may improve the concrete with respect to its strength, hardness, workability, water resisting power etc.

7. Name any two chemical admixtures and write their significance [Nov / Dec 2017]

The types of chemical admixtures are as follows

1. Plasticizers
2. Superplasticisers
3. Accelerators
4. Retarders
5. Water proofers.

Chemical admixtures are used to improve the quality of concrete during mixing, transporting, placement and curing. They reduce the cost of construction, modify properties of hardened concrete, ensure quality of concrete during mixing/transporting/placing/curing, and overcome certain emergencies during concrete operations.

They are basically chemical compounds**.** Dosage ranges from 0.2% to 2% by weight of cement.

8. Mention few mineral admixtures.

1. Fly ash
2. Silica fume
3. Rice husk ash
4. Metakaoline
5. GGBFS

9. **What are retarders?**

A retarder is a chemical admixture that slows down the chemical process of hydration so that concrete remains plastic and workable for a longer time than concrete without retarder. Retarders are used to overcome the accelerating effect of high temperature on setting properties of concrete in hot weather concreting.

10. Mention few characteristic of fly ash.

a) Low carbon content
b) High fineness
c) Spherical form of particle
d) Reduces the water demand.

Unit -3

Proportioning of Concrete Mix

PART –A

1. What is the objectives of a concrete mix design? [May / June 2016]

The object of mix design is to decide the proportions of materials which will produce concrete of required properties. The mix proportions should be selected in such a way that the resulting concrete is of desired workability while fresh and it could be placed and compacted easily for the intended purpose

2. Distinguish design mix from nominal mix [May / June 2016]

Nominal mix specifies the proportion of the cement , sand and aggregates without making special effort to know their individual properties. Nominal mix has Volumetric batching. However , design mix is a process where each and every ingredient of the concrete is first tested in the laboratory

3. **Write any four grades of cement concrete. [April / May 2017]**

Grade	Mix	Compressive Strength (N/mm^2)
M 5	1 : 5 : 10	5
M 7.5	1 : 4 : 8	7.5
M 10	1 : 3 : 6	10
M 15	1: 1.5 : 3	15

4. What is the principle of mix proportioning?

Principle of concrete mixes involves determination of the proportions of the given constituents, namely, cement, water, coarse and fine aggregates and admixtures, if any, which would produce concrete possessing specified properties both in the fresh and hardened states with the maximum overall economy.

5. Give reasons for the variations in compressive strength of the samples of the same mix [April / May 2018]

1, Improper compaction

2. Improper placing

3. Improper mixing

4. Improper curing

6. Write any four methods of proportioning [Nov / Dec 2016]

1. Arbitrary Method of Proportioning Concrete.
2. Fineness Modulus Method of Proportioning Concrete.
3. Minimum Void Method.
4. Maximum Density Method:

7. On what circumstances high grade concrete are utilized effectively? [Nov / Dec 2016]

. High-grade concrete is typically used in the erection of high-rise structures. It has been used in components such as columns (especially on lower floors where the loads will be greatest), shear walls, and foundations. High strengths are also occasionally used in bridge applications as well.

8. What are the various methods of proportioning?

1. Arbitrary proportion
2. Fineness modulus method
3. Maximum density method
4. Surface area method
5. Indian standard recommended method IS 10262 – 82.

9. What are the common terminologies used in the statistical quality control?

1. Mean strength
2. Variance
3. Standard deviation
4. Coefficient of variation

10. **What is proportioning of concrete mix?**

Proportioning of concrete mix is the art of obtaining a suitable ratio of the various ingredients of concrete with the required properties at the lowest cost.

Unit -4

Fresh and Hardened Properties of Concrete

PART –A

1. What are the advantages of ring tension test? [April / May 2017]

The ring test is used for the determination of tensile strength of concrete. The specimen and the testing apparatus are so simple that both fabrication and testing can be carried out rapidly even at a construction site.

2. Define bleeding of concrete. [April / May 2017]

It is the tendency of the water to rise to the surface of freshly laid concrete. This results from inability of the solid material of concrete to hold the all the water mixed fro preparation of concrete and during the process of material downward settling.

3. List the various factors affecting workability of concrete [April / May 2018]

1. Cement content of concrete
2. Water content of concrete
3. Mix proportions of concrete
4. Size of aggregates
5. Shape of aggregates

4. Name any four properties of hardened concrete [April / May 2018]

1. Strength of concrete
2. Concrete Creep
3. Shrinkage
4. Modulus Of Elasticity
5. Water tightness (impermeability)

5. **Mention the various factors affecting strength of concrete. [Nov / Dec 2017]**

1. Quality of raw materials
2. Water/ Cement ratio
3. Coarse/ fine aggregate ratio
4. Temperature

6. What are the effects of w/ c ratio on concrete strength and durability? [May / June2016]

The water–cement ratio is the ratio of the weight of water to the weight of cement used in a concrete mix. A lower ratio leads to higher strength and durability, but may make the mix difficult to work with and form. Workability can be resolved with the use of plasticizers or super-plasticizers.

7. Define workability.

Workability is the property of concrete which determines the amount of internal work necessary to produce full compaction. It is a measure with which concrete can be handled from the mixer stage to its final fully compacted stage.

8. List out the requirements of fresh concrete.

1. Mixability
2. Stability
3. Mobility
4. Compactability
5. Finishability

9. Mention the various tests conducted to test the properties of hardened concrete.

1. Compression Testing Machine
2. Flexure Strength Testing Machine
3. Lateral Extensometer
4. Split Tensile Test

10. Mention the various methods to measure the workability of concrete.

1. Slump Test
2. Compaction Factor
3. Vee-Bee Consistometer
4. Kelly Ball Penetration test
5. Flow table Test

Unit -5

Special Concrete

PART –A

1. Define high performance concrete. [May / June 2016]

High-performance concrete (HPC) is concrete that has been designed to be more durable and, if necessary, stronger than conventional concrete. HPC mixtures are composed of essentially the same materials as conventional concrete mixtures, but the proportions are designed, or engineered, to provide the strength and durability needed for the structural and environmental requirements of the project.

2. What is polymer concrete? State its advantage. [May / June 2016]

Polymer concrete is a composite material in which the aggregate is bound together in a matrix with a **polymer** binder. The composites do not contain a hydrated cement phase, although Portland cement can be used as an aggregate or filler.

Advantages Of **Polymer Concrete**:

1. It has high impact resistance and high compressive strength.

2. **Polymer concrete** is highly resistant to freezing and thawing. 3. Highly resistant to chemical attack and abrasion.

3. Enumerate SIFCON [April / May 2017]

SIFCON (Slurry Infiltrated Fiber concrete) is a relatively new composite material utilizing steel fibers in a cement-based matrix. It differs from conventional steel-fiber-reinforced concrete in which the steel fibers are added directly to a typical concrete mix in the ratio of 0. 5 to 1. 5 percent by volume. SIFCON has the potential for many applications in the building industry.

4. Write any two advantages of geo polymer concrete [April / May 2017]

1. Fire proof
2. Low permeability
3. Eco friendly
4. Better compressive strength.

5. What is light weight concrete? **[Nov / Dec 2017]**

Lightweight concrete mixture is made with a lightweight coarse aggregate and sometimes a portion or entire fine aggregates may be lightweight instead of normal aggregates. Structural lightweight concrete has an in-place density (unit weight) on the order of (1440 to 1840 kg/m^3).

6. What is ferro cement? **[Nov / Dec 2017]**

Ferrocement is a construction material consisting of wire meshes and cement mortar. Applications of ferrocement in construction are vast due to the low self weight, lack of skilled workers, no need of framework etc.

7. List any two applications of heavy weight concrete. **[April / May 2018]**

1. Radiation Shielding that includes nuclear or shelter bomb, offshore structure, ballasting. ..
2. Counter weights.
3. Application in which high mass to volume ratio is required.

8.Write short notes on shortcrete. **[April / May 2018]**

Shotcrete, also called Gunite, concrete applied by spraying. **Shotcrete** is a mixture of aggregate and Portland cement, conveyed by compressed air to the nozzle of a spray gun, where water is added. The wet mixture is then sprayed in place and may be carved or troweled almost immediately.

9. What are the different types of polymers added to the concrete? **[April / May 2019]**

1. Acrylic polymers
2. Poly vinyl chloride
3. Poly vinyl acetate
4. Styrene butadiene copolymer latex.

10. What are the applications of light weight concrete? **[April / May 2019]**

1. Decks of long span bridges.
2. Fire and corrosion protection.
3. Covering for architectural purposes.
4. Heat insulation on roofs.
5. Insulation of water pipes.

BE8255-BASIC ELECTRICAL ,ELECTRONICS AND MEASUREMENT ENGINEERING

UNIT I ELECTRICAL CIRCUIT ANALYSIS

PART A

1. **State Ohm's Law.may 2017**

The potential difference across any two ends of a conductor is directly proportional to the current flowing between the two ends provided the temperature of the conductor remains constant.

2. **State Krichoff's Law ,may2015**

KVL states that the algebraic sum of voltages in a closed path is zero.

KCL states that the algebraic sum of currents in a node is zero.

3. **Distinguish between a mesh and a loop of a circuit.**

A mesh is a loop that does not contain other loops. All meshes are loop, but all loops are not meshes. A loop is any closed path of branches.

4. **Write down the formula for a star connected network is converted into a delta network?**

RA=(R1 R2)/(R1 +R2+ R3) RB=(R1 R3)/(R1 +R2+ R3) RC=(R2 R3)/(R1 +R2+ R3)

5. **What is reactive power?**

If we consider the circuit as purely inductive the output power is reactive power. Its unit is VAR.

6. **Define Form factor and Crest factor.**

Form factor= RMS value / Average Value

Crest(peak) factor=Maximum Value / RMS value

7. **What are the three types of power used in a a.c circuit?**

i) Real power or active power $P=EI \cos\theta$
ii) Reactive power $Q=EI \sin\theta$
iii) Apparent power, $S=EI$

8. **Define RMS value.**

The effective value of an alternating current is that value of steady ,direct current which produces the same heat as that produced by the alternating current when passed which produces the same heat as that produced by the alternating current when passed through the same resistance for the same interval of time.

9. **What is meant by eddy current damping?**

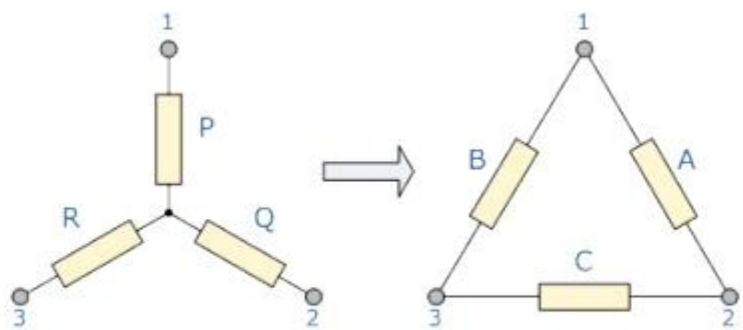
When the conductor moves in a magnetic field an emf is induced in it and if a closed path is provided ,a current flows known as eddy current. This current intersect with the magnetic field to produce an electromagnetic torque , which opposes the deflecting torque.

10. **Which type of instrument is called as universal instrument?**

The moving iron instrument are known as universal instruments, because these instruments can be used for AC and DC.

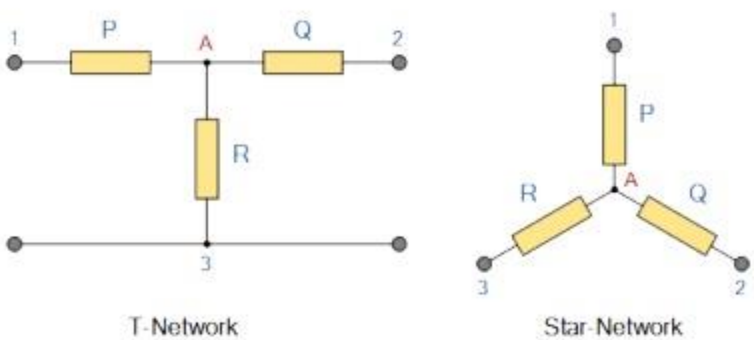
PART B

1.**Explain the Star to Delta transformation in detailed manner?**

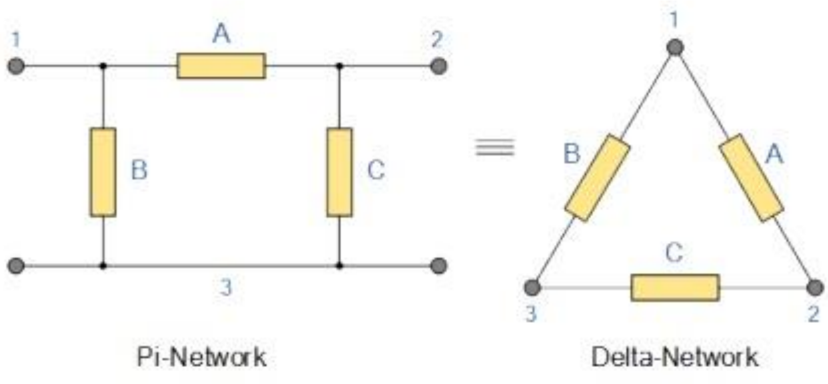


Star Delta Transformations allow us to convert impedances connected together from one type of connection to another. Standard 3-phase circuits or networks take on two major forms with names that represent the way in which the resistances are connected, a **Star** connected network which has the symbol of the letter, Y (wye) and a**Delta** connected network which has the symbol of a triangle, (delta).

If a 3-phase, 3-wire supply or even a 3-phase load is connected in one type of configuration, it can be easily transformed or changed it into an equivalent configuration of the other type by using either the **Star Delta Transformation** or **Delta Star Transformation** process.



Pi-connected and Equivalent Delta Network.



These Circuit Transformations allow us to change the three connected resistances (or impedances) by their equivalents measured between the terminals 1-2, 1-3 or 2-3 for either a star or delta connected circuit.

For example, resistor A is given as:

A= (PQ + QR + RP) / R with respect to terminal 3 and resistor B is given as:

B = (PQ + QR + RP) / Q with respect to terminal 2 and resistor C given as:

B = (PQ + QR + RP) / R with respect to terminal 1.

Star Delta Transformation allows us to convert one type of circuit connection into another type in order for us to easily analyze the circuit and star delta transformation techniques can be used for either resistances or impedances.

2.Three resistances of values 2Ω, 3Ω and 5Ω are connected in series across 20 V, D.C supply Calculate (a) equivalent resistance of the circuit (b) the total current of the circuit (c) the voltage drop across each resistor and (d) the power dissipated in each resistor?

Given data:

$R_1 = 2\Omega$

$R_2 = 3\Omega$

$R_3 = 5\Omega$

V = 20V

To find:

R_T =?

I_T =?

V_1, V_2, V_3 =?

P_1, P_2, P_3 =?

Formula used:

$R_T = R_1+R_2+R_3$ (series connection)

$I_T = V_T / R_T$

$V_1 = R_1*I_1$

$V_2= R_2*I_2$

$V_3 = R_3*I_3$

$P_1=V_1*I_1$

$P_2=V_2*I_2$

$P_3=V_3*I_3$

Solution:

$R_T = R_1+R_2+R_3 = 2+3+5$

$\mathbf{R_T = 10\Omega}$

$I_T = V_T / R_T = 20 / 10$

$\mathbf{I_T = 2\ A}$

In series connection $I_1 = I_2 = I_3 = I_T = 2A$

$V_1 = I_1*R_1 = 2*2$

$\mathbf{V_1 = 4\ V}$

$V_2 = I_2*R_2 = 2*3$

$\mathbf{V_2 = 6\ V}$

$V_3 = I_3*R_3 = 5*2$

$\mathbf{V_3 = 10V}$

$P_1 = V_1 * I_1$

$= 4*2$

P_1 = 8W

$P_2 = V_2 * I_2$

$= 6*2$

P_2 = 12W

$P_3 = V_3 * I_3 = 10*2$

P_3 = 20W

Result:

(a). Equivalent resistance of the circuit $R_T = 10\Omega$

(b). The total current of the circuit $I_T = 2A$

(c). Voltage drop across each resistor $V_1 = 4$ V, $V_2 = 6$ V, $V_3 = 10V$

(d). The power dissipated in each resistor $P_1 = 8W$, $P_2 = 12W$, $P_3 = 20W$

3.Explain the Kirchhoff's Law in detailed manner?

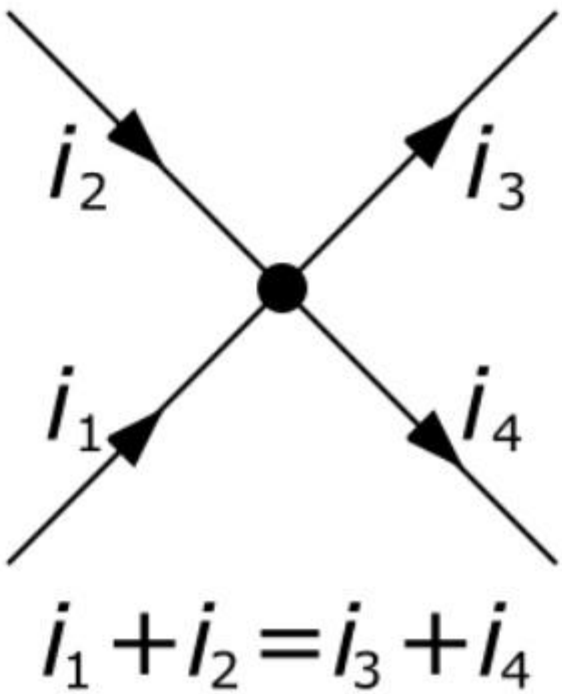
Kirchhoff's Current Law:

First law (Current law or Point law): Statement:

The sum of the currents flowing towards any junction in an electric circuit equal to the sum of currents flowing away from the junction.

Kirchhoff's Current law can be stated in words as the sum of all currents flowing into a node is zero. Or conversely, the sum of all currents leaving a node must be zero. As the image below demonstrates, the sum of currents I_b, I_c, and I_d, must equal the total current in I_a. Current flows through wires much like water flows through pipes. If you have a definite amount of water entering a closed pipe system, the amount of water that enters the system must equal the amount of water that exists the system. The number of branching pipes does not change the net volume of water (or current in our case) in the system.

Kirchhoff’s law:



Kirchhoff's Voltage Law:

Second law (voltage law or Mesh law): Statement:

In any closed circuit or mesh, the algebraic sum of all the electromotive forces and the voltage drops is equal to zero.

Kirchhoff's voltage law can be stated in words as the sum of all voltage drops and rises in a closed loop equals zero. As the image below demonstrates, loop 1 and loop 2 are both closed loops within the circuit. The sum of all voltage drops and rises around loop 1 equals zero, and the sum of all voltage drops and rises in loop 2 must also equal zero. A closed loop can be defined as any path in which the originating point in the loop is also the ending point for the loop. No matter how the loop is defined or drawn, the sum of the voltages in the loop must bezero.

4.Explain the superposition theorem in detailed manner?

The superposition theorem is unquestionably one of the most powerful in this field. It has such widespread application that people often apply it without recognizing that their maneuvers are valid only because of this theorem.

In general, the theorem can be used to do the following:

• Analyze networks such as introduced in the last chapter that have two or more sources that are not in series or parallel.

• Reveal the effect of each source on a particular quantity of interest.

• For sources of different types (such as dc and ac, which affect the parameters of the network in a different manner) and apply a separate analysis for each type, with the total result simply the algebraic sum of the results.

• Become familiar with the superposition theorem and its unique ability to separate the impact of each source on the quantity of interest.

• Be able to apply Thévenin's theorem to reduce any two-terminal, series-parallel network with any number of sources to a single voltage source and series resistor.

• Become familiar with Norton's theorem and how it can be used to reduce any two-terminal, seriesparallel network with any number of sources to a single current source and a parallel resistor.

The superposition theorem states the following: The current through, or voltage across, any element of a network is equal to the algebraic sum of the currents or voltages produced independently by each source. In other words, this theorem allows us to find a solution for a current or voltage using only one source at a time. Once we have the solution for each source, we can combine the results to obtain the total solution. The term algebraic appears in the above theorem statement because the currents resulting from the sources of the network can have different directions, just as the resulting voltages can have opposite polarities. If we are to consider the effects of each source, the other sources obviously must be removed. Setting a voltage source to zero volts is like placing a short circuit across its terminals. Therefore, when removing a voltage source from a network schematic, replace it with a direct connection (short circuit) of zero ohms. Any internal resistance associated with the source must remain in the network. Setting a current source to zero amperes is like replacing it with an open circuit. Therefore, when removing a current source from a network schematic, replace it by an open circuit of infinite ohms. Any internal resistance associated with the source must remain in the network.

5. Explain the thevenin's theorem in detailed manner?

Thévenin's theorem The next theorem to be introduced, Thévenin's theorem, is probably one of the most interesting in that it permits the reduction of complex networks to a simpler form for analysis and design.

In general, the theorem can be used to do the following:

• Analyze networks with sources that are not in series or parallel.

• Reduce the number of components required to establish the same characteristics at the output terminals.

Thévenin's Theorem Procedure Preliminary:

1. Remove that portion of the network where the Thévenin equivalent circuit is found. this requires that the load resistor RL be temporarily removed from the network.

2. Mark the terminals of the remaining two-terminal network. (The importance of this step will become obvious as we progress through some complex networks.) RTh

3. Calculate RTh by first setting all sources to zero (voltage sources are replaced by short circuits and current sources by open circuits) and then finding the resultant resistance between the two marked terminals. (If the internal resistance of the voltage and/or current sources is included in the original network, it must remain when the sources are set to zero.) Eth

4. Calculate ETh by first returning all sources to their original position and finding the open-circuit voltage between the marked terminals. (This step is invariably the one that causes most confusion and errors. In all cases, keep in mind that it is the open-circuit

5. Draw the Thévenin equivalent circuit with the portion of the circuit previously removed replaced between the terminals of the equivalent circuit.

6. Explain the norton's theorem in detailed manner?

The theorem states the following: Any two-terminal linear bilateral dc network can be replaced by an equivalent circuit consisting of a current source and a parallel resistor

Norton's Theorem Procedure Preliminary:

1. Remove that portion of the network across which the Norton equivalent circuit is found.

2. Mark the terminals of the remaining two-terminal network. RN:

3. Calculate RN by first setting all sources to zero (voltage sources are replaced with short circuits and current sources with open circuits) and then finding the resultant resistance between the two marked terminals. (If the internal resistance of the voltage and/or current sources is included in the original network, it must remain when the sources are set to zero.) Since RN = RTh, the procedure and value obtained using the approach described for Thévenin's theorem will determine the proper value of RN. IN:

4. Calculate IN by first returning all sources to their original position and then finding the short-circuit current between the marked terminals. It is the same current that would be measured by an ammeter placed between the marked terminals. Conclusion:

5. Draw the Norton equivalent circuit with the portion of the circuit previously removed replaced between the terminals of the equivalent circuit.

7. Explain the maximum power transfer theorem in detailed manner?

maximum power transfer theorem When designing a circuit, it is often important to be able to answer one of the following questions:

What load should be applied to a system to ensure that the load is receiving maximum power from the system

Conversely: For a particular load, what conditions should be imposed on the source to ensure that it will deliver the maximum power available

Even if a load cannot be set at the value that would result in maximum power transfer, it is often helpful to have some idea of the value that will draw maximum power so that you can compare it to the load at hand.

For instance, if a design calls for a load of 100 Ω, to ensure that the load receives maximum power, using a resistor of 1 Ω or 1 kΩ results in a power transfer that is much less than the maximum possible. However, using a load of 82 Ω or 120 Ω probably results in a fairly good level of power transfer.

Fortunately, the process of finding the load that will receive maximum power from a particular system is quite straightforward due to the maximum power transfer theorem, which states the following: A load will receive maximum power from a network when its resistance is exactly equal to the Thévenin resistance of the network , for the Thévenin equivalent circuit in when the load is set equal to the Thévenin resistance, the load will receive maximum power from the network. with RL = RTh,

we can determine the maximum power delivered to the load by first finding the current: IL = ETh RTh + RL = ETh RTh + RTh = ETh 2RTh Then we substitute into the power equation: PL = I 2 LRL = a ETh 2RTh b 2 (RTh) = E2 ThRTh 4R2 Th and PLmax = E 2 Th 4RTh To demonstrate that maximum power is indeed transferred to the load under the conditions defined above, consider the Thévenin equivalent circuit in Before getting into detail, however, if you were to guess what value of RL would result in maximum power transfer to RL, you might think that the smaller the value of RL, the better it is because the current reaches a maximum when it is squared in the power equation. The problem is, however, that in the equation PL = I 2 LRL, the load resistance is a multiplier. As it gets smaller, it forms a smaller product. Then again, you might suggest larger values of RL because the output voltage increases, and power is determined by PL = V 2 L /RL. This time, however, the load resistance is in the denominator of the equation and causes the resulting power to decrease. A balance must obviously be made between the load resistance and the resulting current or voltage. The following discussion shows that maximum power transfer occurs when the load voltage and current are one-half their maximum possible values. For the circuit in Fig. 9.85, the current through the load is determined by IL = ETh RTh + RL = 60 V 9 Ω + RL The voltage is determined by VL = RLETh RL + RTh = RL(60 V) RL + RTh and the power by PL = I 2 LRL = a 60 V 9 Ω + RL b 2 (RL) = 3600RL (9 Ω + RL) 2 If we tabulate the three quantities versus a range of values for RL from 0.1 Ω to 30 Ω, If the load applied is less than the Thévenin resistance, the power to the load will drop off rapidly as it gets smaller.

However, if the applied load is greater than the Thévenin resistance, the power to the load will not drop off as rapidly as it increases.

8. Explain the parallel circuit analysis in detailed manner?

Resistors in Parallel Consider a circuit with 3 resistors in parallel (such as the circuit below, if N = 3). Since the voltages across all the parallel elements in a circuit are the same (E = V1 = V2=V3),

This result can be generalized to provide the total resistance of any number of resistors in parallel:

Special Case: Two Resistors in Parallel For only two resistors connected in parallel, the equivalent resistance may be found by the product of the two values divided by the sum:

Current through resistors in parallel. The total current I is shared by the resistors in inverse proportion to their resistances. Stated another way: "More current follows the path of least resistance."

Extreme cases for current division: Current Divider Rule The Current Divider Rule (CDR) allows us to determine how the current flowing into a node is split between the various parallel resistors.

Compare the formulas for the voltage divider rule and the current divider rule. Special Case: Two resistors in parallel. For only two resistors in parallel: open circuit short circuit

Special Case: If current enters a parallel network with a number of equal resistors, the current will split equally between the resistors. Note:

In a parallel network, the smallest value resistor will have the largest current. Analysis of Parallel Circuits To analyze parallel circuits we should use the following guidelines:

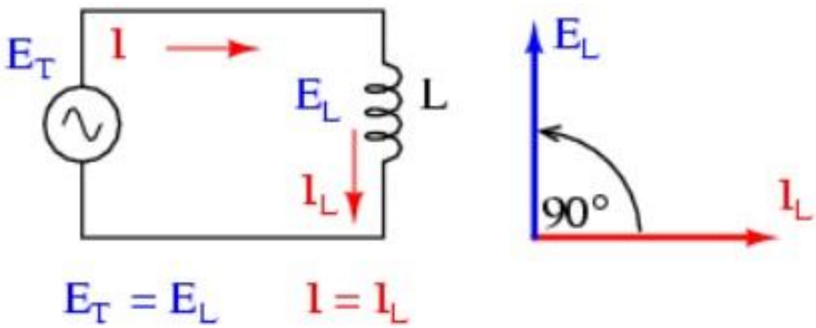
1. Voltage across all branches is the same as the source voltage

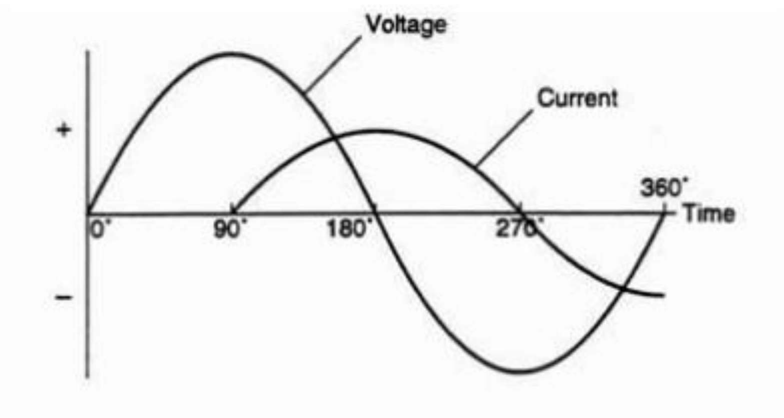
2. Determine current through each branch using Ohm's Law

3. Find the total current using Kirchhoff's Current Law

9. Explain the inductive networks in detailed manner?

Pure Inductive circuits:





This simple circuit above consists of a pure inductance of L Henries (H), connected across a sinusoidal voltage given by the expression: $V(t) = V_{max} \sin \omega t$. When the switch is closed this sinusoidal voltage will cause a current to flow and rise from zero to its maximum value. This rise or change in the current will induce a magnetic field within the coil which in turn will oppose or restrict this change in the current.

But before the current has had time to reach its maximum value as it would in a DC circuit, the voltage changes polarity causing the current to change direction. This change in the other direction once again being delayed by the self-induced back emf in the coil, and in a circuit containing a pure inductance only, the current is delayed by 90^o.

The applied voltage reaches its maximum positive value a quarter ($1/4f$) of a cycle earlier than the current reaches its maximum positive value, in other words, a voltage applied to a purely inductive circuit "LEADS" the current by a quarter of a cycle or 90^o as shown below.

The instantaneous voltage across the resistor, V_R is equal to the supply voltage, V_t and is given as:

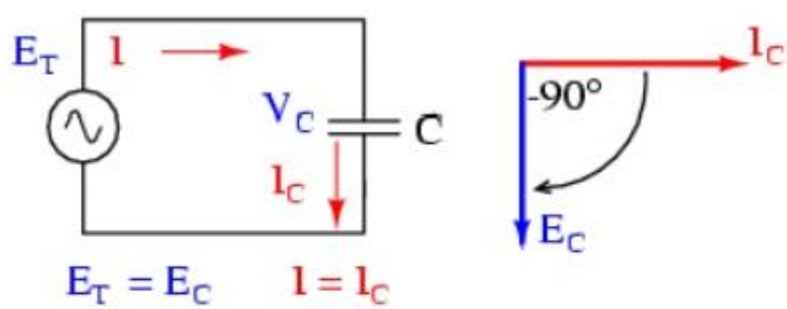
$V_L = V_{max} \sin(\omega t + 90)$

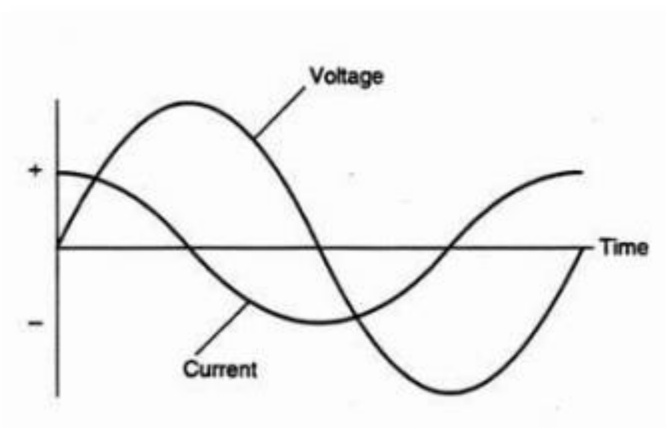
$I_L = V / X_L$

$X_L = 2\pi fL$

10. Explain the capacitive networks in detailed manner?

Pure Capacitive circuits:





When the switch is closed in the circuit above, a high current will start to flow into the capacitor as there is no charge on the plates at $t = 0$. The sinusoidal supply voltage, V is increasing in a positive direction at its maximum rate as it crosses the zero reference axis at an instant in time given as 0^{o}. Since the rate of change of the potential difference across the plates is now at its maximum value, the flow of current into the capacitor will also be at its maximum rate as the maximum amount of electrons are moving from one plate to the other.

As the sinusoidal supply voltage reaches its 90^o point on the waveform it begins to slow down and for a very brief instant in time the potential difference across the plates is neither increasing nor decreasing therefore the current decreases to zero as there is no rate of voltage change. At this 90^opoint the potential difference across the capacitor is at its maximum (V_{max}), no current flows into the capacitor as the capacitor is now fully charged and its plates saturated with electrons.

At the end of this instant in time the supply voltage begins to decrease in a negative direction down towards the zero reference line at 180^o. Although the supply voltage is still positive in nature the capacitor starts to discharge some of its excess electrons on its plates in an effort to maintain a constant voltage. These results in the capacitor current flowing in the opposite or negative direction.

When the supply voltage waveform crosses the zero reference axis point at instant 180^o, the rate of change or slope of the sinusoidal supply voltage is at its maximum but in a negative direction, consequently the current flowing into the capacitor is also at its maximum rate at that instant. Also at this 180^o point the potential difference across the plates is zero as the amount of charge is equally distributed between the two plates.

Then during this first half cycle 0^o to 180^o, the applied voltage reaches its maximum positive value a quarter $(1/4f)$ of a cycle after the current reaches its maximum positive value, in other words, a voltage applied to a purely capacitive circuit “LAGS” the current by a quarter of a cycle or 90^o

$I_C = I_{max} \sin(\omega t + 90)$

$I_L = V / X_C$

$X_C = 1 / 2\pi fC$

UNIT II ELECTRICAL MACHINES

PART A

1. What is an electric generator?

An electrical machine, which converts mechanical energy into electrical Energy, is called as electric generator.

2. What is an electric motor?

An electrical machine, which converts electrical energy into mechanical Energy, is called as electric motor.

3.What is the function yoke?

It serves the purpose of outermost cover of the dc machine. So that

the insulating material get protected from harmful atmospheric elements like moisture, dust and various gases like SO2, acidic fumes etc.It provides mechanical support to the poles.

4. **Define voltage transformation ratio?dec2015**

The ratio of secondary induced emf to primary induced emf is called as voltage regulation ratio devoted by K.

$$\frac{E_2}{E_1} = \frac{N_2}{N_1} = K$$

5.Write down the emf equation for d.c generator.

$$\boxed{E = (\phi NZ / 60)(P/A)} \quad V$$

Where

P = number of poles

Z = Total number of conductors

A = number of parallel paths

Φ = flux per pole

N = speed in rpm

6. **what is the principle of DC motor?**

Whenever a current carrying conductor placed in a magnetic field, it experiences a mechanical force.

7. **List the different types of DC motor.**

- DC series motor
- DC Shunt motor
- DC Compound motor
  - Long shunt compound motor
  - Short shunt compound motor

8.Give the torque equation of a DC motor.

Ta=0.159fIa.PZ/A N-m

Ia - Armature current

P - Number of poles

Z - Total number of conductors

A -Number of parallel paths

9.List out the characteristics of DC motor.

i. Torque-Armature current characteristics (T VS Ia)

ii. Speed-Armature current characteristics (N VS Ia)

10. **What are all the applications of DC motor?**

Blowers and fans

Centrifugal and reciprocating pumps

Lathe machines

Machine tools

Milling machines

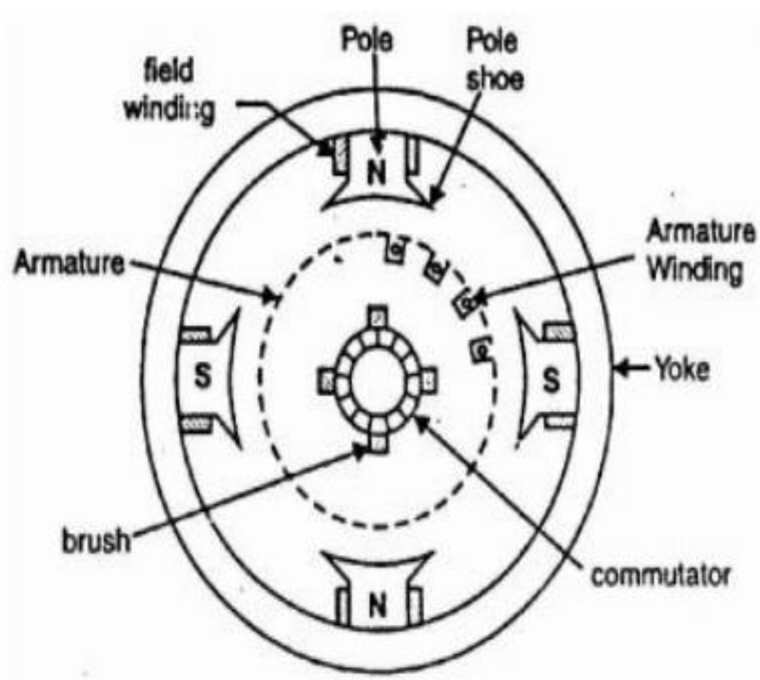
Drilling machines

PART B

1. **write the notes on construction of d.c. machines in clear manner?**

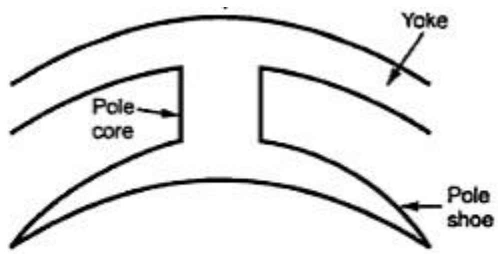
Frame

Frame is the stationary part of a machine on which the main poles and commutator poles are bolted and it forms the supporting structure by connecting the frame to the bed plate.



poles:

Inter-poles are small additional poles located in between the main poles.



These can be solid, or laminated just as the main poles. These are also fastened to the yoke by bolts.

Armature

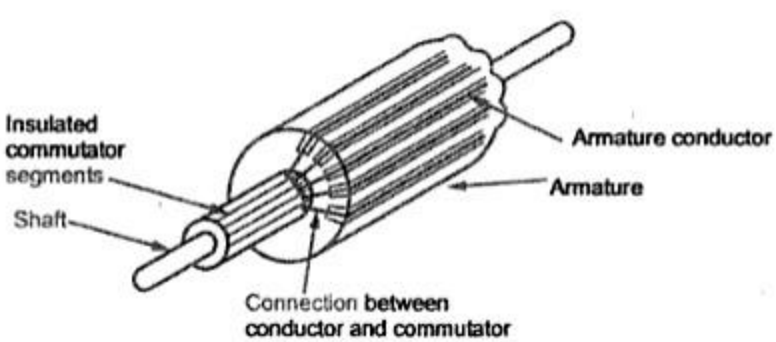
The armature is where the moving conductors are located. The armature is constructed by stacking laminated sheets of silicon steel. Thickness of these lamination is kept low to reduce eddy current losses.

Field windings:

Hence the armature windings are in general pre-formed, taped and lowered into the open slots on the armature. In the case of small machines, they can be hand wound. The coils are prevented from flying out due to the centrifugal forces by means of bands of steel wire on the surface of the rotor in small groves cut into it. In the case of large machines slot wedges are additionally used to restrain the coils from flying away.

Commutator:

Commutator is the key element which made the d.c. machine of the present day possible. It consists of copper segments tightly fastened together with mica/micanite insulating separators



on an insulated base. The whole commutator forms a rigid and solid assembly of insulated copper strips and can rotate at high speeds.

Brush and brush holders:

The brushes are kept pressed on the commutator with the help of springs. This is to ensure proper contact between the brushes and the commutator even under high speeds of operation. Jumping of brushes must be avoided to ensure arc free current collection and to keep the brushcontact drop low. Other mechanical parts End covers, fan and shaft bearings form other important mechanical parts.

End Shields or Bearings

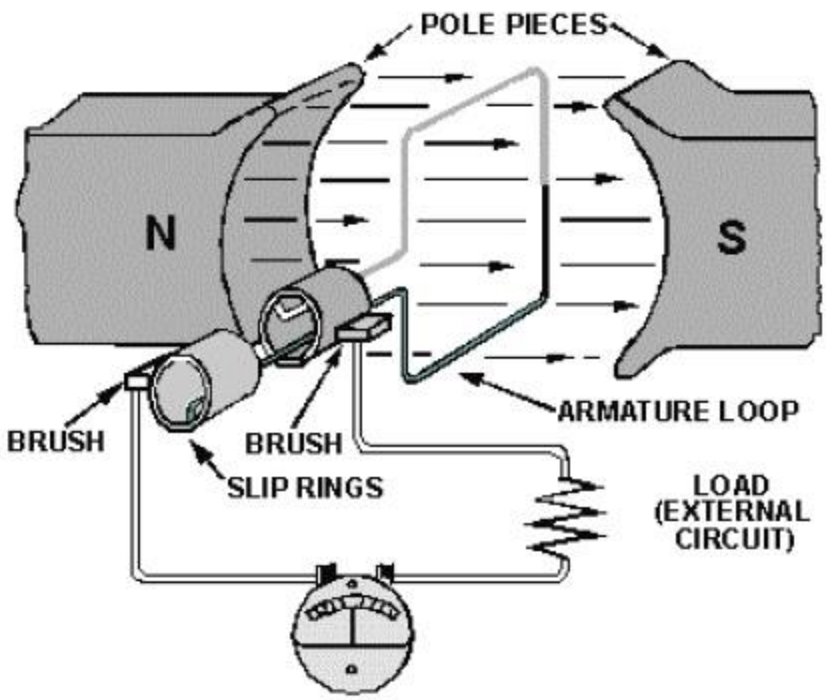
If the armature diameter does not exceed 35 to 45 cm then in addition to poles end shields or frame head with bearing are attached to the frame.If the armature diameter is greater than 1m **pedestral type bearings** are mounted on the machine bed plate outside the frame.

2. write the notes on principle of d.c. machines in clear manner?

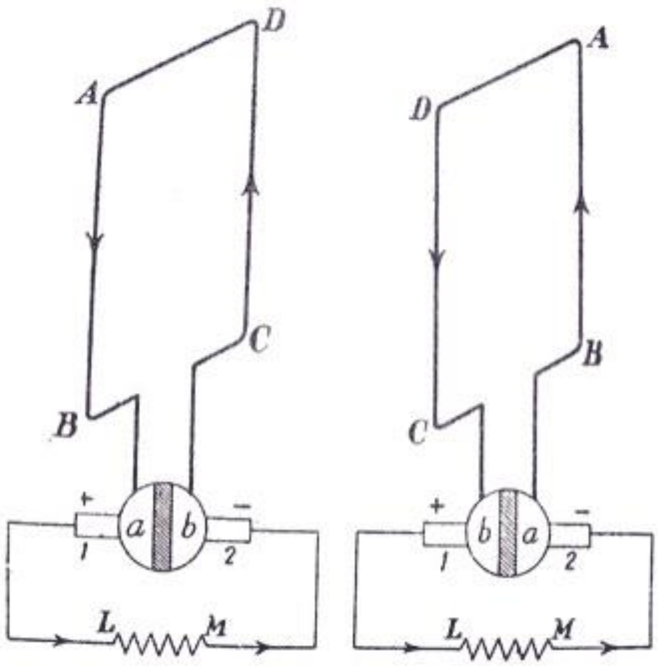
PRINCIPLE OF OPERATION

DC generator converts mechanical energy into electrical energy. when a conductor move in a magnetic field in such a way conductors cuts across a magnetic flux of lines and emf produces in a generator and it is defined by faradays law of electromagnetic induction emf causes current to flow if the conductor circuit is closed. The pole pieces (marked N and S) provide the magnetic field. The pole pieces are shaped and positioned as shown to concentrate the magnetic field as close as possible to the wire loop. The loop of wire that rotates through the field is called the ARMATURE. The ends of the armature loop are connected to rings called SLIP RINGS. They rotate with the armature.

The brushes, usually made of carbon, with wires attached to them, ride against the rings. The generated voltage appears across these brushes. The elementary generator produces a voltage in the following manner (fig. 1-3). The armature loop is rotated in a clockwise direction. The initial or starting point is shown at position A. (This will be considered the zero-degree position.) At 0º_ the armature loop is perpendicular to the magnetic field. The black and white conductors of the loop are moving parallel to the field. The instant the conductors are moving parallel to the magnetic field, they do not cut any lines of flux. Therefore, no emf is induced in the conductors, and the meter at position A indicates zero. This position is called the NEUTRAL PLANE. As the armature loop rotates from position A (0º) to position B (90º), the conductors cut through more and more lines of flux, at a continually increasing angle. At 90º they are cutting through a maximum number of lines of flux and at maximum angle. The result is that between 0º and 90º , the induced emf in the conductors builds up from zero to a maximum value. Observe that from 0º_ to 90º_, the black conductor cuts DOWN through the field. At the same time the white conductor cuts UP through the field.



The induced emfs in the conductors are series-adding. This means the resultant voltage across the brushes (the terminal voltage) is the sum of the two induced voltages. The meter at position B reads maximum value. As the armature loop continues rotating from 90º_ (position B) to 180º_ (position C), the conductors which were cutting through a maximum number of lines of flux at position B now cut through fewer lines. They are again moving parallel to the magnetic field at position C. They no longer cut through any lines of flux. As the armature rotates from 90º_ to 180º_, the induced voltage will decrease to zero in the same manner that it increased during the rotation from 0º_ to 90º_. The meter again reads zero. From 0º_ to 180º_ the conductors of the armature loop have been moving in the same direction through the magnetic field. Therefore, the polarity of the induced voltage has remained the same. This is shown by points A through C on the graph.



<u>3. Explain the E.M.F equations of d.c. machines in clear manner?</u>

E.M.F EQUATION

Let

Φ = flux/pole in weber

Z = total number of armture conductors = No.of slots x No.of conductors/slot

P = No.of generator poles

A = No.of parallel paths in armature

N = armature rotation in revolutions per minute (r.p.m) E = e.m.f induced in any parallel path in armature

Generated e.m.f Eg = e.m.f generated in any one of the parallel paths i.e E. Average e.m.f geneated /conductor = $d\Phi/dt$ volt (n=1)

Now, flux cut/conductor in one revolution $d\Phi = \Phi P$ Wb No.of revolutions/second = N/60

Time for one revolution, dt = 60/N second

Hence, according to Faraday's Laws of Electroagnetic Induction,

E.M.F generated/conductor is

$$\frac{d\varnothing}{dt} = \frac{\varnothing PN}{60}$$

For a simplex wave-wound generator

No.of parallel paths = 2

No.of conductors (in series) in one path = Z/2

E.M.F. generated/path is

$$\frac{\varnothing PN}{60} \times \frac{Z}{2} = \frac{\varnothing ZPN}{120} \text{ volt}$$

For a simplex lap-wound generator

No.of parallel paths = P

No.of conductors (in series) in one path = Z/P

E.M.F.generated/path

$$\frac{\varnothing PN}{60} \times \frac{Z}{P} = \frac{\varnothing ZN}{60} \text{ volt}$$

In general generated e.m.f

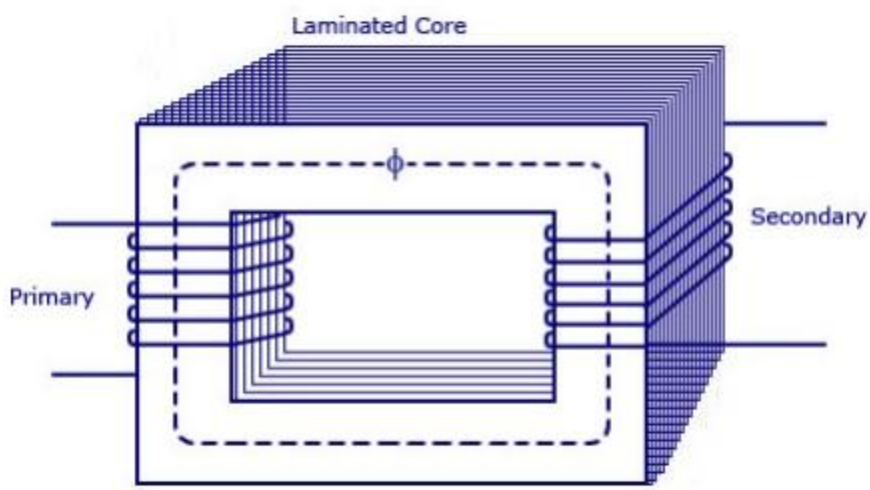
$$E_g = \frac{\varnothing ZN}{60} \times \left(\frac{P}{A}\right) \text{ volt}$$

where A = 2 for simplex wave-winding A = P for simplex lap-winding

4. Explain the working principle of transformer in clear manner?

BASIC WORKING PRINCIPLE OF TRANSFORMER

A transformer can be defined as a static device which helps in the transformation of electric power in one circuit to electric power of the same frequency in another circuit. The voltage can be raised or lowered in a circuit, but with a proportional increase or decrease in the current ratings. The main principle of operation of a transformer is mutual inductance between two circuits which is linked by a common magnetic flux. A basic transformer consists of two coils that are electrically separate and inductive, but are magnetically linked through a path of reluctance. The working principle of the transformer can be understood from the figure below.



The core laminations are joined in the form of strips in between the strips there are some narrow gaps right through the cross-section of the core. These staggered joints are said to be'imbricated'. Both the coils have high mutual inductance. A mutual electro-motive force is induced in the transformer from the alternating flux that is set up in the laminated core, due to the coil that is connected to a source of alternating voltage. Most of the alternating flux developed by this coil is linked with the other coil and thus produces the mutual induced electro-motive force. The so produced electro-motive force can be explained with the help of Faraday's laws of Electromagnetic Induction as

$e=M*dI/dt$

If the second coil circuit is closed, a current flows in it and thus electrical energy is transferred magnetically from the first to the second coil.

The alternating current supply is given to the first coil and hence it can be called as the primary winding. The energy is drawn out from the second coil and thus can be called as the secondary winding.

In short, a transformer carries the operations shown below:

Transfer of electric power from one circuit to another.

Transfer of electric power without any change in frequency.

Transfer with the principle of electromagnetic induction.

The two electrical circuits are linked by mutual induction

5. Explain the construction of transformer in clear manner?

TRANSFORMER CONSTRUCTION

Two coils of wire (called windings) are wound on some type of core material. In some cases the coils of wire are wound on a cylindrical or rectangular cardboard form. In effect, the core material is air and the transformer is called an AIR-CORE TRANSFORMER. Transformers used at low frequencies, such as 60 hertz and 400 hertz, require a core of low-reluctance magnetic material, usually iron. This type of transformer is called an IRON-CORE TRANSFORMER. Most power transformers are of the iron-core type.

The principle parts of a transformer and their functions are:

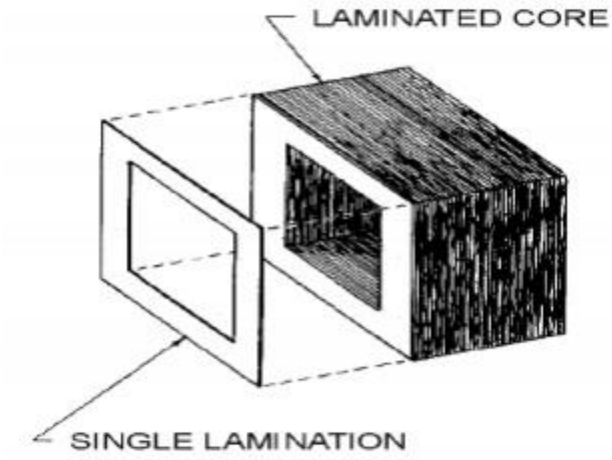
The CORE, which provides a path for the magnetic lines of flux.

The PRIMARY WINDING, which receives energy from the ac source.

The SECONDARY WINDING, which receives energy from the primary winding and delivers it to the load.

The ENCLOSURE, which protects the above components from dirt, moisture, and mechanical damage.

(i) CORE



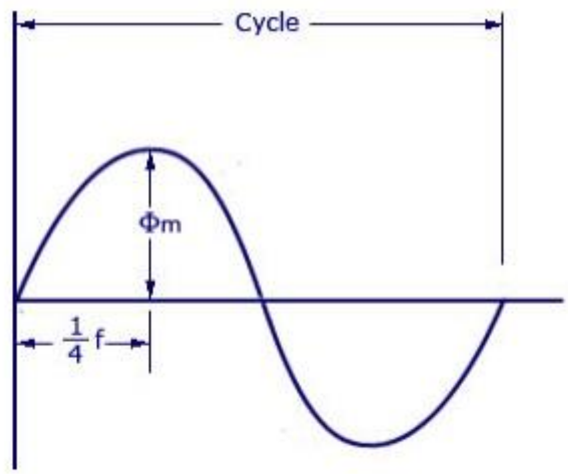
There are two main shapes of cores used in laminated-steel-core transformers. One is the HOLLOWCORE, so named because the core is shaped with a hollow square through the center. This shape of core. Notice that the core is made up of many laminations of steel it shows how the transformer windings are wrapped around both sides of the core.

(ii) WINDINGS

the transformer consists of two coils called WINDINGS which are wrapped around a core. The transformer operates when a source of ac voltage is connected to one of the windings and a load device is connected to the other. The winding that is connected to the source is called the PRIMARY WINDING. The winding that is connected to the load is called the SECONDARY WINDING. The primary is wound in layers directly on a rectangular cardboard form.

6. Write the E.M.F equation of transformer in clear manner?

The applied voltage V1 applied to the primary of a transformer, with secondary open-circuited, be sinusoidal (or sine wave). Then the current I1, due to applied voltage V1, will also be a sine wave. The mmf N1 I1 and core flux Ø will follow the variations of I1 closely. That is the flux is in time phase with the current I1 and varies sinusoidally.



N_A = Number of turns in primary

N_B = Number of turns in secondary

$Ø_{max}$ = Maximum flux in the core in webers = B_{max} X A f = Frequency of alternating current input in hertz (H_Z)

the core flux increases from its zero value to maximum value $Ø_{max}$ in one quarter of the cycle , that is in ¼ frequency second.

Therefore, average rate of change of flux = $Ø_{max}$/ ¼ f = 4f $Ø_{max}$Wb/s

Now, rate of change of flux per turn means induced electro motive force in volts. Therefore,

average electro-motive force induced/turn = 4f $Ø_{max}$volt

If flux Ø varies sinusoidally, then r.m.s value of induced e.m.f is obtained by multiplying the average value with form factor.

$$EA = 4.44f\ NA Ømax = 4.44fNABmA$$

Similarly, r.m.s value of induced e.m.f in secondary is

$$EB = 4.44f\ NB\ Ømax = 4.44fNBBmA$$

In an ideal transformer on no load, VA = EA and VB = EB , where VB is the terminal voltage

Voltage Transformation Ratio.

The ratio of secondary voltage to primary voltage is known as the voltage transformation ratio and is designated by letter K. i.e.

Voltage transformation ratio, K = V2/V1 = E2/E1 = N2/N1

Current Ratio

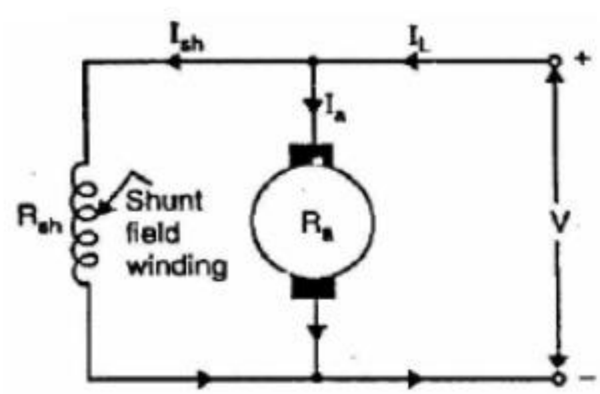
The ratio of secondary current to primary current is known as current ratio and is reciprocal of voltage transformation ratio in an ideal transformer.

<u>7. Explain the types of DC motors in clear manner?</u>

DC MOTOR TYPES

1. Shunt Wound
2. Series Wound
3. Compound wound

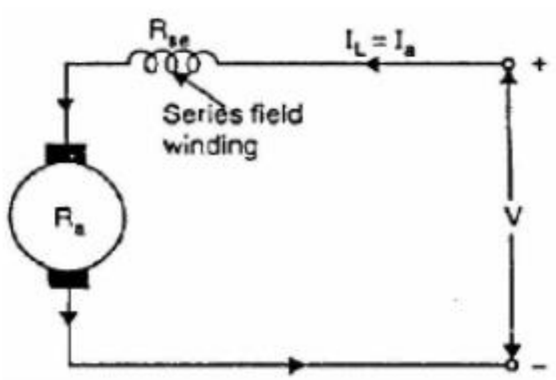
1. Shunt Motor



Shunt field windings are designed to produce the necessary m.m.f. by means of a relatively large number of turns of wire having high resistance. Therefore, shunt field current is relatively small compared with the armature current

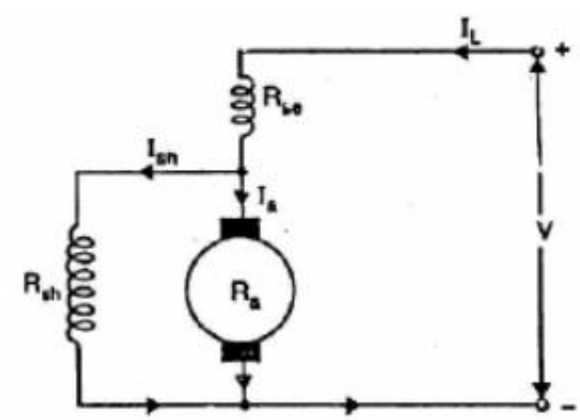
2. Series Motor

The current passing through a series field winding is the same as the armature current, series field windings must be designed with much fewer turns than shunt field windings for the same mmf.Therefore, a series field winding has a relatively small number of turns of thick wire and, therefore, will possess a low resistance.



3. **Compound Wound Motor**

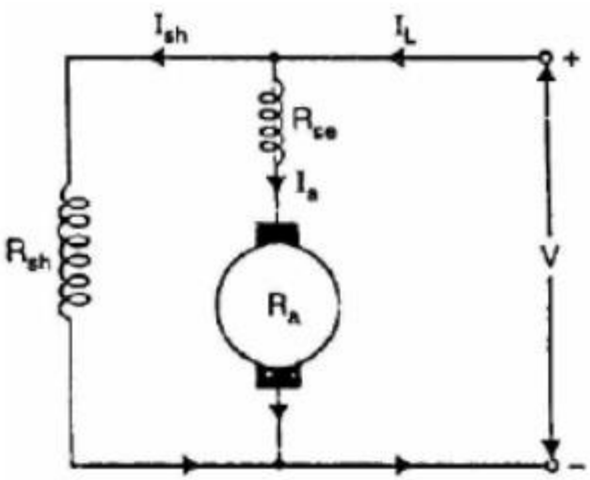
1) Short-shunt connection
2) Long shunt connection



Short-shunt connection

When the shunt field winding is directly connected across the armature terminals it is called short-shunt connection.

When the shunt winding is so connected that it shunts the series combination of armature and series field it is called long-shunt connection.

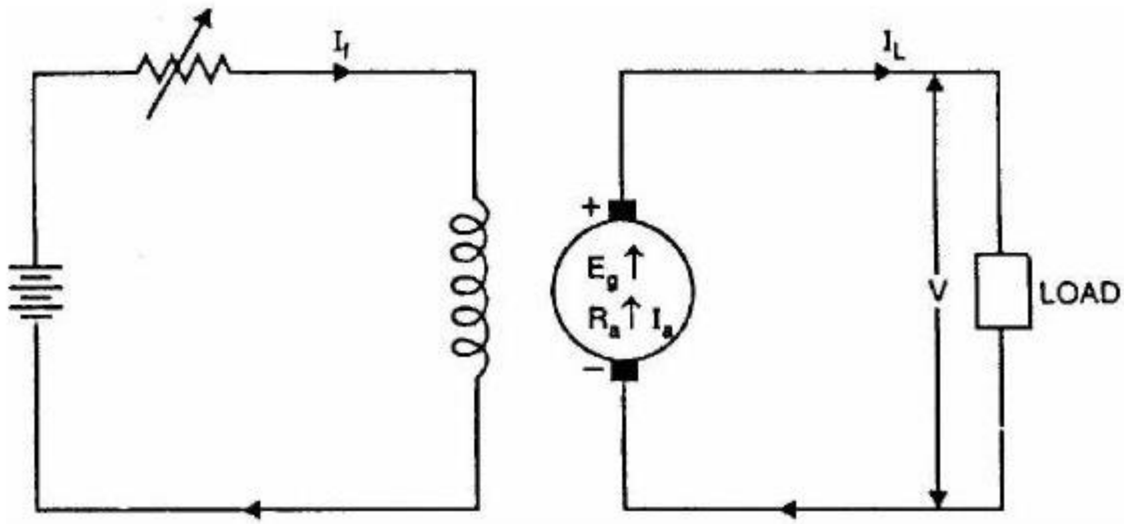


Long-shunt connection

8. Explain the types of DC generators in clear manner?

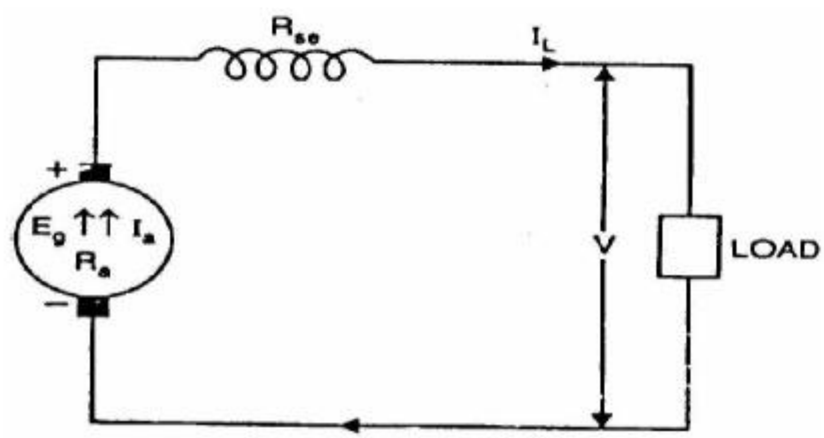
(i)Separately Excited D.C. Generators

A d.c. generator whose field magnet winding is supplied from an independent external d.c. source (e.g., a battery etc.) is called a separately excited generator. Fig shows the connections of a separately excited generator. The voltage output depends upon the speed of rotation of armature and the field current (Eg =PfØ ZN/60 A). The greater the speed and field current, greater is the generated e.m.f. It may be noted that separately excited d.c. generators are rarely used in practice. The d.c. generators are normally of self-excited type.



(ii)Self-Excited D.C. Generators

A d.c. generator whose field magnet winding is supplied current from the output of the generator itself is called a self-excited generator. There are three types of self-excited generators depending upon the manner in which the field winding isconnected to the armature, namely;



Armature current, Ia = Ise = IL = I(say)

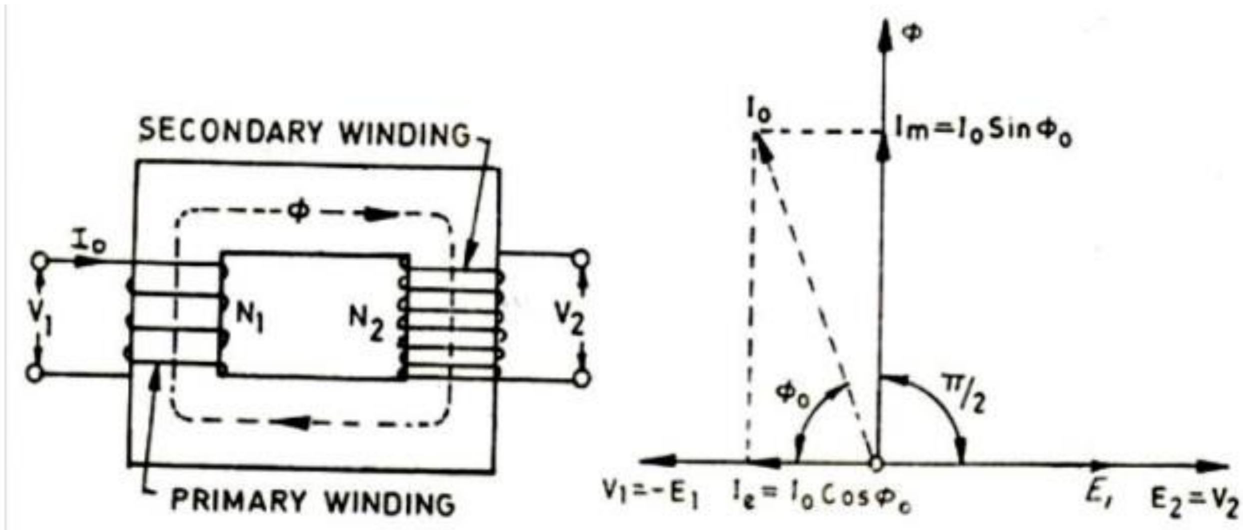
Terminal voltage, V = EG - I(Ra + Rse)

Power developed in armature = EgIa

Power delivered to load

9. Explain the transformer with no load condition in clear manner?

When the primary of a transformer is connected to the source of an ac supply and the secondary is open circuited, the transformer is said to be on no load. The Transformer on No Load alternating applied voltage will cause flow of an alternating current I0 in the primary



winding, which will create alternating flux Ø. No-load current I0, also known as excitation or exciting current, has two components the magnetizing component Im and the energy component Ie. Im is used to create the flux in the core and Ie is used to overcome the hysteresis and eddy current losses occurring in the core in addition to small amount of copper losses occurring in the primary only (no copper loss occurs in the secondary, because it carries no current, being open circuited.)

From vector diagram shown in above it is obvious that

1. Induced emfs in primary and secondary windings, E1 and E2 lag the main flux Ø by and are in phase with each other.

2. Applied voltage to primary V1 and leads the main flux Ø by and is in phase opposition to E1.

3. Secondary voltage V2 is in phase and equal to E2 since there is no voltage drop in secondary.

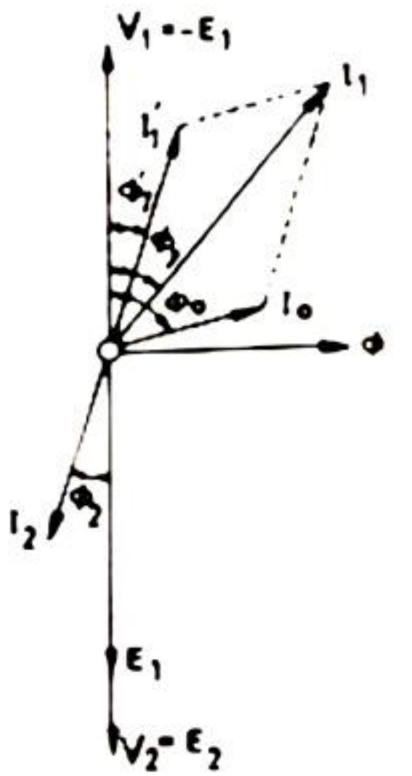
4. Im is in phase with Ø and so lags V1 by

5. Ie is in phase with the applied voltage V1.

6. Input power on no load = V1Ie = V1I0 cos Ø0 where Ø0 = $\tan^{-1}$

10. Explain the transformer with load condition in clear manner?

The transformer is said to be loaded, when its secondary circuit is completed through an impedance or load. The magnitude and phase of secondary current (i.e. current flowing through secondary) I2 with respect to secondary terminals depends upon the characteristic of the load i.e. current I2 will be in phase, lag behind and lead the terminal voltage V+2+ respectively when the load is non-inductive, inductive and capacitive. The net flux passing through the core remains almost constant from no-load to full load irrespective of load conditions and so core losses remain almost constant from no-load to full load. Vector diagram for an ideal transformer supplying inductive load is shown



Resistance and Leakage Reactance In actual practice, both of the primary and secondary windings have got some ohmic resistance causing voltage drops and copper losses in the windings. In actual practice, the total flux created does not link both of the primary and secondary windings but is divided into three components namely the main or mutual flux Ø linking both of the primary and secondary windings, primary leakage flux $ØL_1$ linking with primary winding only and secondary leakage flux $ØL_2$ linking with secondary winding only. The primary leakage flux $ØL_1$ is produced by primary ampere-turns and is proportional to primary current, number of primary turns being fixed.

The primary leakage flux $ØL_1$ is in phase with I_1 and produces self induced emf $ØL_1$ is in phase with I_1 and produces self induced emf EL_1 given as 2f L_1 I_1 in the primary winding.

The self induced emf divided by the primary current gives the reactance of primary and is denoted by X1.

$X1 = EL1/I1 = 2\pi fL1I1/I1 = 2FL1$,

leakage reactance of secondary $X2 = EL2/E2 = 2f\pi L2I2/I2 = 2\pi fL2$

Equivalent Resistance and Reactance. The equivalent resistances and reactance's of transformer windings referred to primary and secondary sides are given as below Referred to primary side Equivalent resistance,

Equivalent resistance, = X'1 = Referred to secondary side Equivalent resistance,

Equivalent resistance, = $X2 + K^2X1$ Where K is the transformation ratio.

UNIT III UTILIZATION OF ELECTRICAL POWER

PART A

1. What are the mechanisms for producing forces from wind?

There are two primary mechanism for producing forces from the winds. They are

i. Lift force, and

ii. Drag force

When life force

2. **Define Airfoil**

Lift forces are produced by changing the velocity of the air stream flowing over either side of the lifting surface. Speeding up the air flow causes the pressure to drop, while slowing the air stream down leads to increase in pressure.

This pressure difference produces a force that begins to act on the high pressure side and moves towards the low pressure side of the lifting surface which is called an **airfoil**.

3. **Define Magnus Effect**

Magnus Effect, caused by spinning a cylinder in an air stream at a high-speed of rotation. The spinnings slows down the air speed on the side where the cylinder is moving into wind and increases it on the other side; the result is similar to an airfoil. This principle has been put to practical use in one or two cases but is not generally employed.

4. **Define Stalling.**

When lift decreases and the drag increases quite substantially; this phenomenon is known as **Stalling**. For efficient operation, a wind turbine blade needs to function with as much lift and as little drag as possible because drag dissipates energy.

5. **What is the function of back-up in small producers?**

For small producers, back-up can take the form of

(1) Battery storage

(2) Connection with the local electricity distribution systems, or

(3) A stand by generator powered by liquid or gaseous fuels

Drag force

6. **Define Power Co-efficient.**

The fraction of the free-flow wind power that can be ectracted by a rotor is a called the power co-efficient. Thus

Power Coefficient = Power of wind rotor / Power available in the wind

Where, power available is calculated from the air density, rotor diameter and free wind speed as discussed earlier. The maximum theoretical power coefficient is equal to 16/27 or 0.593. This value cannot be exceeded by a rotor in free-flow wind-stream.

7. **Why utilization of wind is considered as part of solar technology?**

The major forcing function causing surface winds from the poles toward the equator is convective circulation. Solar radiation heats the air near the equator, and this low density heated air is buoyed up. At the surface it is displaced by cooler more dense higher pressure air flowing from the poles. In the upper atmosphere near the equator the air thus tends to low back toward the poles and away from the equator. The net result is a global convective with surface winds from north to south in the northan hemisphere.

It is clear from the above over simplified model that the wind is basically caused by the Solar Energy irradiating the Earth. This is why wind utilization is considered part solar technology.

8. **Define Wind.**

Wind results from air motion. Air in motion arises from a pressure gradient. The circulation of air in the atmosphere is caused by the non-uniform heating of the earth’s surface by the Sun.

9. **What are the different types of forces acting on propeller type wind turbine.**

There are two types of forces which are acting on the blades. They are

(1) Circumferential force acting in the direction of wheel rotation that provides the torque, and

(2) Axial force acting in the wind stream that provides an axial thrust that must be countered by proper mechanical design.

10. **What are the different types of vertical axis wind turbines.**

i. Savonius Rotor type machines

ii. Darrieus type machines

PART B

1.Write short notes about Wind Power?

All renewable energy (except tidal and geothermal power), ultimately comes from the sun. The earth receives 1.74x1017 watts of power (per hour) from the sun. About one or 2 percent of this energy is converted to wind energy (which is about 50-100 times) more than the energy converted to biomass by all plants on earth.

Differential heating of the earth's surface and atmosphere induces vertical and horizontal air currents that are affected by the earth's rotation and contours of the land - > WIND. E.g.: Land Sea Breeze Cycle. Winds are influenced by the ground surface at altitudes up to 100 meters. Wind is slowed by the surface roughness and obstacles.

When dealing with wind energy, we are concerned with surface winds. A wind turbine obtains it power input by converting the force o the wind into a torque (turning force) acting on the rotor blades. The amount of energy which the wind transfers to the rotor depends on the density of the air, the rotor area, and the wind speed.

The kinetic energy of a moving body is proportional to its mass (or weight). The kinetic energy in the wind thus depends on the density of the air, i.e. its mass per unit of volume. In other words, the "heavier" the air, the more energy is received by the turbine at 15oC air weight about 1.225 kg per cubic meter, but the density decrease slightly with increasing humidity.

A typical 600 kW wind turbine has a rotor diameter of 43-44 meters, i.e., a rotor area of some 1,500 square meters. Fig 5.1 shows the power generated by the wind mill with respect to the height.

The rotor area determines how much energy a wind turbine is able to harvest from the wind. Since the rotor area increases with the square of the rotor diameter, a tubine which is twice as large will receive 22=2x2 = Four times as much energy.

To be considered a good location for wind energy, an area needs to have average annual wind speeds of at least 12 miles per hour.

They have traditionally been measured at a standard height of ten meters where they are found to be 20-25% greater than close to the surface. At a height of 60 metre they may be 30-60% higher because of the reduction in the drag effect of the earth surface.

2.Write short notes about the Wind Power calculation?

Calculation of Power in the Wind

The power in the wind can be computed by using of Kinetics (Kinetic means relating to or resulting from motion). The wind mill works on the principle of converting Kinetic energy of the wind to mechanical energy.

We know that power is equal to energy per unit time. The energy available is the kinetic energy of the wind. The kinetic energy of any particle is equal to one half its mass times the square of its velocity.

Kinetic Energy of particle = ½ mv2

Where

M : Mass of particle (kg)

V : Velocity of particle (m/s)

The amount of air passing in unit time, through an area ‘A’, with velocity ‘V’ is A x V, and its mass ‘m’ is equal to its volume multiplied by its density ‘ρ’ of air.

$m = \rho AV$

Where, m is the mass of air transversing the area ‘A’ swept by the rotating blades of a wind mill type generator.

Power Coefficient

The fraction of the free-flow wind power that can be extracted by the rotor is called the power co-efficient; Thus,

Power Coefficient = Power of wind rotor / Power available in the wind

Where, power available is calculated from the air density, rotor diameter and free wind speed as discussed earlier. The maximum theoretical power coefficient is equal to 16/27 or 0.593. This value cannot be exceeded by a rotor in free-flow wind-stream.

An ideal rotor, with propeller-type blades of proper aerodynamic design, would have a power co-efficient approaching 0.59. But such a rotor would not be strong enough to withstand the stresses to which it is subjected when rotating at a high rate in a high-speed wind stream.

3.Write short notes about the circuit breakers?

Braking is very frequent in electric drives to stop a motor in a reasonably short time.

1) Reliable and quick in its action.

2) The braking force must be capable of being controlled.

3) Adequate means be provided for dissipating the stored energy that is kinetic energy of the rotating parts.

4) In case of a fault in any part of the braking system the whole system must come to instantaneous rest or result in the application of the brakes.

There are two types of braking:

1) Mechanical braking:

The motor in this case is stopped due to friction between the moving part of the motor and the brake shoe that is stored energy is dissipated as heat by a brake shoe or brake lining which rubs against a brake shoe or brake lining which rubs against a brake drum.

2) Electric braking:

the kinetic energy of the moving parts that is motor is converted into electrical energy which is consumed in a resistance as heat or alternatively it is returned to the supply source. During braking operation a motor has to function as a generator.The motor can be held at stand still. In other words the electric braking cannot hold the motor at rest. Thus it becomes essential to provide mechanical brakes in addition to electric braking.

Electric braking:

Various types of electrical braking are:

a) Plugging

b) Rheostatic braking

c) Regenerative braking

4.Write short notes about the illumination in detailed manner?

Luminous intensity

Luminous intensity is an expression of the amount of light power emanating from a point source within a solid angle of one steradian.

Laws of illumination:

The original standard of light was Wax Candle, which is highly unreliable. It was replaced by a Vaporized Pentane Lamp. This is equal to10 original Candles. In the year 1909, Incandescent Lamp was taken as standard by comparison with a Pentane Lamp. Thing to be kept in mind is Primary Standard should be reproducible.It was in1948, Luminous Intensity; based on Luminance (objective brightness) of a small aperture due to Light from a Radiator maintained at1773°c i.e. Solidification temperature of platinum was adopted as Standard. It consists of:

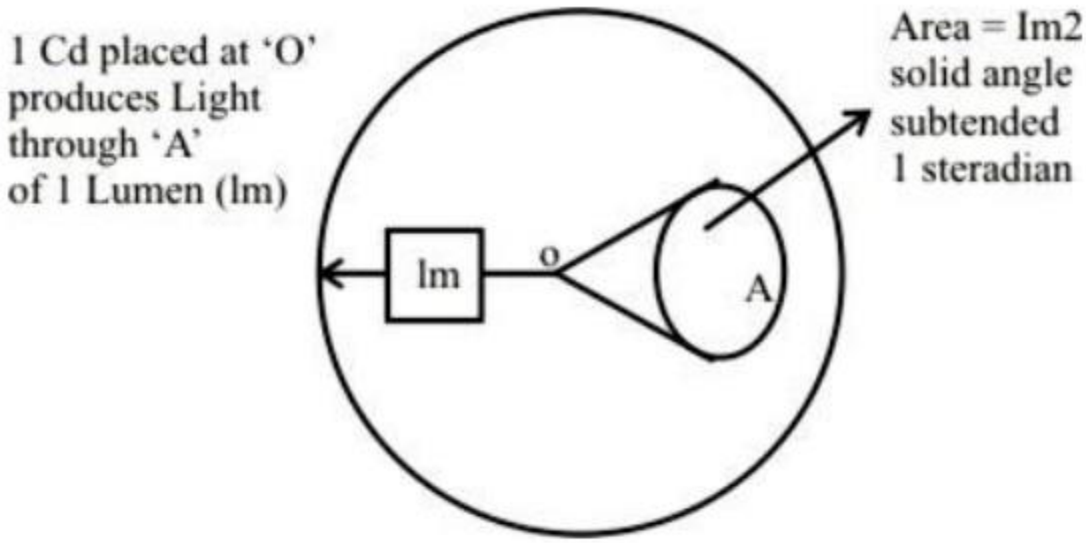
1. Radiator – Fused Thoria – Thorium Oxide. 45mm long internal dia of 2.5mm. Packed with Fused Thoria Powder at the bottom.

2. Supported Vertically Pure Platinum in a Fused thoria crucible with a small aperture of 1.5mm in a large refractory container.

3. Platinum melted by a High Frequency Eddy current.Luminance = 589000 Candles /m2 ≈600 000 units.

Transparent (Law of Inverse Squares):

Common unit of light intensity is candela. It is Luminous intensity in the Perpendicular direction of a surface, 1 / 600,000 of a black body at temperature of solidification or Freezing of Platinum under Standard Atmospheric pressure. It is abbreviated as Cd. It is indicative of Light Radiating Capacity of a source of Lamp.



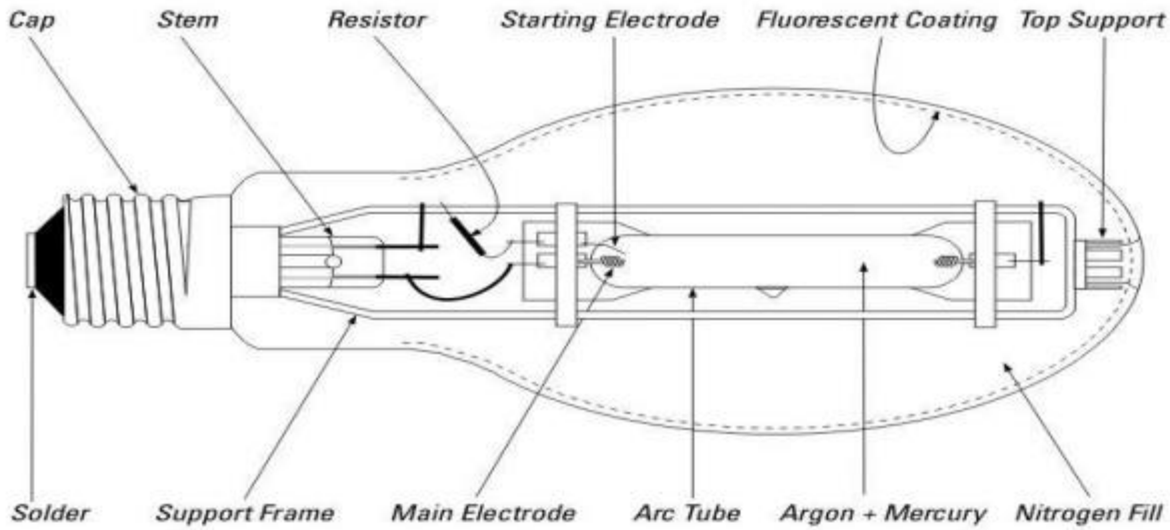
Consider a transparent sphere of radius 1m shown in Fig. If we place a 1 Cd source at the centre then light flux coming out through an area of 1m2 over 1 steradian solid angle will be 1 lumen.Thus Luminous Intensity over 1 Str. by 1, Cd, we call it 1 lumen ≈ 1 lm. Basic unit of Light Flux.

$\phi = I\ 4\pi$lumens

5.Write short notes about the Sodium Vapour Lamp in detailed manner?

Principally sodium vapour lamp consists of a bulb containing a small amount of metallic sodium, neon gas and two sets of electrodes connected to a pin type base. The lamp operates at a temperature of about 300°C and in order to conserve the heat generated and assure the lamp operating at normal air temperatures the discharge envelope is enclosed in special vacuum envelope designed for this purpose.

The efficiency of a sodium vapour lamp under practical conditions is about 40-50 lumens/watt. Such lamps are manufactured in 45, 60, 85 and 140 W ratings. The average life is about 3000 hours and is not affected by voltage variations. The major application of this type of lamp is for highway and general outdoor lighting where colour discrimination is not required, such as street lighting, parks, rail yards, storage yards.



6.Write short notes about the fluorescent Lamp in detailed manner?

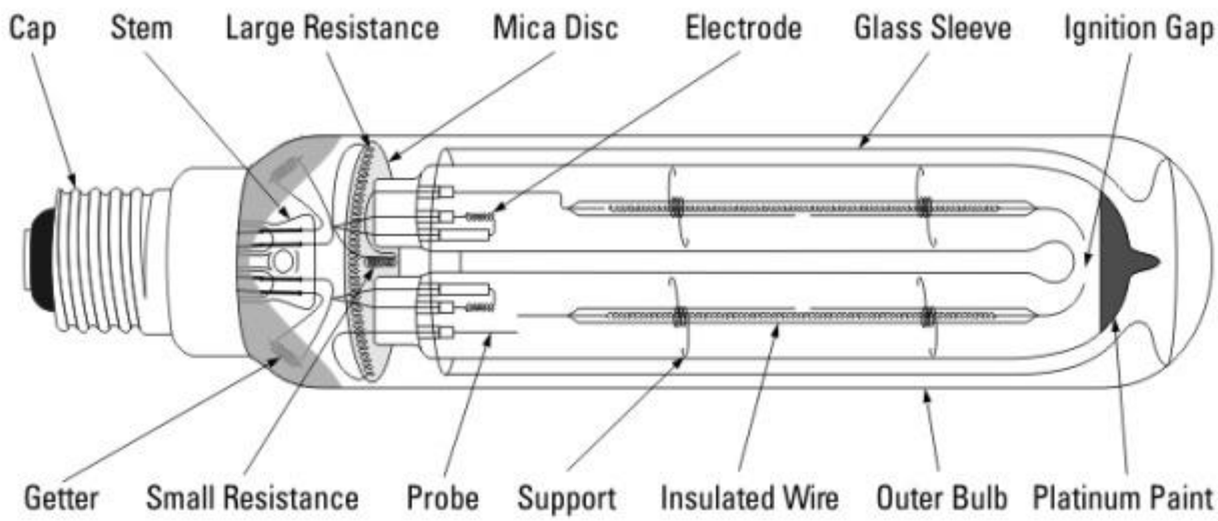
Employs transformation of UV radiation due to low pressure mercury vapor. Luminescent Powder in tubular vapor Lamps Enhances brilliancy of light.Radiation from Low Pressure Mercury Vapor (which is in UV region) is impinged on Luminescent Materials and re – radiated at longer wavelengths of visible spectrum. In a Glass Tube small drop of Mercury and small amount of Argon gas are placed for initiation of discharge. Pressure, voltage and current are so adjusted that 253.7 nm line is excited. This re-radiates at longer wavelength. Typically a 40W lamp requires 2-3g of phosphors. Maximum sensitivity is around 250 – 260 nm. Various types of Fluorescent Lamps are:

1. Day Light Fluorescent Lamps- Average Noon Day Light. 6500°k suitable where demands are not exacting
2. Standard white Light - 3500°k general Lighting.
3. 4500°k white Lamp – between std. white Light & Day Light Lamp.
4. Soft white Lamp – Pinker Light. 25% lower light output than Std. white Lamp suitable for Residential lighting and Restaurants.

Dimension and Voltage depend on Luminous Efficacy, Brightness, Lumen Output and Lumen Maintenance. Reliable Starting is achieved by having preheated cathodes / hot cathode. Half the open circuit voltage should be used by the Lamp and the other half by the ballast. Lamp Voltage decides the arc length, bulb diameter and lamp current. Hot Cathode lamps operate at lower voltage < cold Cathode lamps. Typically cold cathodes have 70-100V drop at the cathode.

7.Write short notes about the mercury vapour Lamp in detailed manner?

High Pressure Mercury Vapour Lamp:



The mercury vapour lamp in construction is similar to sodium vapour lamp. It gives greenish blue colour light, which causes colour distortion. The efficiency is about 30-40 lumens per watt.

These lamps (MA type) are manufactured in 250 and 400 W ratings for use on 200-250 Vac supply. Lamps of this type are used for general industrial lighting, railway yards, ports, work areas; shopping centers etc where greenish-blue colour ligh is not objectionable.

Another type, which is manufactured in 300 and 500 W ratings for use on ac as well as dc supply mains is MAT type. This is similar to MA type except that it does not use choke as ballast.

Lower wattage lamps, such as 80 and 125 W, are manufactured in a different design and using high vapour pressure of about 5-10 atmospheres. These are known as MB type lamps.

8.Write short notes about the charge and discharge characteristics of LI ION in detailed manner?

nickel and cobalt have been replaced by cobalt has been replaced by nickel and manganese right, and here it is only manganese and this is of course, is a different, the same structure the M n 2 O 4, the M n 2 O 4 will have a spinal structure, but this is also a same structure ok, so these are some of the layers. Next oxides and here this is the characteristics charge, charge discharge characteristics of the particular compound, which is spinal structure lethain lithium manganese 4, manganese 4 spinal structural, we have seen earlier.

This is the charging characteristics of that, and these are the discharge characteristics under different conditions of discharging, now discharging is done normally, done at a rate of designated like C by 2 or C by 5 or 20 C the charge rate or discharge rate, the charge rate is denoted as C or C rate, and signifies a charge or discharge rate, charge or discharge rate equal to the capacity of the battery in in 1 hour

the capacity of a battery is normally given as ampere hour, that is the total amount of energy which it can accommodate. So, if you have a capacity of a particular batteries 1.6 ampere hour, the C 1 C it becomes 1.6 ampere, that means in 1 hour, 1 hour you charge it fully, or of discharge it fully at the rate of 1.6 amp. So, if you draw current of 1.6 ampere over a period of 1 hour, then this is the total capacity of the battery, and this becomes then the C, a charge rate of C by 2 means actually 0.8 ampere, 0.8 ampere, half of 1.6 will be needed for 2 hours, and a charge rate of 2 C that means the double the value of the capacity, we have to charge 3.2 ampere would need 30 minutes half a minute to fully charged. So, it is basically there rate at which the current is being drawn from the, from the battery or it is being introduced the charges, introduced battery or to recharge the battery, so that is what is known as C rate, it assumes that the battery of course, whenever we are doing it assumed the battery is 100 percent efficient at absorbing the charge, and can support the pled rate that means, if you charges it at a very fast rate. For example, 2 C or 10 C, 20 C that means your charging or discharging at a very fast rate, and the kinetics may not support it. So, the there may be a breakdown of the structure, this can be done in fact, that is one of the criteria when it battery is tested.

charging is done at C by 2 rate, half the total capacity, and discharging has been tried out, discharge have been tried out at C by 5 and in this increasing 20 C, 20 times the overall the capacity of the battery, and even then one can although the voltage will drop obviously, and charging rate increase, and then you can get a fairly high a specific charges. So, M n O 4, so L i M n O 4 an alternative cathode material replacing L i C O 2, so these are the some of the typical experimental data, and which is been taken from literature of course, and the these are the possibilities, so one can charge it was very fast rate, as well as discharge fairly at a very fast rate.

9.Write short notes about the domestic refrigerator in detailed manner?

refrigeration is the cooling of air/liquids, thus providing lower temperatures to preserve food, cool beverages, make ice and for many other applications.

refrigeration is the process of removing heat from a place where it is not wanted and transferring that heat to a place where it makes little difference.

In the average household, the room temperature from summer to winter is normally between 700F and 900F.

The temperature inside the refrigerator fresh food section should be about 350F

The rating of a refrigeration machine is obtained by refrigerating effect or the amount of heat extracted in a given time from a body or space.

One tonne of refrigeration is defined as the refrigerating effect (amount of heat extracted) produced by melting 1 tonne of ice from and at 00C in 24 hours. We know that latent heat of fusion of ice = 336 kJ/kg.

Refrigerating effect of this heat in terms of tonne in 24 hours is rated as tonne of refrigeration

1T.R = 336x 1000/ 24 = 14000kJ/hr.

= 210kJ/min. = 3.85 kJ/se

Performance of the refrigerator is determined by using co-efficient of performance which is defined as requiredinput. In desired output from the conservation of energy principle.

10.Write short notes about the earthing system in detailed manner?

Need of Earthing or Grounding.

The primary purpose of earthing is to avoid or minimize the danger of electrocution, fire due to earth leakage of current through undesired path and to ensure that the potential of a current carrying conductor does not rise with respect to the earth than its designed insulation.

When the metallic part of electrical appliances (parts that can conduct or allow passage of electric current) comes in contact with a live wire, maybe due to failure of installations or metal become charged and static charge accumulates on it**.** To avoid such instances, the power supply systems and parts of appliances have to be earthed so as to transfer the charge directly to the earth.

Below are the basic needs of Earthing.

- To protect human lives as well as provide safety to electrical devices and appliances from leakage current.
- To keep voltage as constant in the healthy phase (If fault occurs on any one phase).
- To Protect Electric system and buildings form lighting.
- To serve as a return conductor in electric traction system and communication.
- To avoid the risk of fire in electrical installation systems.

Different Terms used in Electrical Earthing

- **Earth:** The proper connection between electrical installation systems via conductor to the buried plate in the earth is known as Earth.
- **Earthed:** When an electrical device, appliance or wiring system connected to the earth through earth electrode, it is known as earthed device or simple “Earthed”.
- **Solidly Earthed:** When an electric device, appliance or electrical installation is connected to the earth electrode without a fuse, circuit breaker or resistance/Impedance, It is called “solidly earthed”.
- **Earth Electrode:** When a conductor (or conductive plate) buried in the earth for electrical earthing system. It is known to be Earth Electrode. Earth electrodes are in different shapes like, conductive plate, conductive rod, metal water pipe or any other conductor with low resistance.
- **Earthing Lead**: The conductor wire or conductive strip connected between Earth electrode and Electrical installation system and devices in called Earthing lead.
- **Earth Continuity Conductor:** The conductor wire, which is connected among different electrical devices and appliances like, distribution board, different plugs and appliances etc. in other words, the wire between earthing lead and electrical device or appliance is called earth continuity conductor. It may be in the shape of metal pipe (fully or partial), or cable metallic sheath or flexible wire.

- **Sub Main Earthing Conductor**: A wire connected between switch board and distribution board i.e. that conductor is related to sub main circuits.
- **Earth Resistance:** This is the total resistance between earth electrode and earth in Ω (Ohms). Earth resistance is the algebraic sum of the resistances of earth continuity conductor, earthing lead, earth electrode and earth.

points to be earthed

Earthing is not done anyhow. According to IE rules and IEE (Institute of Electrical Engineers) regulations,

- Earth pin of 3-pin lighting plug sockets and 4-pin power plug should be efficiently and permanently earthed.
- All metal casing or metallic coverings containing or protecting any electric supply line or apparatus such as GI pipes and conduits enclosing VIR or PVC cables, iron clad switches, iron clad distribution fuse boards etc should be earthed (connected to earth).
- The frame of every generator, stationary motors and metallic parts of all transformers used for controlling energy should be earthed by two separate and yet distinct connections with the earth.
- In a dc 3-wire system, the middle conductors should be earthed at the generating station.
- Stay wires that are for overhead lines should be connected to earth by connecting at least one strand to the earth wires.

UNIT IV ELECTRONIC CIRCUITS

PART A

1. What is meant by Q-factor?

Q-factor is known as the quality factor. It is used to measure the quality factor of the coils such as inductors, Capacitors etc.

2. **Define transistor action.**

A transistor consists of 2 coupled PN junctions. The base is a common region to both junctions and makes a coupling between them. Since the base regions are smaller, a significant interaction between junctions will be available. This is called transistor actions.

3. Define hybrid parameters.

Any linear circuit having input and output terminals can be analysed by four parameters(one measured on ohm, one in mho and two dimensionless) called hybrid or hparameters.

4. **Which is the most commonly used transistor configuration? Why?**

The CE Configuration is most commonly used. The reasons are

- High Current gain
- High voltage gain
- High power gain
- Moderate input to output ratio.

5. **What are the types of transistors?**

- Unipolar junction transistor
- Bipolar junction transistor.

6. Define delay time

It is defined as the time required for the current to rise from 0 to 10% of its maximum value.

7. Define rise time

It is the time required for the current to rise from 0 to 90 percentage of the maximum value.

8. **Define Biasing**

"Biasing" is providing minimum external voltage and current to activate the device to study its characteristics.

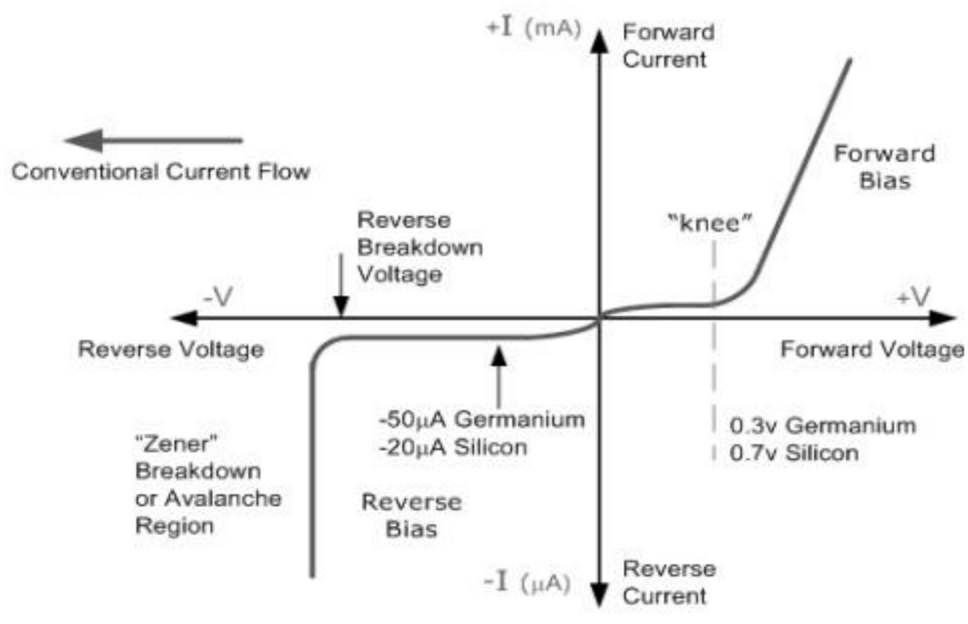
There are two operating regions and two "biasing" conditions for the standard Junction Diode and they are:

1. Zero Bias 2.Forward Bias 3.Reverse Bias

9. What is meant by zener effect?

When the doping is heavy, even the reverse voltage is low, the electric field at barrier will be so strong thus the electrons in the covalent bonds can break away from the bonds. This effect is known as**Zener effect.**

10.Draw thw V/I characteristics of PN diode?



PART B

1.Explain the V/I characteristics of ZENER diode?

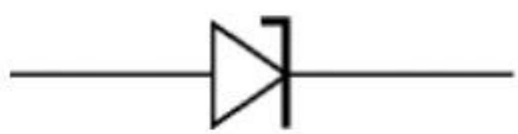
Zener Diode

A diode which exhibits the zener effect is called a Zener Diode. Hence it is defined as a reverse biased heavily doped PN junction diode which operates in breakdown region.

zener effect

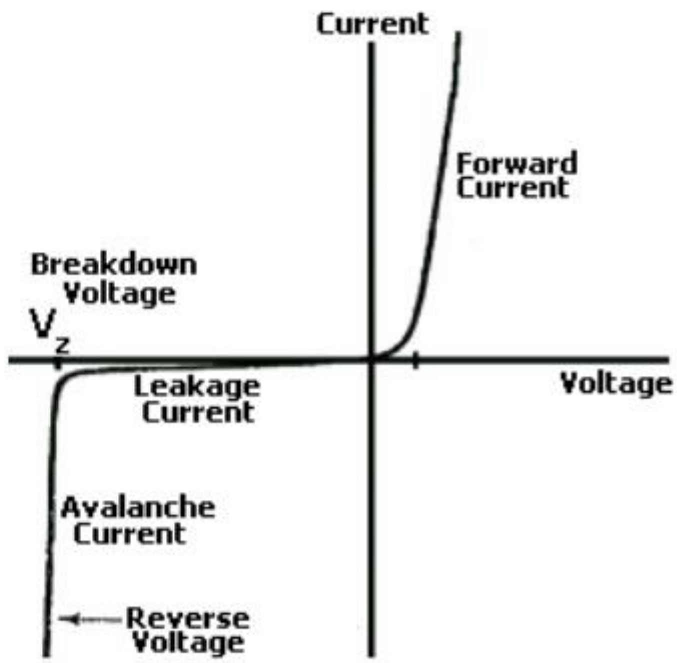
In a general purpose PN diode the doping is light; as a result of this the breakdown voltage is high. If a P and N region are heavily doped then the breakdown voltage can be reduced. When the doping is heavy, even the reverse voltage is low, the electric field at barrier will be so strong thus the electrons in the covalent bonds can break away from the bonds. This effect is known as**Zener effect.**

ZENER DIODE



A diode which exhibits the zener effect is called a **Zener Diode**. Hence it is defined as a reverse biased heavily doped PN junction diode which operates in breakdown region. The zener diodes have been designed to operate at voltages ranging from a few volts to several hundred volts.**Zener Breakdown** occurs in junctions which is heavily doped and have narrow depletion layers. The breakdown voltage sets up a very strong electric field. This field is so strong enough to break or rupture the covalent bonds thereby generating electron hole pairs.Even a small reverse voltage is capable of producing large number of current carrier. When a zener diode is operated in the breakdown region care must be taken to see that the power dissipation across the junction is within the power rating of the diode otherwise heavy current flowing through the diode may destroy it.

V-I characteristics of Zener diode



The illustration above shows this phenomenon in a current vs voltage graph with a zener diode connected in the forward direction .It behaves exactly as a standarddiode. In the reverse direction however there is a very small leakage current between 0v and the zener voltage –i.e. just a tiny amount of current is able to flow.Then, when the voltage reaches the breakdown voltage (vz),suddenly current can flow freely through it.

Application of Zener diode

a) as voltage regulator

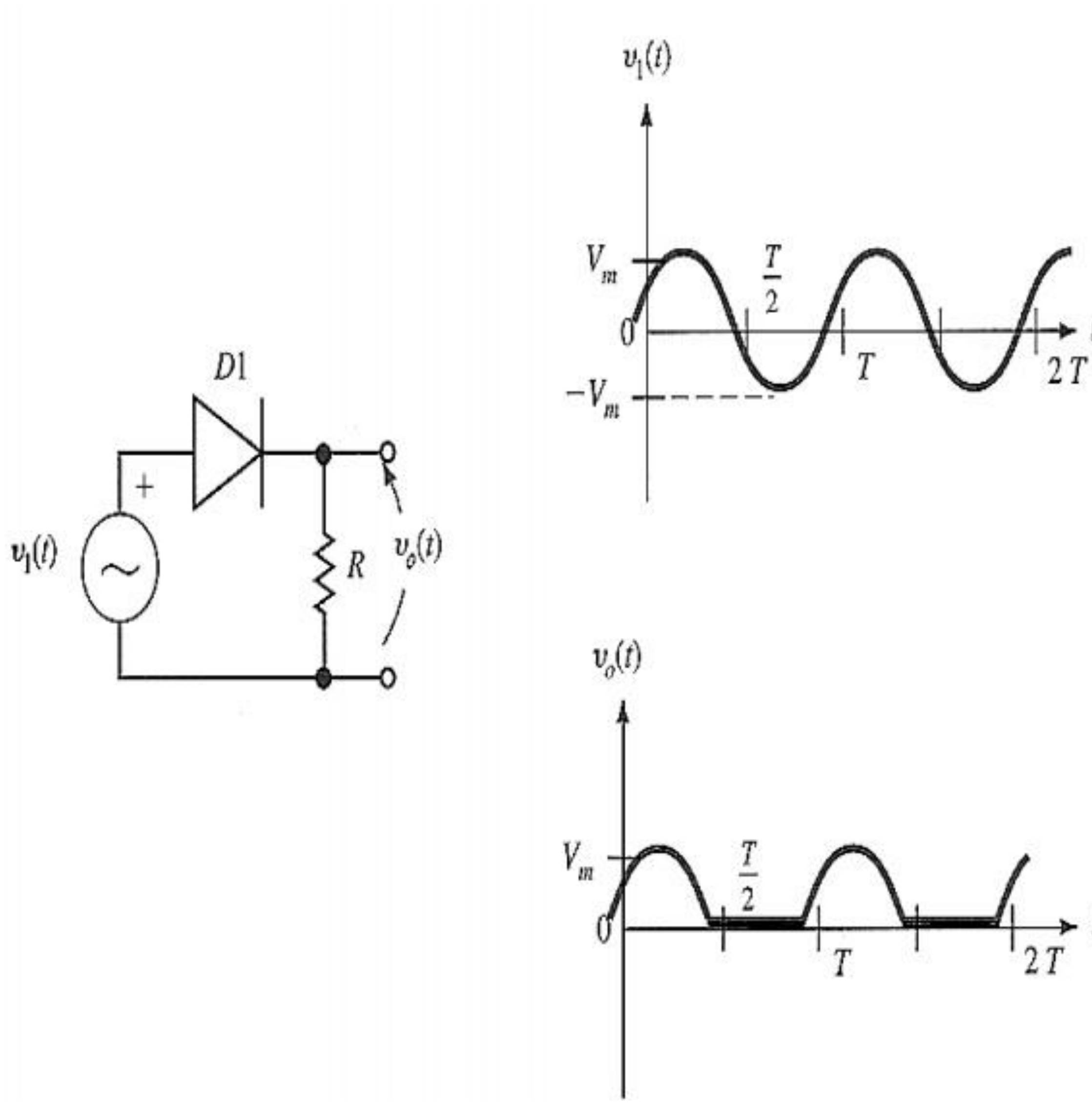
b) as peak clippers

c) for reshaping waveforms

2. **Briefly describe the operation of Half wave Rectifier?**

Principle

It is a circuit that converts alternating voltage or current into pulsating voltage or current for half the period of input cycle hence it is named as "**half wave rectifier**"



Operation

- During the positive half cycle of input, the diode D is forward biased, it offers very small resistance and it acts as closed switch and hence conducts the current through the load resistor.
- During the negative half cycle of the input diode D is heavily reverse biased, it offers very high resistance and it acts as open switch hence it does not conduct any current. The rectified output voltage will be in phase with AC input voltage for completely resistive load.

Construction

- It consists of step-down transformer, semiconductor diode and the load resistance.
- The step-down transformer – reduce the available ac voltage into required level of smaller ac voltage.
- The diode can be used to convert the ac into pulsating dc.

3. **Briefly describe the operation of Full wave Rectifier?**

Principle

A circuit that converts the ac voltage or current into pulsating voltage or current during both half cycle of input is known as "full wave rectifier".

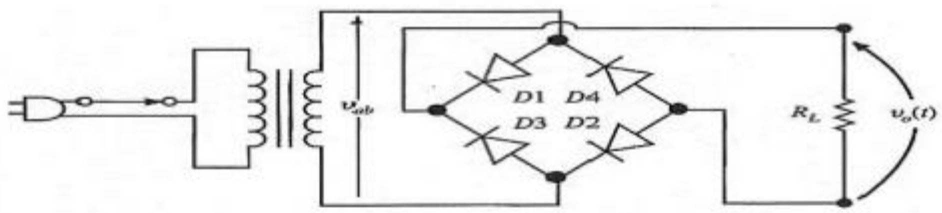
Operation

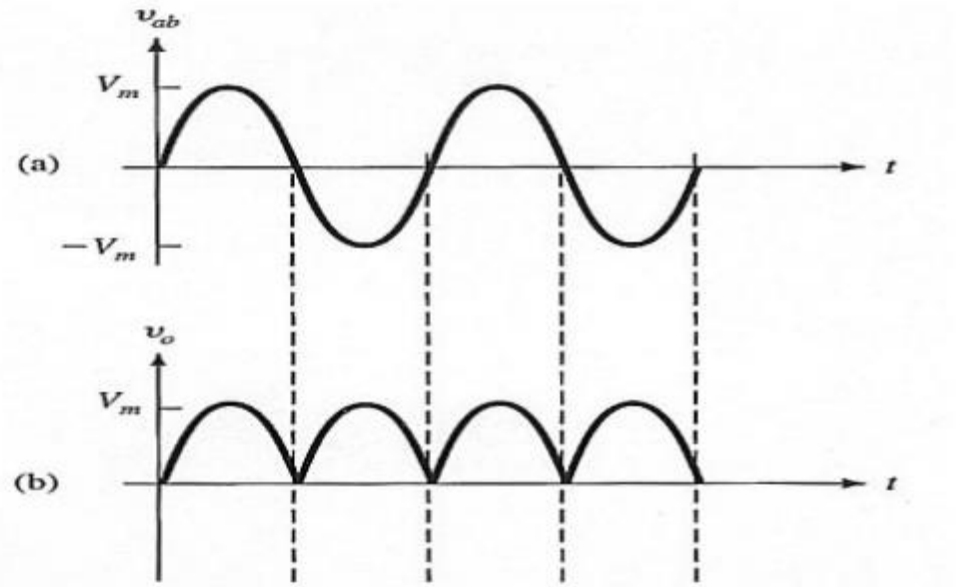
- During positive half cycle of ac input, diode D_1 becomes forward biased, provides very small resistance and acts as closed switch, resulting in the flow of current.
- During negative half cycle, diode D_1 reverse biased, offers high resistance and it acts as open circuit.

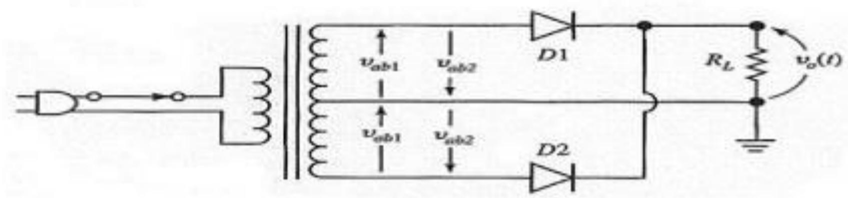
The "rectifier" is a circuit that converts AC voltages and currents into pulsating DC voltages and currents. It consists of DC components and the unwanted ac ripple or harmonic components which can be removed by using filter circuit. Thus the output obtained will be steady DC voltage and magnitude of DC voltage can be varied by varying the magnitude of AC voltage.

Filters: A circuit that removes ripples (unwanted ac components) present in the pulsating dc voltage.

Regulator: A circuit that maintains the terminal voltage as constant even if the input voltage or load current varying.







4. **Explain the operation of BIPOLAR JUNCTION TRANSISTOR?**

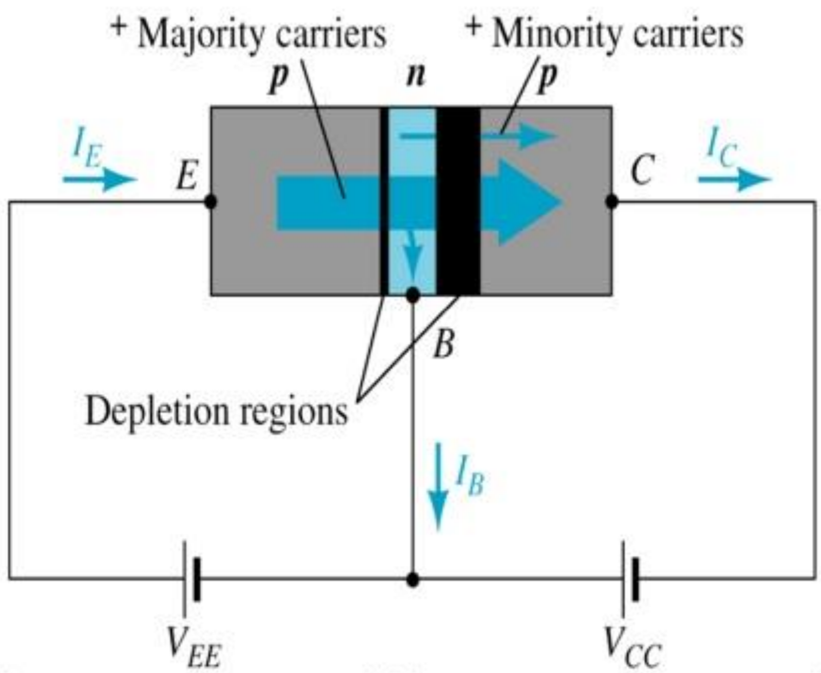
A bipolar junction transistor is a three terminal semiconductor device in which the operation depends on the interaction of majority and minority carriers.Transistor refers to Transfer Resistor i.e., signals are transferred from low resistance circuit into high resistance circuit.BJT consists of silicon crystal in which a layer of ‘N’ type silicon is sandwiched between two layers of ‘P’ type silicon. The semiconductor sandwiched is extremely smaller in size.In other words, it consists of two back to back PN junction joined together to form single piece of semiconductor crystal. These two junctions gives three region called Emitter, Base and Collector.

.

There are two types of transistors such as PNP and NPN. The arrow on the emitter specifies whether the transistor is PNP or NPN type and also determines the direction of flow of current, when the emitter base junction is forward biased.

Operation of Transistor

The basic operation will be described using the pnp transistor. The operation of the pnp transistor is exactly the same if the roles played by the electron and hole are interchanged. One p-n junction of a transistor is reverse-biased, whereas the other is forward-biased.Both biasing potentials have been applied to a pnp transistor and resulting majority and minority carrier flows indicated.



Majority carriers (+) will diffuse across the forward-biased p-n junction into the n-type material.A very small number of carriers (+) will through n-type material to the base terminal. Resulting IB is typically in order of microamperes. The large number of majority carriers will diffuse across the reverse-biased junction into the p-type material connected to the collector terminal.Majority carriers can cross the reverse-biased junction because the injected majority carriers will appear as minority carriers in the n-type material.

Applying KCL to the transistor :

$$I_E = I_C + I_B$$

The comprises of two components – the majority and minority carriers

$$IC = ICmajority + ICOminority$$

I_{CO} – I_C current with emitter terminal open and is called leakage current.

5.<u>Describe the Common Base configuration of transistor?</u>

- Common-base terminology is derived from the fact that the :

  base is common to both input and output of the configuration.

  base is usually the terminal closest to or at ground potential.

- All current directions will refer to conventional (hole) flow and the arrows in all electronic symbols have a direction defined by this convention.

- Note that the applied biasing (voltage sources) are such as to establish current in the direction indicated for each branch.

- To describe the behavior of common-base amplifiers requires two set of characteristics:

  1. Input or driving point characteristics.

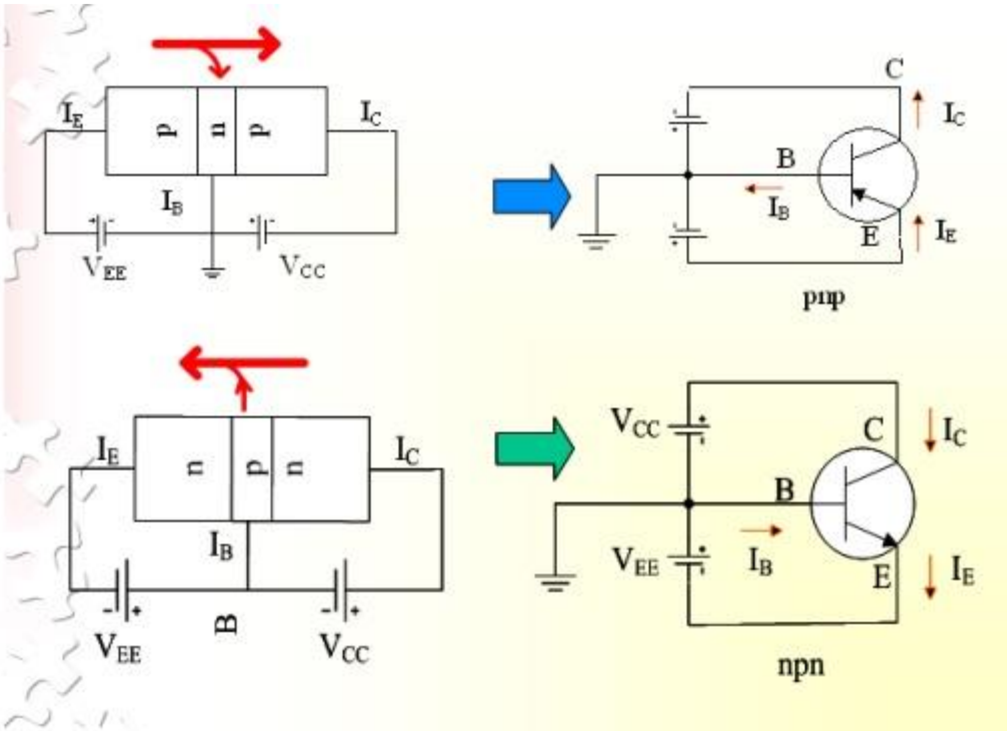
  2. Output or collector characteristics

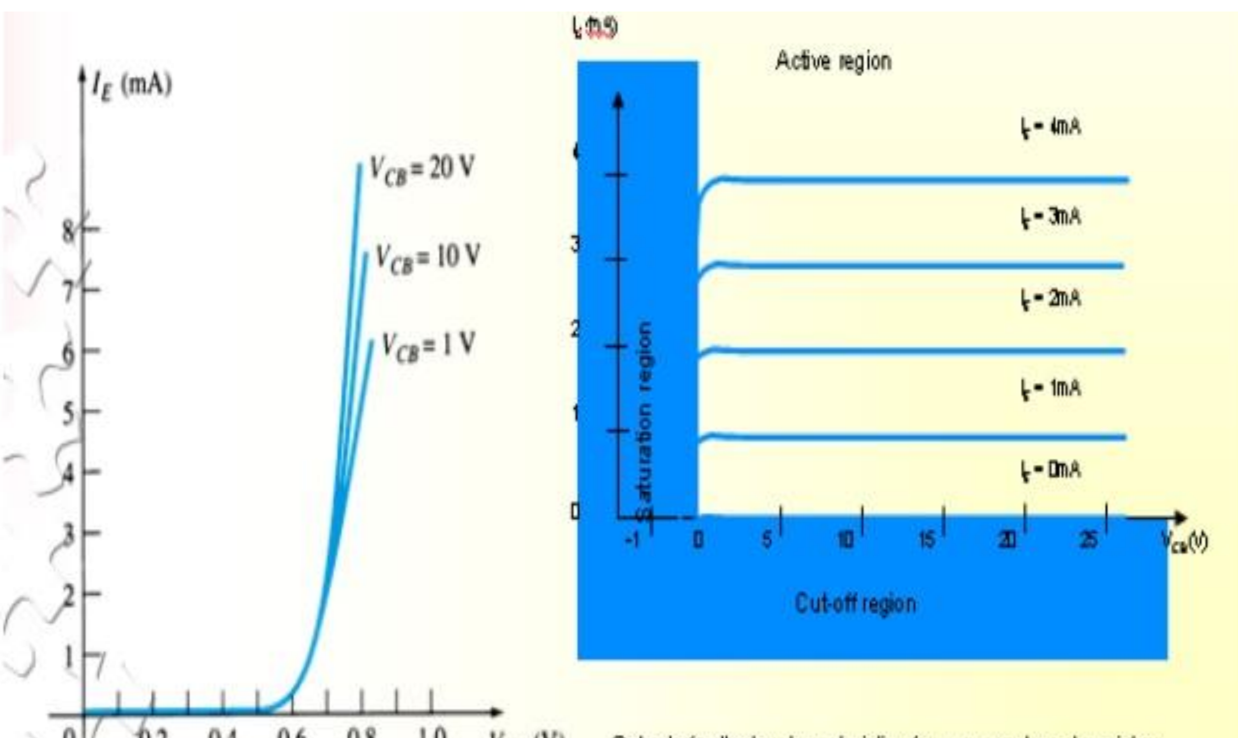
- The output characteristics has 3 basic regions:

  1. Active region –defined by the biasing arrangements

  2. Cutoff region – region where the collector current is 0A

  3. Saturation region- region of the characteristics to the left of V_{CB} = 0V





Input characteristics for a common silicon transistor

Output of collector characteristics for common-base transistor amplifier

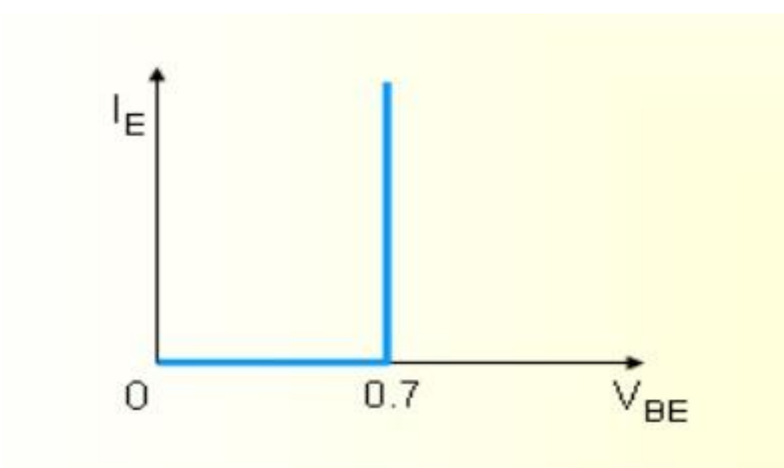
Active region	Saturation region	Cut-off region
•I_E increased, I_C increased •BE junction forward bias and CB junction reverse bias •Refer to the graf, $I_C \approx I_E$ •I_C not depends on V_{CB} •Suitable region for the transistor working as amplifier	• BE and CB junction is forward bias • Small changes in V_{CB} will cause big different to I_C • The allocation for this region is to the left of V_{CB}= 0 V.	• Region below the line of I_E=0 A • BE and CB is reverse bias • no current flow at collector, only leakage current

The curves (output characteristics) clearly indicate that a first approximation to the relationship between IE and IC in the active region is given by

$$I_C \approx IE$$

- Once a transistor is in the 'on' state, the base-emitter voltage will be assumed to be

$$V_{BE} = 0.7V$$



- In the dc mode the level of I_C and I_E due to the majority carriers are related by a quantity called alpha

$$\alpha = I_C / I_E$$

$$I_C = \alpha I_E + I_{CBO}$$

- It can then be summarize to IC = αI_E (ignore I_{CBO} due to small value)
- For ac situations where the point of operation moves on the characteristics curve, an ac alpha defined by
- Alpha a common base current gain factor that shows the efficiency by calculating the current percent from current flow from emitter to collector. The value of is typical from

0.9 ~ 0.998.

6. **Describe the Common Emitter configuration of transistor?**

- It is called common-emitter configuration since :

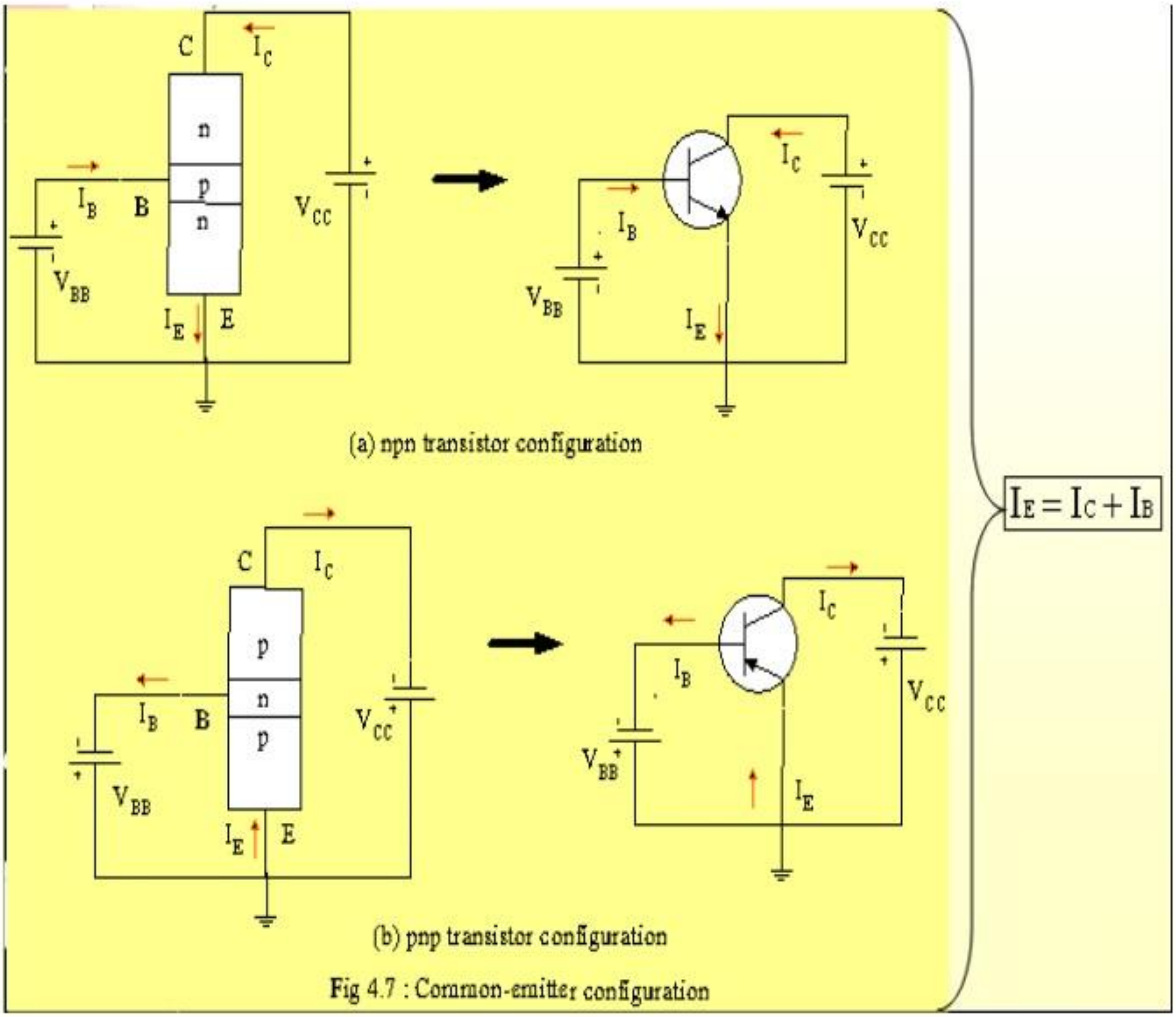
emitter is common or reference to both input and output terminals.

emitter is usually the terminal closest to or at ground potential.

- Almost amplifier design is using connection of CE due to the high gain for current and voltage.
- Two set of characteristics are necessary to describe the behavior for CE; input (base terminal) and output (collector terminal) parameters.

Input characteristics for CE configuration

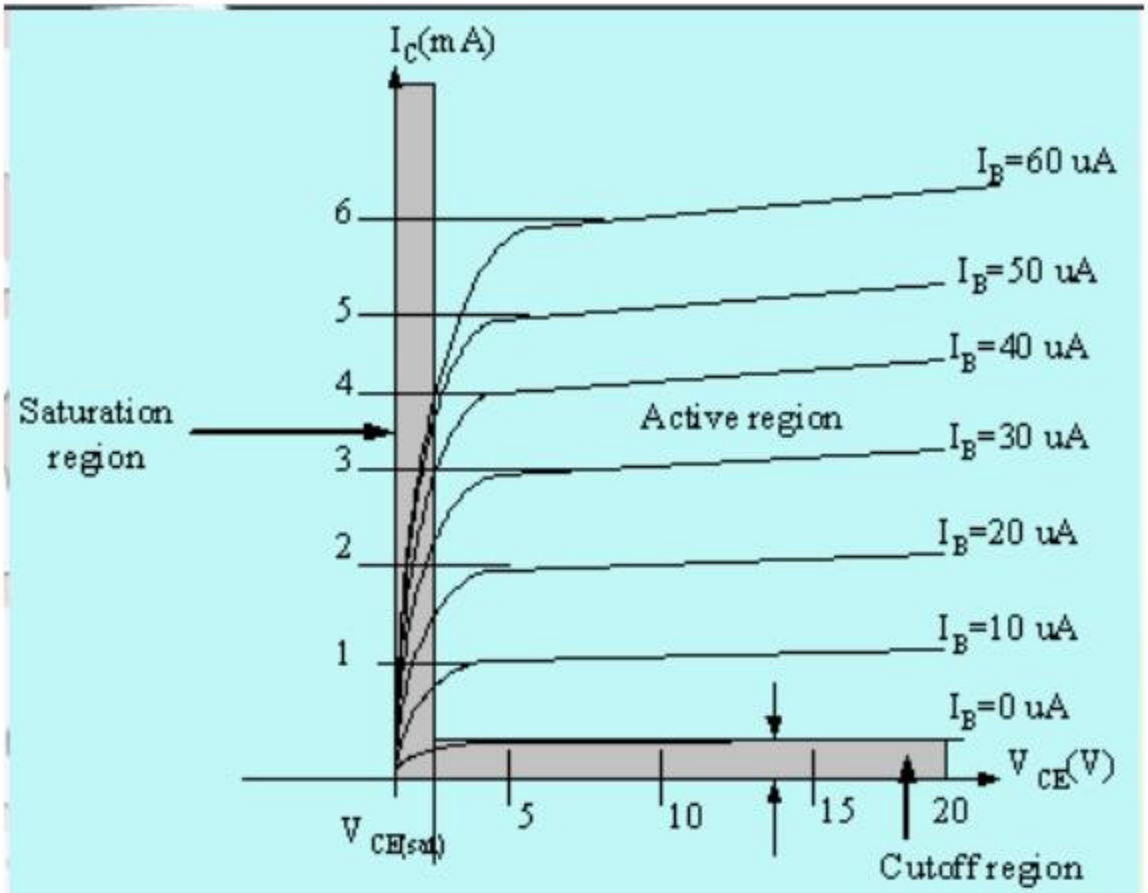
- I_B in microamperes compared to milliamperes of I_C.
- I_B will flow when V_{BE} > 0.7V for silicon and 0.3V for germanium
- Before this value I_B is very small and no I_B.
- Base-emitter junction is forward bias
- Increasing V_{CE} will reduce I_B for different values.



(a) npn transistor configuration

(b) pnp transistor configuration

Fig 4.7 : Common-emitter configuration



Output characteristics for CE configuration

Output characteristics for CE configuration

- For small V_{CE} ($V_{CE} < V_{CESAT}$, I_C increase linearly with increasing of V_{CE}
- $V_{CE} > V_{CESAT}$ I_C not totally depends on V_{CE} -- > constant I_C
- I_B(uA) is very small compare to I_C (mA). Small increase in I_B cause big increase in I_C
- I_B=0 A -- > I_{CEO} occur.
- Noticing the value when I_C=0A. There is still some value of current flows.

7. **<u>Describe the Common Collector configuration of transistor?</u>**

➢ Also called emitter-follower (EF).

➢ It is called common-emitter configuration since both the

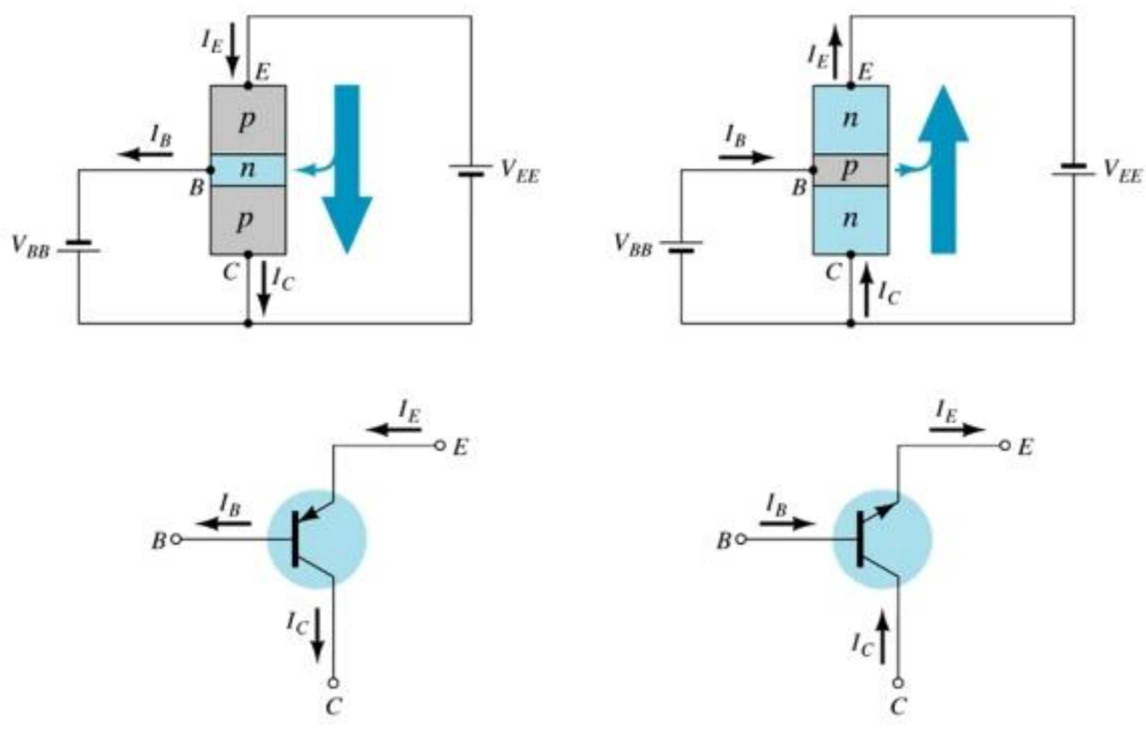
signal source and the load share the collector terminal as a common connection point.

➢ The output voltage is obtained at emitter terminal.

➢ The input characteristic of common-collector configuration is similar with common-emitter. configuration.

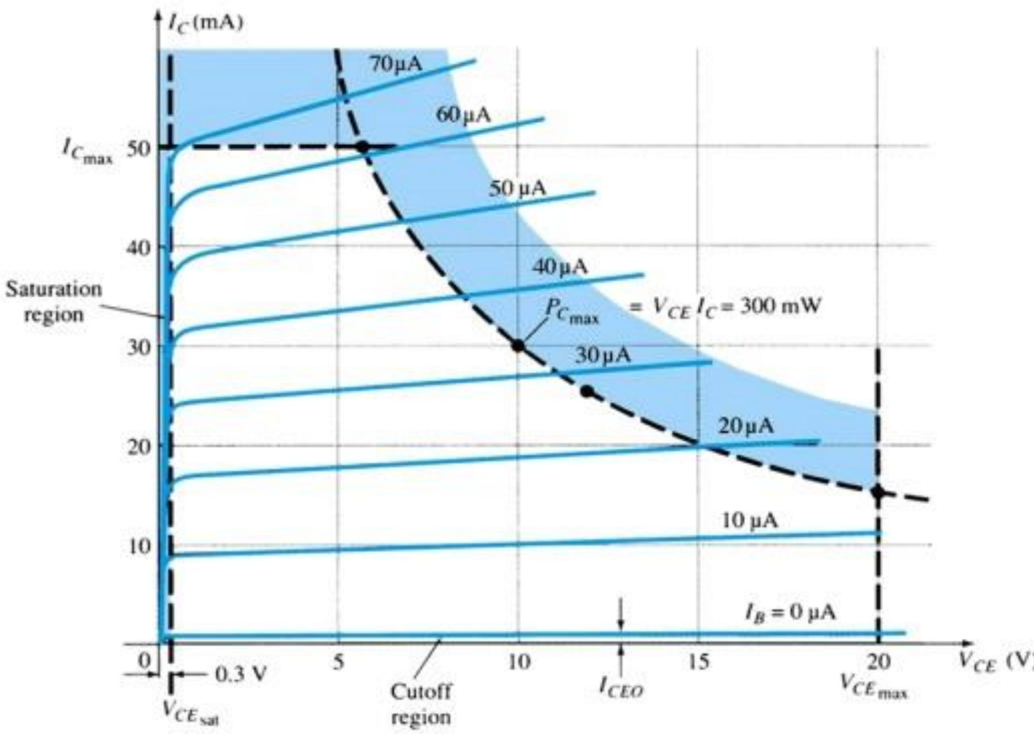
➢ Common-collector circuit configuration is provided with the load resistor connected from emitter to ground.

➢ It is used primarily for impedance-matching purpose since it has high input impedance and low output impedance.



(a) (b)

➢ For the common-collector configuration, the output characteristics are a plot of I_E vs V_{CE} for a range of values of I_B.



Input characteristics of CC configuration

8. **Explain how the Small Signal Amplifier has functioned in clear manner?**

When the input signal is so weak as to produce small fluctuations in the collector current compared to its quiescent value, the amplifier is known as Small Signal Amplifier.

In other words, as the name indicates, the input applied to the circuit is $V_{in} << V_{th}$. It has only one amplifying device.

$$A = I_C / I_E$$

$$I_C = \alpha \; I_E + I_{CBO}$$

Voltage and current equation for hybrid parameters:

$V_1 = h_{11}i_1 + h_{12}V_2$

$I_2 = h_{21}i_1 + h_{22}V_2$

The values of h-parameters:

$h_{11} = V_1 / i_1$

$h_{12} = V_1 / V_2$

$h_{21} = i_2 / i_1$

$\mathbf{h_{22} = i_2 / V_2}$

9. Explain the method of ADC in detail manner?

Successive Approximation Technique

When unknown voltage (V_a) is applied, the circuit starts up from 0000, as shown above. The output of SAR advances with each MSB. The output of SAR does not increase step–by–step in BCD bus pattern, but individual bit becomes high–starting from MSB. Then by comparison, the bit is fixed or removed. Thus, it sets first MSB (1000), then the second MSB (0100) and so on. Every time, the output of SAR is converted to equivalent analog voltage by binary ladder.

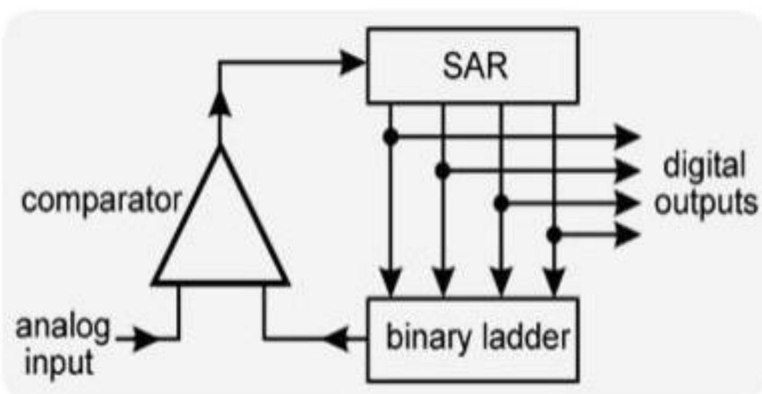


Figure: Successive Approximation Technique

Flash ADC

Also called the parallel A/D converter, this circuit is the simplest to understand. It is formed of a series of comparators, each one comparing the input signal to a unique reference voltage. The comparator outputs connect to the inputs of a priority encoder circuit, which then produces a binary output.

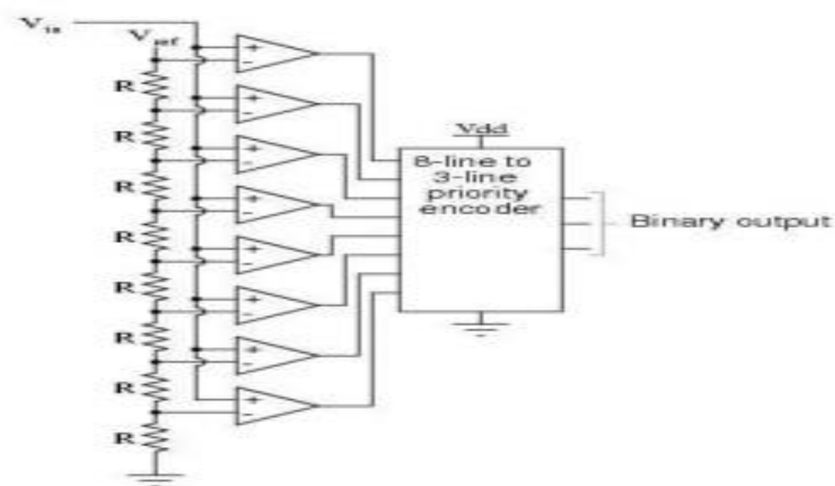


Figure: Flash ADC

10. Explain the method of DAC in detail manner?

Weighted resistors D/A converter

There are four resistors R, 2R, 4R and 8R at the input terminals of the OPAMP with R as feedback resistor. The network of resistors at the input terminal of OPAMP is called as variable resistor network. The four inputs of the circuit are D, C, B & A. Input D is at MSB and A is at LSB. Here we shall connect 8V DC voltage as logic–1 level. So we shall assume that 0 = 0V and 1 = 8V.

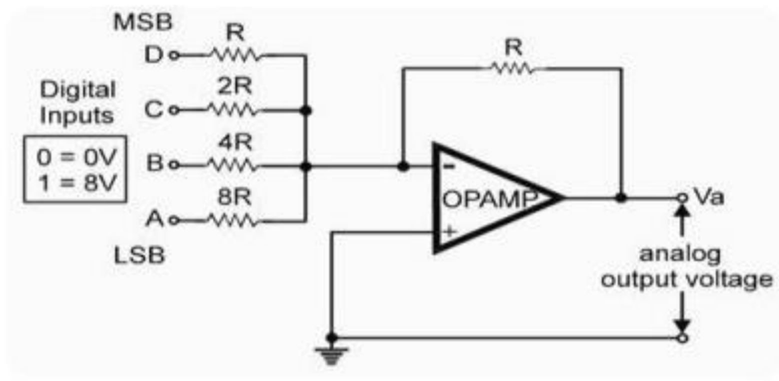


Figure: Weighted resistors D/A converter

Figure: Weighted resistors D/A converter

Now the working of the circuit is as follows. Since the circuit is summing amplifier, its output is given by the following equation

$$v_0 = R\left(\frac{D}{R} + \frac{C}{2R} + \frac{B}{4R} + \frac{A}{8R}\right)$$

Working of the circuit

When input DCBA = 0000, then putting these value in above equation (1) we get

$$v_0 = R\left(\frac{0}{R} + \frac{0}{2R} + \frac{0}{4R} + \frac{0}{8R}\right) = 0V$$

When digital input of the circuit DCBA = 0001, then putting these value in above equation (1) we get

$$v_0 = R\left(\frac{0}{R} + \frac{0}{2R} + \frac{0}{4R} + \frac{0}{8R}\right) = 0V$$

When digital input of the circuit DCBA = 0010, then putting these value in above equation (1) we get

$$v_0 = R\left(\frac{0}{R} + \frac{0}{2R} + \frac{8V}{4R} + \frac{0}{8R}\right) = -R\frac{8V}{4R} = -2V$$

R–2R Ladder D/A Converter

It is modern type of resistor network. It has only two values of resistors the R and 2R. These values repeat throughout in the circuit. The OPAMP is used at output for scaling the output voltage. The working of the circuit can be understood as follows. For simplicity, we ignore the OPAMP in the above circuit (this is because its gain is unity). Now consider the circuit, without OPAMP. Suppose the digital input is DCBA = 1000. Then the circuit is reduced to a small circuit.

$$output = \left(\frac{2R}{2R + 2R}\right) \times (+V) = \frac{V}{2}$$

Now suppose digital input of the same circuit is changed to DCBA = 0100. Then the output voltage will be V/4, when DCBA = 0010, output voltage will be V/8, for DCBA = 0001, output voltage will be V/16 and so on. The general formula for the above circuit of R–2R ladder, including the OPAMP also, will be –

$$v_0 = -R\left(\frac{D}{2R} + \frac{C}{4R} + \frac{B}{8R} + \frac{A}{16R}\right)$$

You can take (R) common from the above formula and simplify it. With the help of this formula, we can calculate any combination of digital input into its equivalent analog voltage at the output terminals.

UNIT V ELECTRICAL MEASUREMENTS

PART A

1. What are the basic elements of a generalized measurement system?

- Primary sensing element which is generally a transducer. Data conditioning element which further consists of variable conversion element and variable manipulation element.
- Data transmission and presentation elements which include data transmission system and data display system.

2. List any four Static characteristics of a measuring system.

Accuracy,
Precision,
Error,
Resolution,
Stability,
Linearity etc.

3. Define the term Accuracy.

The accuracy is defined as the degree of closeness with which the instrument reading approaches the true value of the quantity to be measured. It indicates the ability of an instrument to indicate the true value of the quantity.

4. What is an Error?

The algebraic difference between the indicated value and the true value of the quantity to be measured is called an error.

5. What is calibration?

Calibration is the process of making an adjustment or making a scale so that the readings of an instrument agree with the accepted value and the certified standard.

6. Define the term Precision.

It is the Measure of consistency or repeatability of measurements. It denotes the amount by which the individual readings are departed about the average of number of readings.

7.Give the applications of measurement systems.

- The instruments and measurement systems are sued for
- Monitoring of processes and operations.
- Control of processes and operations.
- Experimental engineering analysis.

8. **What are the various Dynamic characteristics?**

- Various Dynamic characteristics are
- Fidelity
- Speed of Response
- Time Delay
- Lag

- Dynamic error

9. **Explain the function of measurement system.**

The measurement system consists of a transducing element which converts the quantity to be measured in an analogous form. The analogous signal is then processed by some intermediate means and is then fed to the end device which presents the results of the measurement.

10. **Define static characteristics.**

Static characteristics are the set of rules or criteria that is defined for those instruments that varies very slowly with time or remains a constant.

PART B

1.Explain the Static characteristics of measurement?

The set of criteria defined for the instruments, which are used to measure the quantities which are slowly varying with time or mostly constant, i.e., do not vary with time, is called 'static characteristics'.

Accuracy:

It is the degree of closeness with which the reading approaches the true value of the quantity to be measured. The accuracy can be expressed in following ways:

Conformity:

Consider a resistor having true value as 2385692 , which is being measured by an ohmmeter. But the reader can read consistently, a value as 2.4 M due to the non availability of proper scale. The error created due to the limitation of the scale reading is a precision error.

Number of significant figures:

The precision of the measurement is obtained from the number of significant figures, in which the reading is expressed. The significant figures convey the actual information about the magnitude & the measurement precision of the quantity. The precision can be mathematically expressed as:

$$P=1-\left|\frac{X_n-\overline{X_n}}{\overline{X_n}}\right|$$

Where, P = precision

Xn = Value of nth measurement

Xn = Average value the set of measurement values

Sensitivity:

The sensitivity denotes the smallest change in the measured variable to which the instrument responds. It is defined as the ratio of the changes in the output of an instrument to a change in the value of the quantity to be measured.

Reproducibility:

It is the degree of closeness with which a given value may be repeatedly measured. It is specified in terms of scale readings over a given period of time.

Repeatability:

It is defined as the variation of scale reading & random in nature Drift: Drift may be classified into three categories:

a) zero drift:

If the whole calibration gradually shifts due to slippage, permanent set, or due to undue warming up of electronic tube circuits, zero drift sets in.

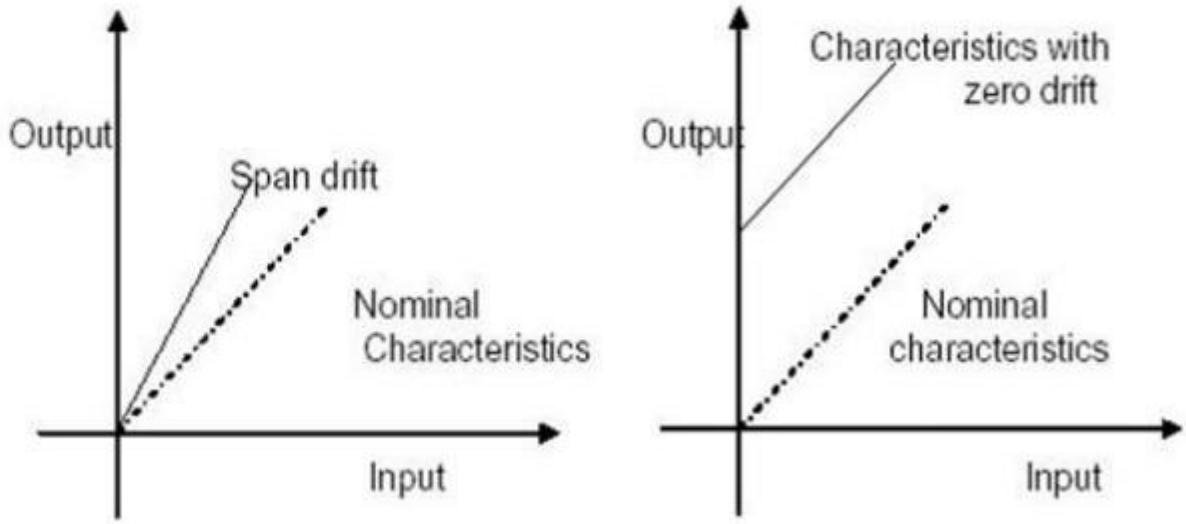


Fig. 4.1 Span Drift and Zero Drift

b) Span drift or sensitivity drift

If there is proportional change in the indication all along the upward scale, the drifts is called span drift or sensitivity drift.

c) Zonal drift:

In case the drift occurs only a portion of span of an instrument, it is called zonal drift.

Resolution:

If the input is slowly increased from some arbitrary input value, it will again be found that output does not change at all until a certain increment is exceeded. This increment is called resolution.

Threshold:

If the instrument input is increased very gradually from zero there will be some minimum value below which no output change can be detected. This minimum value defines the threshold of the instrument.

Stability:

It is the ability of an instrument to retain its performance throughout is specified operating life.

Tolerance:

The maximum allowable error in the measurement is specified in terms of some value which is called tolerance.

Range or span:

The minimum & maximum values of a quantity for which an instrument is designed to measure is called its range or span.

2.Explain the Dynamic characteristics of measurement?

The set of criteria defined for the instruments, which are changes rapidly with time, is called 'dynamic characteristics'.

The various static characteristics are:

Speed of response

Measuring lag

Fidelity

Dynamic error

Speed of response:

It is defined as the rapidity with which a measurement system responds to changes in the measured quantity.

Measuring lag:

It is the retardation or delay in the response of a measurement system to changes in the measured quantity. The measuring lags are of two types:

a) Retardation type:

In this case the response of the measurement system begins immediately after the change in measured quantity has occurred.

b) Time delay lag:

In this case the response of the measurement system begins after a dead time after the application of the input. Fidelity: It is defined as the degree to which a measurement system indicates changes in the measurand quantity without dynamic error.

3.Explain the types of measurement errors in detailed manner?

Errors in Measurement

1.Theoretical errors**:**

The explicit or implicit model on which we base our interpretation of our measurements may be inapplicable or inaccurate.Range of Validity: A model is applicable only within a limited range of Conditions.Be-yond that, it will give inaccurate predictions.Approximation: Models have finite precision even within their range of validity

2.Static errors**:**

i. Parallax: Analog meters use a needle as a pointer to indicate the measured value. Reading this at an oblique angle causes a misreading, known as a parallax reading error.

ii. Interpolation: The needle often rests between two calibrated marks. Guessing its position by interpolation is subject to an error that depends on the size of the scale, and on the visual acuity and experience of the person reading the meter.

iii. Last-digit bobble: Digital readouts re often observed to oscillate between two neighboring values, for example a digital voltmeter (DVM) may alternately show 3.455 and 3.456 volts. This occurs when the actual value is about midway between the two displayed values. Small variations in the system under test, or in the meter itself, are sufficient to change the reading when it is delicately poised between the two values.

3.Environmental errors:

Measurements can be affected by change in ambient factors

I. Temperature
II. Pressure
III. Electromagnetic field: Static electric or magnetic f i e l d s , dynamic (changing) fields, and propagating fields (radiation) can interfere with measurements.

4. Characteristic errors:

Zero Offset: a meter (for example) may read zero when the actual value is nonzero. This is a common form of calibration error.

Gain error: amplifiers are widely used in instruments such as CRO probes, and we may trust that “times 10” means precisely what it says only when the amplification has been carefully calibrated.

Processing error: modern instruments contain complex processing devices such as analog computers which can introduce errors into the process leading to thedisplayed value of a measurement.

Repeatability error: instruments change over time, which is why they must be regularly calibrated, just as a car must be serviced. Instruments change, however slightly, even between consecutive measurements.

Nonlinearity: Drive an amplifier to too high a gain and it will operate in its nonlinear regions, producing a severely distorted output signal.

Resolution: devices can only resolve (that is, distinguish) values that are sufficiently separated .For example, optical instruments cannot easily resolve objects less than one wavelength apart.

5.Drift:

Drift is a complex phenomenon for which the observed effects are that the sensitivity and offset values vary. It also can alter the accuracy of the instrument differently at the various amplitudes of the signal present.

4.Describe the working principle of strain gauges in detailed manner?

Principle of Working of Strain Gauges

When force is applied to any metallic wire its length increases due to the strain. The more is the applied force, more is the strain and more is the increase in length of the wire. If L 1 is the initial length of the wire and L2 is the final length after application of the force, the strain is given as: $\varepsilon = (L2-L1)/L1$ Further, as the length of the stretched wire increases, its diameter decreases

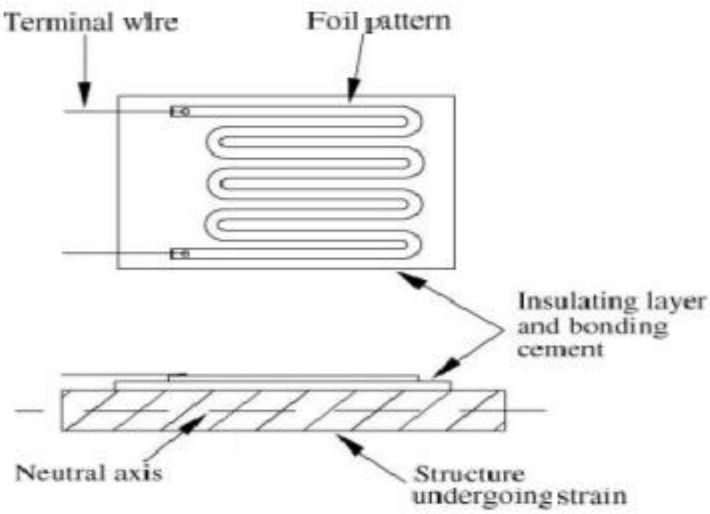


Fig. 4.5 Strain Gauge

Now, we know that resistance of the conductor is the inverse function of the length. As the length of the conductor increases its resistance decreases. This change in resistance of the conductor can be measured easily and calibrated against the applied force. Thus strain gauges can be used to measure force and related parameters like displacement and stress. The input and output relationship of the strain gauges can be expressed by the term gauge factor or gauge gradient, which is defined as the change in resistance R for the given value of applied strain ε.

Applications of the Strain Gauges

1) Measurement of strain

2) Measurement of other quantities

5.Describe the working principle of LVDT in detailed manner?

LVDT (Linear Variable Differential Transformer)

The LVDT operation does not require electrical contact between the moving part (probe or core rod assembly) and the transformer, but rather relies on electromagnetic coupling; this and the fact that they operate without any built-in electronic circuitry are the primary reasons why LVDTs have been widely used in applications where long life and high reliability under severe environments are a required, such Military/Aerospace applications.

The LVDT consists of a primary coil (of magnet wire) wound over the whole length of a non-ferromagnetic bore liner (or spool tube) or a cylindrical coil form. Two secondary coils are wound on top of the primary coil for “long stroke” LVDTs (i.e. for actuator main RAM) or each side of the primary coil for “Short stroke” LVDTs (i.e. for electro-hydraulic servo-valve or EHSV). The two secondary windings are typically connected in “opposite series” (or wound in opposite rotational directions). A ferromagnetic core, which length is a fraction of the bore liner length, magnetically couples the primary to the secondary winding turns that are located above the length of the core.

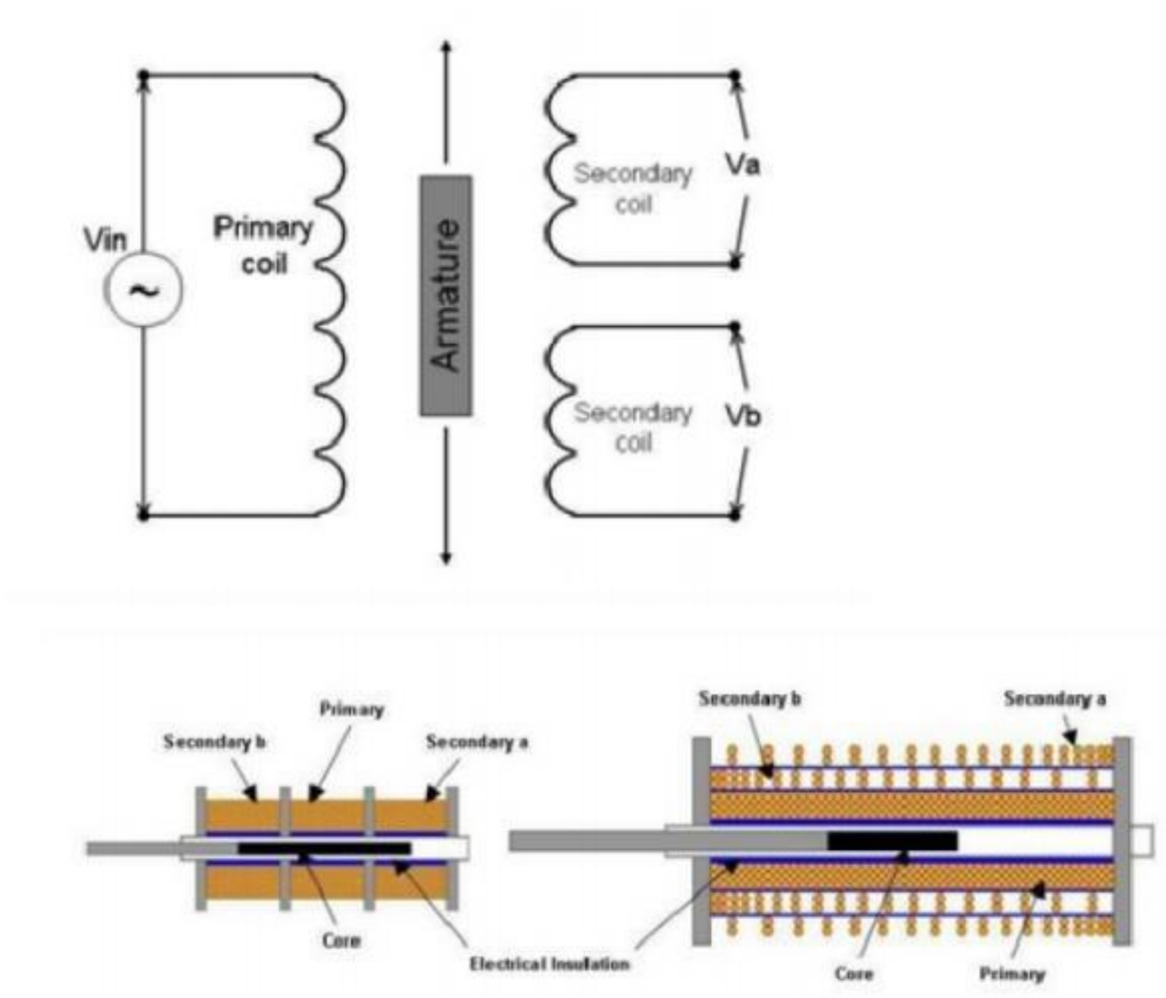


Fig. 4.9 LVDT

When the primary coil is excited with a sine wave voltage (Vin), it generate a variable magnetic field which, concentrated by the core, induces the secondary voltages (also sine waves). While the secondary windings are designed so that the differential output voltage (Va-Vb) is proportional to the core position from null, the phase angle (close to 0 degree or close to 180 degrees depending of direction) determines the direction away from the mechanical zero. The zero is defined as the core position where the phase angle of the (Va-Vb) differential output is 90 degrees.

The differential output between the two secondary outputs (Va-Vb) when the core is at the mechanical zero (or "Null Position") is called the Null Voltage; as the phase angle at null position is 90 degrees, the Null Voltage is a "quadrature" voltage. This residual voltage is due to the complex nature of the LVDT electrical model, which includes the parasitic capacitances of the windings

6.Describe the working principle of RVDT in detailed manner?

Rotary Variable Differential Transformer (RVDT)

Rotary Variable Differential Transformer (RVDT) A Rotary Variable Differential Transformer (RVDT) is an electromechanical transducer that provides a variable alternating current (AC) output voltage that is linearly proportional to the angular displacement of its input shaft.

When energized with a fixed AC source, the output signal is linear within a specified range over the angular displacement. RVDT's utilize brushless, non-contacting technology to ensure long-life and reliable, repeatable position sensing with infinite resolution. Such reliable and repeatable performance assures accurate position sensing under the most extreme operating conditions. Moog offers seven frequency optimized RVDT's in a basic size 8 configured housing. Each is designed to operate at a specific frequency. Frequency optimization provides the benefit of an increased operating range of angular displacement with a reduction in sensor size and weight.

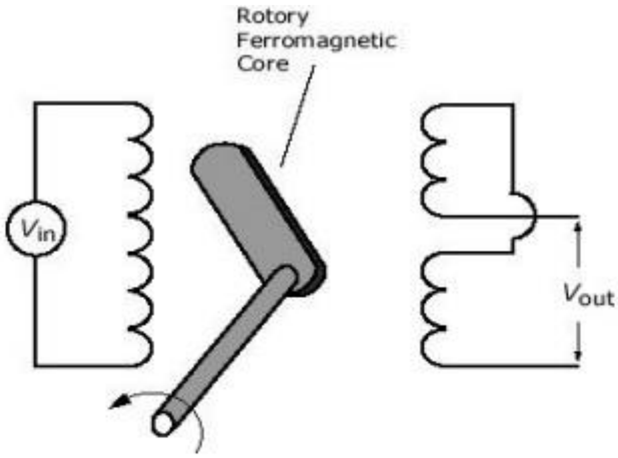


Fig. 4.10 RVDT

The Rotational Variable Differential Transformer (RVDT) is used to measure rotational angles and operates under the same principles as the LVDT sensor. Whereas the LVDT uses a cylindrical iron core, the RVDT uses a rotary ferromagnetic core.

7.Describe the working principle of Piezoelectric Transducer

in detailed manner?

The main principle of a piezoelectric transducer is that a force, when applied on the quartz crystal, produces electric charges on the crystal surface. The charge thus produced can be called as piezoelectricity. Piezo electricity can be defined as the electrical polarization produced by mechanical strain on certain class of crystals. The rate of charge produced will be proportional to the rate of change of force applied as input. As the charge produced is very small, a charge amplifier is needed so as to produce an output voltage big enough to be measured. The device is also known to be mechanically s tiff. For example, if a force of 15 KN is given to the transducer, it may only deflect to a maximum of 0.002mm. But the output response may be a s high as 100 KHz. This proves that the device is besst applicable for dynamic measurement.

Piezoelectric Transducer can me asure*pressure* in the same way a *force* or an *acceleration* can be measured. For low pressure measurement, possible vibration of the amount should be compensated for. The pressure measuring quartz disc stack faces the pressure through a *diaphragm* and on the other side of this stack, the comp ensating mass followed by compensating quart z.

Advantages

- Very high frequency response.
- Self generating, so no need of external source.
- Simple to use as they have small dimensions and large measuring range.

8.Describe the working principle of Energy Meter in detailed manner?

Introduction

The energy meter is an electrical measuring device, which is used to record Electrical Energy Consumed over a specified period of time in terms of units.Electric meters are typically calibrated in billing units, the most common one being the kilowatt hour.

A periodic reading of electric meters establishes billing cycles and energy used during a cycle.

Features:

* Display of current time (24 hours type), week, load power and cost tariff.

* Display of total on time, total used energy and accrued energy cost.

* Display of total record time, total on time and percentage.

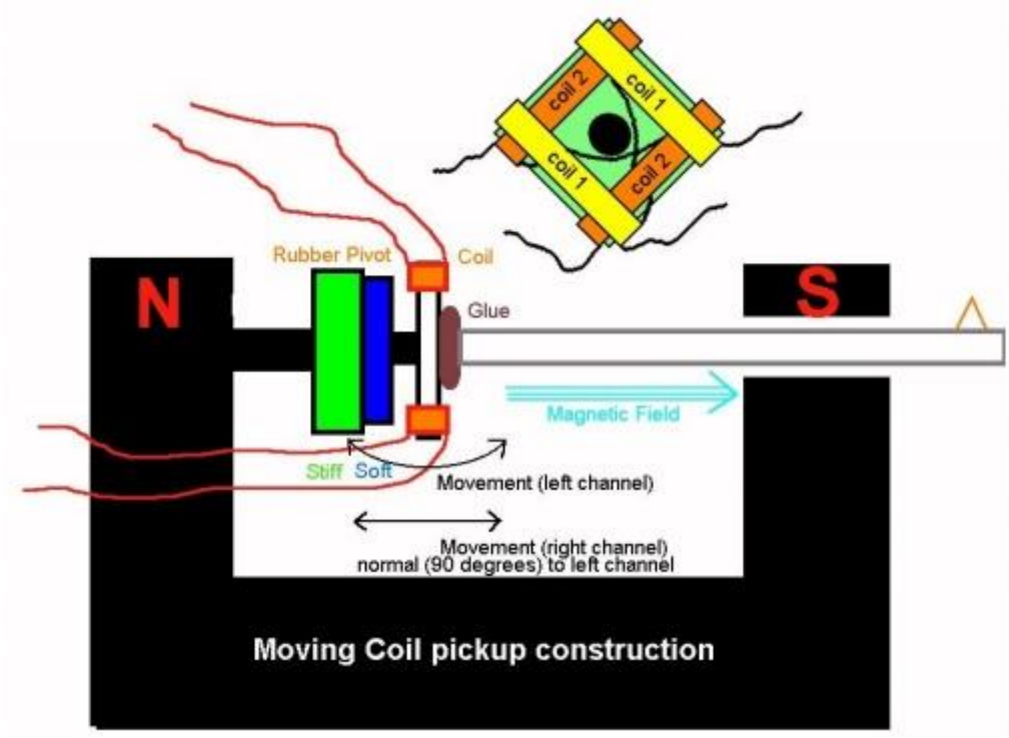
* Dual programmable power tariffs.

* Connection, operation settings.

9.Describe the working principle of moving coil in detailed manner?

Moving Coil

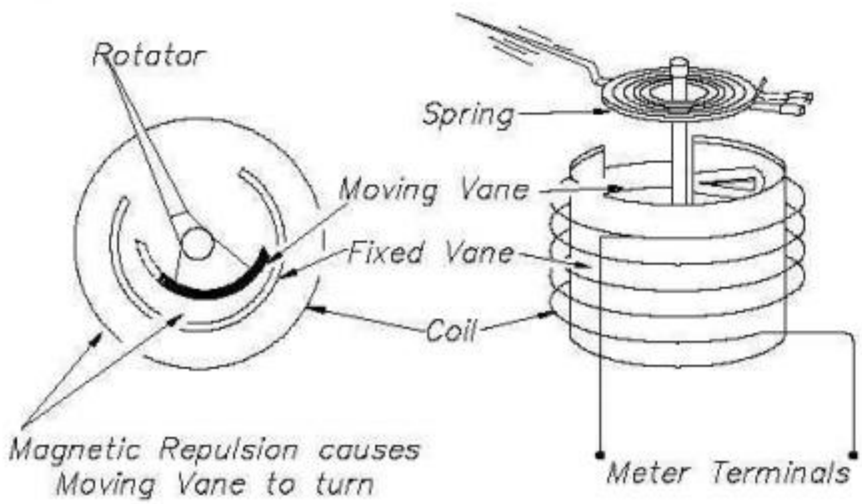
Moving Coil Instruments are used for measuring DC quantities. They can be used on AC systems when fed through bridge rectifiers. Center magnet system is incorporated in our moving coil instruments which completely shields the movement from the effect of external magnetic fields. The movement is pivoted between synthetic sapphire jewel bearings for frictionless operation.

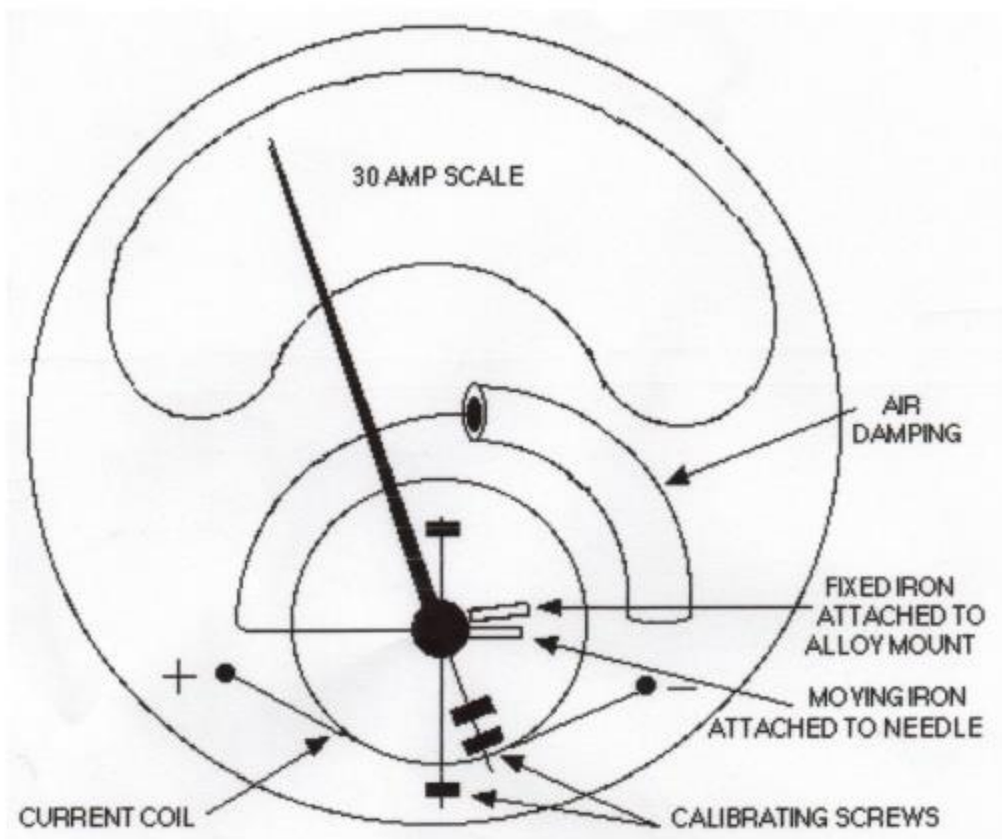


10.Describe the working principle of moving iron in detailed manner?

Moving Iron

Moving Iron Instruments are generally used for measuring AC Voltage and Currents. A feature of the moving element is that it is fitted with synthetic sapphire jewels. The movement is light, quick acting, but extremely robust. An efficient system of fluid damping is employed. The movement is efficiently shielded against the effect of external magnetic fields.


Rotator
Spring
Moving Vane
Fixed Vane
Coil
Magnetic Repulsion causes
Moving Vane to turn
Meter Terminals


30 AMP SCALE
AIR
DAMPING
FIXED IRON
ATTACHED TO
ALLOY MOUNT
MOVING IRON
ATTACHED TO NEEDLE
CURRENT COIL
CALIBRATING SCREWS

DHANALAKSHMI COLLEGE OF ENGINEERING, CHENNAI

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

EE6010– HIGH VOLTAGE DIRECT CURRENT TRANSMISSION

UNIT – I : INTRODUCTION

PART – A (2 Marks)

1. List out any two merits of AC and DC transmission.

   AC Transmission:

   i. It requires only two conductors as compared to three for AC transmission.
   ii. There is no skin effect in a DC system.

   DC Transmission:

   i. The power can be generated at high voltages.
   ii. The maintenance of AC sub-station is easy and cheaper.

1. What are the different types of DC link?

   i. Monopolar link
   ii. Bipolar link
   iii. Homopolar link

2. List some of the advantages and disadvantages of HVDC transmission.

   Advantages:

   i. Full control over power transmitted
   ii. The ability to enhance transient and dynamic stability in associated AC network.

   Disadvantages:

   i. Inability to use transformer to change voltage levels
   ii. High cost of converter equipment

3. What are the types of power losses in thyristor?

   i. Forward conduction losses
   ii. Loss due to leakage current during forward & reverse blocking
   iii. Switching losses due to T_{on} and T_{off}
   iv. Gate triggering loss

4. Define - Reliability

   The reliability of DC transmission system is quite good on exhaustive record of existing HVDC lines in the world in available from which the reliability statistics can be computed from the development of LTT.

5. Define - Energy Availability

It is defined as,

Energy Availability=100 (1 - equivalent outage time)

Where equivalent outage time is the product of the actual outage time and the fraction of system capacity lost to outage.

9. List out any two application DC transmission.

   i. Long distance bulk power transmission
   ii. Underground or underwater cables
   iii. Asynchronous interconnection of A.C systems operating at different frequencies.

10. What are the factors to be considered for planning HVDC transmission?

The factors to be considered are,

   i. Cost
   ii. Technical performance
   iii. Reliability

11. What are the advantages of LTT over ETT?

   i. Infinite gate isolation
   ii. Total noise immunity for the control circuits
   iii. Faster turn-on time
   iv. Elimination if high voltage pulse transformers and auxiliary power supplies.

12. Distinguish between AC and DC transmission.

Sl.No.	AC Transmission	DC Transmission
1.	It requires three conductors for transmission	It requires only 2conductors
2.	The skin effect is present in AC transmission	There is no skin effect in DC Transmission
3.	More corona loss	Less corona loss
4.	Stability problem occurs.	No stability problem.

13. What is meant by MOS controlled thyristor?

An MCT is a new device in the field of semiconductor-controlled devices. It is basically a thyristor with two MOSFET's built into the gate structure one MOSFET is used for turning on the MCT and other for turning off device. An MCT is a High – frequency, high power, low – conduction drop switching device.

14. List any two HVDC projects in India.

Sl.No.	System/Project	Year	Supplier	Power Rating (MW)	Voltage (kV)
1.	National HVDC project-stage-I	1989	BHEL	100	100
2.	NHVDC-stage-II	2000	BHEL	100	200

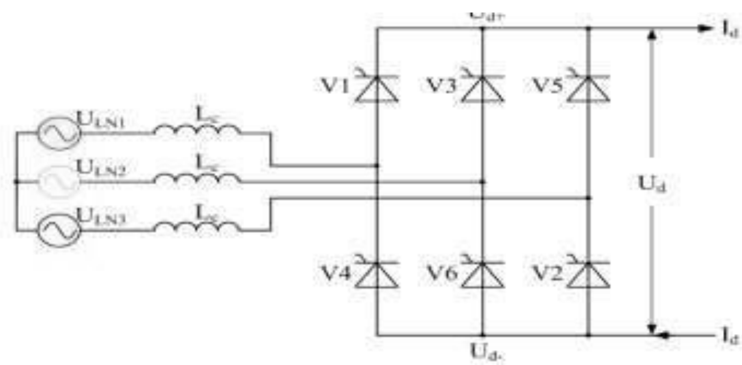
PART – B : (16 Marks)

1. Explain in detail, the economic choice of voltage level selected in DC transmission system.
2. Explain in detail, the technological development in control and protection for better performance and reliability of dc transmission system.
3. Explain in detail, the different applications of dc transmission system.
4. Explain the different types of DC links.
5. Explain in detail, the comparison of AC and DC transmission.
6. Explain in detail, the types and applications of MTDC systems.
7. Explain in detail, the planning of HVDC transmission systems.
8. Explain in detail, the modern trends in DC transmission.
9. Explain in detail, the major components of a HVDC transmission in converter station.
10. Explain in detail, the HVDC transmission based on voltage source converters.

UNIT – II : ANALYSIS OF HVDC CONVERTERS

1. What is meant by firing angle?
   The angle at which thyristor is triggered it is defined as the angle between the zero crossing of the input voltage and the instant the thyristor is fired

2. Draw the circuit model of Graetz circuit.



3. What is meant by pulse number of a converter?
   It is defined as the ratio of the base frequency of the DC voltage ripple to the fundamental frequency of the AC voltage is called pulse number.

4. List some of the converters used in DC transmission.
   Line commutated converter
      i. Six pulse converter
      ii. 12-pulse converter
   Voltage source converter
      i. Basic two level converter
      ii. Three level voltage source converter

5. Define - Valve Rating
   The valve voltage rating is specified in terms of peak inverse voltage (PIV). The ratio of PIV to the average dc voltage is an Index of the value utilization.

6. Define – Converter Configuration
   There are several configuration for a converter of a specified pulse number, and in addition to the Graetz bridge, six phase diametric connection, cascade of three single phase fall wave converters, cascade of two three phase converters.

7. List some of the assumptions made to develop the equivalent circuit of a converter.
   i. All the values in a bridge have identical characteristics
   ii. A value offers infinite impedance in the reverse direction
   iii. The grading and damping circuits across the values are ignored
   iv. The current id is assumed to be continuous and non - zero.
   v. L/R of each phase of the converter transformer in the same.
   vi.

8. Define - Overlap and Overlap Angle

   Overlap is the phenomenon due to the effect of source inductance on the AC side. The current commutation is delayed due to the source inductance which is normally the leakage reactance of a transformer. This period is also known as "overlap" period. The commutation period, when outgoing and incoming thyristors are conducting, is also known as the overlap period. The angular period both devices share conduction is known as the commutation angle / overlap angle.

9. What are the assumptions made for analysis of 6 pulse converter?
   i. DC current is constant (i.e. the smoothing reactor is infinite)
   ii. Valves are ideal switches, and
   iii. AC system is infinitely strong (i.e. the 3 phase emf's are balanced and perfectly sinusoidal).

10. Mention the various modes of operation of rectifier characteristics.

    Mode I : 2 and 3 valve conduction ($u<60^\circ$)
    Mode II : 3 valve conduction only ($\alpha < 30^\circ$)
    Mode III : 3 and 4 valve conduction mode ($\alpha > 30^\circ$) ($60^\circ<u<120^\circ$)

11. What is meant by snubber circuit?

    A Snubber circuits consists of a series combination of resistance R_s and capacitance C_s in parallel with the thyristor. A capacitor C_s in parallel with the device is sufficient to prevent unwanted triggering of the SCR.

12. Define – Graetz Circuit

    The Graetz circuit consists of 6 pulse converter and the 12 pulse converter is composed of two bridges in series supplied from two different transformers with voltages differing in phase by 30°.

13. Define – Pulse Number

    The pulse number is defined as the number of pulsations of direct voltage per cycle of an alternating voltage.

14. Define – DC Voltage Waveform

    The DC voltage waveform consists of ripple whose fundamental frequency is six times the supply frequency. This can be analyzed in fourier series and contains harmonics of order,

    $$h= np$$

PART – B (16 Marks)

1. For a 3 phase 6 pulse gratez's circuit draw the timing diagram considering overlap angle is less than 60 degree and without overlap for the following:

a. Voltage across load

b. Voltage across any two pair of conduction valves

2. Explain in detail, the individual characteristics of a rectifier and an inverter with sketches.(

3. Explain in detail, the principle of operation of a 6 pulse gratez's circuit.
4. Explain in detail, the effect of source inductance on HVDC system.

5. Explain in detail, the converter bridge characteristics.

6. Explain the effect of overlap angle on the performance of converter circuit.

7. Explain the choice of converter configuration for any pulse number.

8. Explain the analysis of 12 pulse converter with bridge rectifier.

9. Explain the analysis of two and three valve conduction mode.
10. Explain in detail, the analysis of VSC topologies and firing schemes.

UNIT - III : CONVERTER AND HVDC SYSTEM CONTROL

1. What is meant by firing angle control?
   The current or extinction angle controller generates a control signal V_c, Which is related to the firing angle required. The firing angle controller generates gate pulses in response to the control signal V_c.

2. What are the main features of HVDC system control?
   i. Current order setting can be quickly and reliably changed
   ii. Power reversal can be done easily and quickly
   iii. Fault current levels are limited to rated values.

3. What is the principal of DC link control?
   The control of power in a DC link can be achieved through the control of current or voltage. It is important to maintain constant voltage in the link and adjust the current to meet the required power to minimize loss.

5. What is meant by current and extinction control?
   The current control is invariably of feedback type. The extinction angle controller can be of predictive type or feedback type with IPC control.

6. Why is current control used in the rectifier station under normal operating conditions?
   i. The inverter can now be operated at minimum value thereby to minimize the reactive power consumption.
   ii. The operation at minimum extinction angle at the inverter and current control at the rectifier results in better voltage regulation them the operation with minimum delay angle at the rectifier and current control at the inverter.
   iii. The current during line fault are automatically limited with rectifier station in current control.

7. How is power reversal achieved in HVDC link?
   The power reversal in the link can take place by the reversal of the DC Voltage. This is done easily by increasing the delay angle at the station initially operating as the rectifier, while reducing the delay angle at the station initially operating as the inverter.

8. Define - Current Margin

   The difference between the current controller settings of the two stations is called current margin (I_m). In order to avoid conflict between the two current controllers at the both ends, the rectifier current controller is provided with a higher current order.

$$I_{di} = I_{dr} - I_m$$

Where, I_{di} is the current order of the inverter

I_{dr} is the current order of the rectifier

I_m is usually 10% of rated value

9. What are the draw backs of constant current control scheme?
   i. Increase in the converter valve voltage stress due to the voltages across the series capacitors
   ii. Increase in the magnitude of AC harmonics as the overlap angle is the reduced for a specified DC current

10. What is the need for transformer tap changer control of HVDC converter?

    The tap changing transformer is used to increase the power factor obtained in the AC side and maintain the operating point at point A or B in the V_d - I_d characteristics of rectifier and inverter by the use tap changing transformer.

11. Define – Equidistant Pulse Control

    In the equidistant pulse control, the firing pulses are generated in steady state at equal intervals through a ring counter. This control was first suggested by Ainsworth using a phase locked oscillator to generate the firing pulses.

12. Define – Individual Phase Control

    In the individual phase control scheme, the firing pulse generation for each phase is independent of each other and the firing pulses are rigidly synchronized with the commutation voltages.

13. What are the different types of individual phase control?

    There are two different types of individual phase control. They are,
    i. Constant alpha control
    ii. Inverse cosine control

14. What is the function of voltage dependent current order limiter?

    The function of voltage dependent current order limiter is to prevent individual thyristors from carrying full current for long periods during commutation failures.

PART – B : (16 Marks)

1. Explain in detail, the control of VSC based HVDC systems.
2. Explain in detail, the current and extinction angle control.
3. Explain in detail, the converter control characteristics of HVDC systems.
4. Explain in detail, different types of firing angle control schemes.
5. Explain the system control hierarchical structure for a DC link.
6. Explain in detail, the principles of DC link control.
7. Explain in detail, the different functions of higher level controllers.
8. Explain the principle of operation of a basic power controller.
9. Explain in detail, the starting and stopping of DC link.

UNIT – IV : REACTIVE POWER AND HARMONICS CONTROL

1. What are the drawbacks in the operation of weak AC systems?

   The operation of weak AC systems can be problematic due to voltage instability and dynamic over voltages.

2. What are the various sources of reactive power?

   The various sources of reactive power are:

   I. AC system
   II. AC filters
   III. Shunt capacitors
   IV. Synchronous condensers
   V. Static var system

3. Why is control of reactive power necessary during transients?

   The control of reactive power is necessary during transients due to the following reasons:

   I. Control of dynamic over voltages caused by load rejection
   II. Speed recovery of power followed by a fault in the inverter section
   III. Control of instability

4. What are the different types of SVS systems?

   There are three basic types of SVS schemes:

   I. Variable impedance type
   II. Current source type
   III. Voltage source type

5. What are the different factors to be considered for selection of harmonic filter?

   I. Harmonic distortion
   II. Telephone influence factor
   III. IT product
   IV. Telephone harmonic form factor

6. List the various types of filters.

   There are basically two types of filters:

   I. Active filters
   II. Passive filters

7. What are the various problems associated with the injection of harmonics?

The various problems associated with the injection of harmonics are:

I. Telephone interference
II. Extra power losses
III. Over voltages due to resonance
IV. Instability of converter control
V. Interference with ripple control systems used in load management

8. Define – Characteristic Harmonics

The characteristic harmonics are the harmonics of order which is always present even under the ideal operation of balanced AC voltages, symmetric three phase network and equidistant pulses.

9. What are the reasons for the non- characteristic harmonics?

The non- characteristic harmonics is due to:

I. Imbalance in the operation of two bridges forming a 12 pulse converter
II. Firing angle control
III. Unbalance and distortion in the AC voltages
IV. Unequal transformer leakage impedances

10. What is the effect of unbalanced voltages in the HVDC system?

The presence of the negative sequence component in the AC voltages shifts the zero crossing of the commutation voltages.

11. What are the various types of AC filters?

The various types of AC filters are:

I. Single tuned filter
II. Double tuned filter
III. High pass filter

12. What are the factors to be considered for selection of DC filter?

I. Maximum voltage TIF on DC high voltage bus
II. Maximum induced noise voltage in mv / km in a particular test line of 1km away from the HVDC line Maximum permissible noise to ground in dB in telephone lines close to the HVDC lines.

13. Define – Telephone Harmonic Form Factor

It is defined as,

$$F_n = \left({nf_1}/{800} \right) W_n$$

Where, W_n is the psophometric weight at the harmonic of order n.

14. Define – KIT product

It is defined as,

$$KIT = {IT}/{1000}$$

PART – B : (16 Marks)

1. Explain in detail, the reactive power requirements in steady state conditions.
2. Explain in detail, the principle of operation and V-I characteristics of SVC.
3. Explain in detail, the principle of operation and V-I characteristics of STATCOM.
4. Explain in detail, the generation of harmonics.
5. Explain in detail, the design of AC and DC filters.
6. Explain in detail, the design of single tuned filters.
7. Explain in detail, the design of double and triple tuned filters.

UNIT - V : POWER FLOW ANALYSIS IN AC/DC SYSTEMS

1. Why is power flow analysis most important in AC/DC systems?
   Power flow analysis is an essential component of system studies which is carried out for planning, design and operation of power systems. It is basically simulation of the systems in steady state and determines the operating point which is later used for initializing variables in transient and dynamic system simulation.

2. Write the necessary equations for the bus voltage estimates used in fast decoupled power flow method.
   The necessary equations for the bus voltage estimates used in fast decoupled power flow method are:

$$\Delta P / V = [B'] \Delta \theta$$
$$\Delta Q / V = [B''] \Delta V$$

3. What are the different components of DC network?
   The DC network consists of DC links, smoothing reactors, and converters can be viewed as a resistive network excited by current or voltage sources in the steady state.

4. What are the elements of the DC network?
   The elements of the DC network can be separated into tree branches and links. In radial DC networks, there is no loss of generality in assuming that all the resistances forms a subset of tree branches.

5. Write the equations describing the DC network.
   The equations describing the DC network are,

$$-[g]v_g = i_g$$
$$i_g = -B_{Lg} I_{dL}$$
$$i_{dT} = -B_{LT} I_{dL}$$
$$V_{dL} = B'_{Lg} v_g + B'_{LT} V_{dT}$$

6. What is meant by DC converter?
   The DC network is a network which consists of N converters which can be put into m groups such that all the converters are in groups. It is governed by an equation,

$$\sum_{i=1}^{m} n_i = N$$

7. Write the voltage equation for the converter.
The voltage equation of the converter is,

$$V_{dj} = \left(\frac{3\sqrt{2}}{\pi}\right)\left(\frac{N_{sj}}{N_{pj}}\right)\left(\frac{E_\sigma}{T_j}\right) V_{b\sigma}\cos\alpha_j - \left(\frac{3}{\pi}\right) X_{cj} I_{dj}$$

8. Write the real power and reactive power equations for the AC bus.
The real power and reactive power equations of the AC bus are,

$$P_\sigma = -\sum_{j=1}^{n_\sigma} V_{dj} I_{dj}$$

$$Q_\sigma = -\sum_{j=1}^{n_\sigma} V_{dj} I_{dj} \tan\varphi_j$$

9. What are the different types of control used for the controller?
The different types of control used for the controller are:
   I. Current control
   II. DC voltage control
   III. Power control
   IV. Reactive power control

10. Write the control equations for the converter.
The control equations for the converter are,

$$F_{dj} = C_j F_{d\sigma}$$

$$\sum_{j=1}^{n_\sigma} C_j = 1$$

11. Write the equation for the base resistance of the converter.
The equation of the base resistance of the converter is,

$$R_{base} = \frac{V_{db}}{I_{db}}$$

12. What are the different methods to solve AC/DC power flow?
The different methods to solve AC/DC power flow are:
   I. Simultaneous or unified method
   II. Sequential or alternating method

13. What is meant by simultaneous method?
The simultaneous method is the method in which both AC and DC equations are solved together. The equations are combined into single set of non – linear algebraic equations.

14. What is meant by sequential method?
The sequential method is the method in which the AC and DC quantities are solved separately and sequentially. The DC is solved using a simplified representation of the system.

PART – B (16 Marks)

1. Explain in detail, the modeling of DC links.
2. Explain in detail, the per unit system of DC quantities and inclusion of constraints.
3. Explain in detail, the case study of a five terminal DC system.
4. Explain in detail, the power flow analysis of VSC based HVDC system.
5. Explain in detail, the power flow analysis under dynamic conditions.

EE6301 DIGITAL LOGIC CIRCUITS
TWO MARK QUESTIONS WITH ANSWERS

UNIT-I NUMBERING SYSTEMS AND DIGITAL LOGIC FAMILIES

1) What are basic properties of Boolean algebra?

The basic properties of Boolean algebra are commutative property, associative Property and distributive property.

2) State the associative property of boolean algebra.

The associative property of Boolean algebra states that the OR ing of several variables results in the same regardless of the grouping of the variables. The associative property is stated as follows: A+ (B+C) = (A+B) +C

3) State the commutative property of Boolean algebra.

The commutative property states that the order in which the variables are OR ed makes no difference. The commutative property is: A+B=B+A

4) State the distributive property of Boolean algebra.

The distributive property states that AND ing several variables and OR ing the result With a single variable is equivalent to OR ing the single variable with each of the the several Variables and then AND ing the sums. The distributive property is: A+BC= (A+B) (A+C)

5) State the absorption law of Boolean algebra.

The absorption law of Boolean algebra is given by X+XY=X, X(X+Y) =X.

6) State De Morgan's theorem.

De Morgan suggested two theorems that form important part of Boolean algebra. They are,

1) The complement of a product is equal to the sum of the complements. (AB)' = A' + B'
2) The complement of a sum term is equal to the product of the complements. (A + B)' = A'B'

7) Reduce A (A + B)

A (A + B) = AA + AB= A (1 + B) [1 + B = 1]= A.

8) Reduce A'B'C' + A'BC' + A'BC

A'B'C' + A'BC' + A'BC = A'C'(B' + B) + A'B'C
= A'C' + A'BC [A + A' = 1]
= A'(C' + BC)
= A'(C' + B) [A + A'B = A + B]

9) Reduce AB + (AC)' + AB'C (AB + C)

AB + (AC)' + AB'C (AB + C) = AB + (AC)' + AAB'BC + AB'CC
= AB + (AC)' + AB'CC [A.A' = 0]
= AB + (AC)' + AB'C [A.A = 1]
= AB + A' + C' =AB'C [(AB)' = A' + B']
= A' + B + C' + AB'C [A + AB' = A + B]
= A' + B'C + B + C' [A + A'B = A + B]
= A' + B + C' + B'C
=A' + B + C' + B'
=A' + C' + 1
= 1 [A + 1 =1]

10) Simplify the following expression Y = (A + B) (A + C') (B' + C')

Y = (A + B) (A + C') (B' + C')
= (AA' + AC +A'B +BC) (B' + C') [A.A' = 0]
= (AC + A'B + BC) (B' + C')

= AB'C + ACC' + A'BB' + A'BC' + BB'C + BCC'
= AB'C + A'BC'

11) Show that (X + Y' + XY) (X + Y') (X'Y) = 0

(X + Y' + XY)(X + Y')(X'Y) = (X + Y' + X) (X + Y') (X' + Y) [A + A'B = A + B]
= (X + Y') (X + Y') (X'Y) [A + A = 1]
= (X + Y') (X'Y) [A.A = 1]
= X.X' + Y'.X'.Y
= 0 [A.A' = 0]

12) Prove that ABC + ABC' + AB'C + A'BC = AB + AC + BC

ABC + ABC' + AB'C + A'BC=AB(C + C') + AB'C + A'BC
=AB + AB'C + A'BC
=A(B + B'C) + A'BC
=A(B + C) + A'BC
=AB + AC + A'BC
=B(A + C) + AC
=AB + BC + AC
=AB + AC +BC ...Proved

13) Convert the given expression in canonical SOP form Y = AC + AB + BC

Y = AC + AB + BC
=AC (B + B') + AB (C + C') + (A + A') BC
=ABC + ABC' + AB'C + AB'C' + ABC + ABC' + ABC
=ABC + ABC' +AB'C + AB'C' [A + A =1]

14) Define duality property.

Duality property states that every algebraic expression deducible from the postulates Of Boolean algebra remains valid if the operators and identity elements are interchanged. If the dual of an algebraic expression is desired, we simply interchange OR and AND operators and replace 1's by 0's and 0's by 1's.

15) Find the complement of the functions F1 = x'yz' + x'y'z and F2 = x (y'z' + yz). By applying De-Morgan's theorem.

F1' = (x'yz' + x'y'z)' = (x'yz')'(x'y'z)' = (x + y' + z)(x + y +z')
F2' = [x (y'z' + yz)]' = x' + (y'z' + yz)'
= x' + (y'z')'(yz)'
= x' + (y + z) (y' + z')

16) Simplify the following expression
Y = (A + B) (A = C) (B + C)

= (A A + A C + A B + B C) (B + C)
= (A C + A B + B C) (B + C)
= A B C + A C C + A B B + A B C + B B C + B C C = A B C

17) What are the methods adopted to reduce Boolean function?

i) Karnaug map ii) Tabular method or Quine Mc-Cluskey method
iii) Variable entered map technique.

18) State the limitations of karnaugh map.

i) Generally it is limited to six variable map (i.e) more then six variable involving expression are not reduced.
ii) The map method is restricted in its capability since they are useful for simplifying only Boolean expression represented in standard form.

19) What is a karnaugh map?

A karnaugh map or k map is a pictorial form of truth table, in which the map diagram is made up of squares, with each squares representing one minterm of the function.44) Find the minterms of the logical expression

Y = A'B'C' + A'B'C + A'BC + ABC'

Y = A'B'C' + A'B'C + A'BC + ABC'

=m0 + m1 +m3 +m6

=_m (0, 1, 3, 6)

20) Write the maxterms corresponding to the logical expression

Y = (A + B + C') (A + B' + C') (A' + B' + C)

= (A + B + C') (A + B' + C') (A' + B' + C)

=M1.M3.M6

= M (1, 3, 6)

PART-B

1. Design a 4-bit binary adder/ subtractor circuit.

a) Basic equations. (4)

b) Comparison of equations. (4)

c) Design using twos complement Circuit diagram. (8)

2. Design a half adder using NAND – NAND logic. (16)

3. Explain how a full adder can be built using two half adders. (16)

4. Design a half adder using at most three NOR gates. (16)

5. Using 8 to 1 multiplexer, realize the Boolean function

T = f(w, x, y, z) = Σ(0,1,2,4,5,7,8,9,12,13) (16)

6. Design a 8421 to gray code converter. (16)

7. Draw the logic diagram of full subtractor and explain its operation. (16)

8. Draw the circuit diagram of NMOS NAND gate and explain its operation. (16)

9. a) Design a full adder circuit using only NOR gates. (4)

b) Draw the circuit of a CMOS two inputs NAND gate (12)

UNIT-II

COMBINATIONAL CIRCUITS

1) What are called don’t care conditions?

In some logic circuits certain input conditions never occur, therefore the Corresponding output never appears. In such cases the output level is not defined, it can be either high or low. These output levels are indicated by ‘X’ or‘d’ in the truth tables and are called don’t care conditions or incompletely specified functions.

2) What is a prime implicant?

A prime implicant is a product term obtained by combining the maximum possible number of adjacent squares in the map.

3) What is an essential implicant?

If a min term is covered by only one prime implicant, the prime implicant is said to be Essential.

4) Define combinational logic.

When logic gates are connected together to produce a specified output for certain specified combinations of input variables, with no storage involved, the resulting circuit is called combinational logic.

5) Write the design procedure for combinational circuits.

- The problem definition
- Determine the number of available input variables & required O/P variables.
- Assigning letter symbols to I/O variables
- Obtain simplified Boolean expression for each O/P.
- Obtain the logic diagram.

6) Define half adder and full adder.

The logic circuit that performs the addition of two bits is a half adder. The circuit that Performs the addition of three bits is a full adder.

7) Define Decoder.

A decoder is a multiple - input multiple output logic circuit that converts coded inputs into coded outputs where the input and output codes are different.

8) What is binary decoder?

A decoder is a combinational circuit that converts binary information from n input lines to a maximum of 2n out puts lines.

9) Define Encoder.

An encoder has 2n input lines and n output lines. In encoder the output lines generate the binary code corresponding to the input value.

10) What is priority Encoder?

A priority encoder is an encoder circuit that includes the priority function. In priority encoder, if 2 or more inputs are equal to 1 at the same time, the input having the highest priority will take precedence.

12) Define multiplexer.

Multiplexer is a digital switch. If allows digital information from several sources to be routed onto a single output line.

13) What do you mean by comparator?

A comparator is a special combinational circuit designed primarily to compare the relative magnitude of two binary numbers.

14) Write down the steps in implementing a Boolean function with levels of NAND Gates.

• Simplify the function and express it in sum of products.
• Draw a NAND gate for each product term of the expression that has at least two Literals.
• The inputs to each NAND gate are the literals of the term.
• This constitutes a group of first level gates.
• Draw a single gate using the AND-invert or the invert- OR graphic symbol in the second level, with inputs coming from outputs of first level gates.
• A term with a single literal requires an inverter in the first level. How ever if the single literal is complemented, it can be connected directly to an input of the second level NAND gate.

15) Give the general procedure for converting a Boolean expression in to multilevel NAND diagram?

• Draw the AND-OR diagram of the Boolean expression.
• Convert all AND gates to NAND gates with AND-invert graphic symbols.
• Convert all OR gates to NAND gates with invert-OR graphic symbols.
• Check all the bubbles in the same diagram. For every bubble that is not compensated by another circle along the same line, insert an inverter or complement the input literal.

PART-B

1) i) Realize a JK flip flop using SR flip flop. (8)
ii) Realize a SR flip flop using NAND gates and explain its operation. (8)
2) Explain various steps in the analysis of synchronous sequential circuits with suitable example.
3) i) Distinguish between a combinational logic circuit and a sequential logic circuit. (4)
ii) Derive the characteristic equation of SR flip flop T1 PG 257. (8)
iii) Using a JK flip flop, explain how a D flip flop can be obtained. (4)
4) Design a four state down counter using T flip flop. (16)
5) Design a 4-bit synchronous 8421 decade counter with ripple carry. (16)
6) Design a synchronous 3-bit gray code up counter with the help of excitation table. (16)
7) Describe the input and output action of JK master/slave flip flops. (16)
8) Design a MOD-10 synchronous counter using JK flip flops. (16)
9) Realize SR neither flip flop using NOR gates and explain its operation. (16)

UNIT-III ASYNCHRONOUS SEQUENTIAL CIRCUITS
TWO MARKS
1. What are secondary variables?
-present state variables in asynchronous sequential circuits
2. What are excitation variables?
-next state variables in asynchronous sequential circuits
3. What is fundamental mode sequential circuit?

-input variables changes if the circuit is stable
-inputs are levels, not pulses
-only one input can change at a given time

-input variables changes if the circuit is stable
-inputs are levels, not pulses
-only one input can change at a given time
4. What is pulse mode circuit?
-inputs are pulses
-widths of pulses are long for circuit to respond to the input
-pulse width must not be so long that it is still present after the new state is reached
5. What are the significance of state assignment?
- In synchronous circuits-state assignments are made with the objective of circuit reduction
- Asynchronous circuits-its objective is to avoid critical races

6. When does race condition occur?
-Two or more binary state variables change their value in response to the change in i/p Variable
7. What is non critical race?
Final stable state does not depend on the order in which the state variable changes race condition is not harmful
8. What is critical race?
-final stable state depends on the order in which the state variable changes -race condition is harmful
9. When does a cycle occur?
-asynchronous circuit makes a transition through a series of unstable state
10. What are the different techniques used in state assignment?
-shared row state assignment
-One hot state assignment
11. What are the steps for the design of asynchronous sequential circuit?
-construction of primitive flow table -reduction of flow table
-state assignment is made -realization of primitive flow table
12. What is hazard?
-unwanted switching transients

13. What is static 1 hazard?
-output goes momentarily 0 when it should remain at 1
14. What are static 0 hazards?

-output goes momentarily 1 when it should remain at 0

15. What is dynamic hazard?

-output changes 3 or more times when it changes from 1 to 0 or 0 to 1

16. What is the cause for essential hazards?

-unequal delays along 2 or more path from same input

17. What is flow table?

-state table of an synchronous sequential network

18. What is SM chart?

-describes the behavior of a state machine

-used in hardware design of digital systems

19. What are the advantages of SM chart?

-easy to understand the operation

-east to convert to several equivalent forms

20. What is primitive flow chart?

-one stable state per row

21. What is state equivalence theorem?

Two states SA and SB, are equivalent if and only if for every possible input X sequence, the outputs are the same and the next states are equivalent i.e., if SA (t + 1) = SB (t + 1) and ZA = ZB then SA = SB.

22. What do you mean by distinguishing sequences?

Two states, SA and SB of sequential machine are distinguishable if and only if their exists at least one finite input sequence. Which, when applied to sequential machine causes different output sequences depending on whether SA or SB is the initial state.

23. Prove that the equivalence partition is unique

Consider that there are two equivalence partitions exist: PA and PB, and PA) PB. This states that, there exist 2 states Si & Sj which are in the same block of one partition and not in the same block of the other. If Si & Sj are in different blocks of say PB, there exists at least on input sequence which distinguishes Si & Sj and therefore, they cannot be in the same block of PA.

24. Define compatibility.

States Si and Sj said to be compatible states, if and only if for every input sequencethat affects the two states, the same output sequence, occurs whenever both outputs arespecified and regardless of whether Si on Sj is the initial state.

25. Define merger graph.

The merger graph is defined as follows. It contains the same number of vertices as the state table contains states. A line drawn between the two state vertices indicates each compatible state pair. It two states are incompatible no connecting line is drawn.

26. Define incompatibility

The states are said to be incompatible if no line is drawn in between them. If implied states are incompatible, they are crossed & the corresponding line is ignored

.

27. Explain the procedure for state minimization.

1. Partition the states into subsets such that all states in the same subsets are 1 - equivalent.

2. Partition the states into subsets such that all states in the same subsets are 2 - equivalent.

3. Partition the states into subsets such that all states in the same subsets are 3 -

equivalent.

28. Define closed covering.

A Set of compatibles is said to be closed if, for every compatible contained in the set, all its implied compatibles are also contained in the set. A closed set of compatibles, which contains all the states of M, is called a closed covering.

29. Define machine equivalence.

Two machines, M1 and M2 are said to be equivalent if and only if, for every state in M1, there is a corresponding equivalent state in M2 & vice versa.

30. Define state table.

For the design of sequential counters we have to relate present states and next states. The table, which represents the relationship between present states and next states, is called state table.

31. Define total state.

The combination of level signals that appear at the inputs and the outputs of the delays define what is called the total state of the circuit.

32. What are the steps for the design of asynchronous sequential circuit?

1. Construction of a primitive flow table from the problem statement.
2. Primitive flow table is reduced by eliminating redundant states using the state Reduction
3. State assignment is made
4. The primitive flow table is realized using appropriate logic elements.

33. Define primitive flow table.

It is defined as a flow table which has exactly one stable state for each row in the table. The design process begins with the construction of primitive flow table.

34. What are the types of asynchronous circuits?

1. Fundamental mode circuits
2. Pulse mode circuits

35. Give the comparison between state Assignment Synchronous circuit and state assignment asynchronous circuit.

In synchronous circuit, the state assignments are made with the objective of circuit reduction. In asynchronous circuits, the objective of state assignment is to avoid critical races.

36. What are races?

When 2 or more binary state variables change their value in response to a change in an input variable, race condition occurs in an asynchronous sequential circuit. In case of unequal delays, a race condition may cause the state variables to change in an unpredictable manner.

37. Define non critical race.

If the final stable state that the circuit reaches does not depend on the order in which the state variable changes, the race condition is not harmful and it is called a non critical race.

38. Define critical race?

If the final stable state depends on the order in which the state variable changes, the race condition is harmful and it is called a critical race.

39. What is a cycle?

A cycle occurs when an asynchronous circuit makes a transition through a series of unstable states. If a cycle does not contain a stable state, the circuit will go from one unstable to stable to another, until the inputs are changed.

40. List the different techniques used for state assignment.

1. Shared row state assignment
2. One hot state assignment.

41. Write a short note on fundamental mode asynchronous circuit.

Fundamental mode circuit assumes that. The input variables change only when the circuit is stable. Only one input variable can change at a given time and inputs are levels and not pulses.

42. Write a short note on pulse mode circuit.

Pulse mode circuit assumes that the input variables are pulses instead of level. The width of the pulses is long enough for the circuit to respond to the input and the pulse width must not be so long that it is still present after the new state is reached.

43. Write short note on shared row state assignment.

Races can be avoided by making a proper binary assignment to the state variables. Here, the state variables are assigned with binary numbers in such a way that only one state variable can change at any one state variable can change at any one time when a state transition occurs. To accomplish this, it is necessary that states between which transitions occur be given adjacent assignments. Two binary are said to be adjacent if they differ in only one variable.

44. Write short note on one hot state assignment.

The one hot state assignment is another method for finding a race free state assignment. In this method, only one variable is active or hot for each row in the original flow table, ie, it requires one state variable for each row of the flow table. Additional row are introduced to provide single variable changes between internal state transitions.

PART B

A sequential circuit has 2D ff's A and B an input x and output y is specified by the following next state and output equations. a. A (t+1)= Ax + Bx
b. B (t+1)= A'x
c. Y= (A+B) x'

(i) Draw the logic diagram of the circuit.
(ii) Derive the state table.

(iii) Derive the state diagram.
2. Design a mod-10 synchronous counter using Jk ff. write excitation table and state

table.
3. a) Write the excitation tables of SR, JK, D, and T Flip flops (b) Realize D and T flip flops using Jk flip flops
4. Design a sequential circuit using JK flip-flop for the following state table [use state

diagram]

Present state	Next state		Output	
AB	X=0	X=1	X=0	X=1
00	00	11	1	0
01	01	11	1	1
10	01	00	1	0
11	11	10	0	0

5. Design a counter with the following repeated binary sequence:0, 1, 2, 3, 4, 5, 6.use JK Flip-flop.
6. Design a 3 bit synchronous gray code counter using flip flop.
7. Draw and explain the block diagram of Mealy circuit.
8. Using positive edge triggering SR flip-flops design a counter which counts in the following sequence: 000,111,110,101,100,011,010,001,000,…

UNIT-IV

PROGRAMMABLE LOGIC DEVICES, MEMORY AND LOGIC FAMILIES

TWO MARKS

1. Explain ROM

A read only memory (ROM) is a device that includes both the decoder and the OR gates within a single IC package. It consists of n input lines and m output lines. Each bit Combination of the input variables is called an address. Each bit combination that comes out of the output lines is called a word. The number of distinct addresses possible with n input variables is 2n.

2. What are the types of ROM?

1. PROM
2. EPROM
3. EEPROM

3. Explain PROM.

PROM (Programmable Read Only Memory) it allows user to store data or program. PROMs use the fuses with materiallike nichrome and polycrystalline. The user can blow these fuses by passingaround 20 to 50 mA of current for the period 5 to 20μs.The blowing of fuses is called programming of ROM. The PROMs are one time programmable. Once programmed, the information is stored permanent.

4. Explain EPROM.

EPROM (Erasable Programmable Read Only Memory) EPROM use MOS circuitry. They store 1's and 0's as a packet of charge in a buried layer of the IC chip. We can erase the stored data in the EPROMs by exposing the chip to ultraviolet light via its quartz window for 15 to 20 minutes. It is not possible to erase selective information. The chip can be reprogrammed.

5. Explain EEPROM.

EEPROM (Electrically Erasable Programmable Read Only Memory). EEPROM also use MOS circuitry. Data is stored as charge or no charge on an insulated layer or an insulated floating gate in the device. EEPROM allows selective erasing at the register level rather than erasing all the information since the information can be changed by using electrical signals.

6. **Define address and word:**

In a ROM, each bit combination of the input variable is called on address. Each bit combination that comes out of the output lines is called a word.

7. What are the types of ROM.?

1. Masked ROM.
2. Programmable Read only Memory
3. Erasable Programmable Read only memory.
4. Electrically Erasable Programmable Read only Memory.

8. What is programmable logic array? How it differs from ROM?

In some cases the number of don't care conditions is excessive, it is more economical to use a second type of LSI component called a PLA. A PLA is similar to a ROM in concept; however it does not provide full decoding of the variables and does not generates all the minterms as in the ROM.

9. What is mask - programmable?

With a mask programmable PLA, the user must submit a PLA program table to the manufacturer.

10. What is field programmable logic array?

The second type of PLA is called a field programmable logic array. The user by means of certain recommended procedures can program the EPLA.

11. List the major differences between PLA and PAL

PLA: Both AND and OR arrays are programmable and Complex Costlier than PAL

PAL:AND arrays are programmable OR arrays are fixed Cheaper and Simpler

12. Define PLD.

Programmable Logic Devices consist of a large array of AND gates and OR gates that can be programmed to achieve specific logic functions.

13. Give the classification of PLDs.

PLDs are classified as PROM (Programmable Read Only Memory), Programmable Logic Array (PLA), Programmable Array Logic (PAL), and Generic Array Logic (GAL)

14. Define PROM.

PROM is Programmable Read Only Memory. It consists of a set of fixed AND gates Connected to a decoder and a programmable OR array.

15. Define PLA.

PLA is Programmable Logic Array (PLA). The PLA is a PLD that consists of a Programmable AND array and a programmable OR array.

16. Define PAL.

PAL is Programmable Array Logic. PAL consists of a programmable AND array and a fixed OR array with output logic.

17. Why was PAL developed?

It is a PLD that was developed to overcome certain disadvantages of PLA, such as longer delays due to additional fusible links that result from using two programmable arrays and more circuit complexity.

18. Define GAL.

GAL is Generic Array Logic. GAL consists of a programmable AND array and a fixed OR array with output logic.

19. Why the input variables to a PAL are buffered

The input variables to a PAL are buffered to prevent loading by the large number of AND gate inputs to which available or its complement can be connected.

20. What does PAL 10L8 specify?

PAL - Programmable Logic Array

10 - Ten inputs

L - Active LOW Ouput

8 - Eight Outputs

21. What is CPLD?

CPLDs are Complex Programmable Logic Devices. They are larger versions of PLDs with a centralized internal interconnect matrix used to connect the device macro cells together.

22. Define bit, byte and word.

The smallest unit of binary data is bit. Data are handled in a 8 bit unit called byte. A complete unit of information is called a word which consists of one or more bytes.

23. How many words can a 16x8 memory can store?

A 16x8 memory can store 16,384 words of eight bits each

24. Define address of a memory.

The location of a unit of data in a memory is called address.

25. What is Read and Write operation?

The Write operation stores data into a specified address into the memory and the Read operation takes data out of a specified address in the memory.

26. Why RAMs are called as Volatile?

RAMs are called as Volatile memories because RAMs lose stored data when the power is turned OFF.

27. Define ROM.

ROM is a type of memory in which data are stored permanently or semi permanently. Data can be read from a ROM, but there is no write operation.

28. Define RAM.
RAM is Random Access Memory. It is a random access read/write memory. The data can be read or written into from any selected address in any sequence.
29. Define Static RAM and dynamic RAM.
Static RAM use flip flops as storage elements and therefore store data indefinitely as long as dc power is applied. Dynamic RAMs use capacitors as storage elements and cannot retain data very long without capacitors being recharged by a process called refreshing.
30. List the two types of SRAM.
Asynchronous SRAMs and Synhronous Burst SRAMs
31. List the basic types of DRAMs.
Fast Page Mode DRAM,Extended Data Out DRAM(EDO DRAM),Burst EDO
DRAM and Synchronous DRAM.
32. Define a bus.
A bus is a set of conductive paths that serve to interconnect two or more functional components of a system or several diverse systems.
33. Define Cache memory.
It is a relatively small, high-speed memory that can store the most recently used instructions or data from larger but slower main memory.
34. What is the technique adopted by DRAMs.
DRAMs use a technique called address multiplexing to reduce the number of address lines.
35.Give the feature of UV EPROM.
UV EPROM is electrically programmable by the user, but the store data must be erased by exposure to ultra violet light over a period of several minutes.
36. Give the feature of flash memory.
The ideal memory has high storage capacity, non-volatility; in-system read and write capability, comparatively fast operation. The traditional memory technologies such as ROM, PROM, EEPROM individually exhibits one of these characteristics, but no single technology has all of them except the flash memory.
37. What are Flash memories?
They are high density read/write memories that are non-volatile, which means data can be stored indefinitely with out power.
38. List the three major operations in a flash memory.
Programming, Read and Erase operation
39. What is a FIFO memory?
The term FIFO refers to the basic operation of this type of memory in which the first
data bit written into the memory is to first to be read out.
40. List basic types of programmable logic devices.
1. Read only memory 2. Programmable logic Array
3. Programmable Array Logic
41. Define address and word.
In a ROM, each bit combination of the input variable is called on address. Each bit combination that comes out of the output lines is called a word.
42. What is programmable logic array? How it differs from ROM?
In some cases the number of don’t care conditions is excessive, it is more economical to use a second type of LSI component called a PLA. A PLA is similar to a ROM in concept; however it does not provide full decoding of the variables and does not generates all the minterms as in the ROM.
43. What is mask - programmable?
With a mask programmable PLA, the user must submit a PLA PLA program table to
the manufacturer.

44. Give the comparison between PROM and PLA.

PROM PLA

1. And array is fixed and OR Both AND and OR arrays are array is programmable. Programmable.

2. Cheaper and simple to use. Costliest and complex than PROMS.

PART B

1) **Explain in detail about PLA with a specific example**
2) **Implement the following using a mux F(a,b,c,d) = _(0,1,3,4,8,9,15)**
3) **Explain with neat diagrams RAM architecture**
4) **Explain in detail about PLA and PAL.**
5) **Explain with neat diagrams a ROM architecture**
6) **Explain in detail about PAL with a specific example**

EE6301 DIGITAL LOGIC CIRCUITS

UNIT-I NUMBERING SYSTEMS AND DIGITAL LOGIC FAMILIES

1) What are basic properties of Boolean algebra?

The basic properties of Boolean algebra are commutative property, associative Property and distributive property.

2) State the associative property of boolean algebra.

The associative property of Boolean algebra states that the OR ing of several variables results in the same regardless of the grouping of the variables. The associative property is stated as follows: A+ (B+C) = (A+B) +C

3) State the commutative property of Boolean algebra.

The commutative property states that the order in which the variables are OR ed makes no difference. The commutative property is: A+B=B+A

4) State the distributive property of Boolean algebra.

The distributive property states that AND ing several variables and OR ing the result With a single variable is equivalent to OR ing the single variable with each of the the several Variables and then AND ing the sums. The distributive property is: A+BC= (A+B) (A+C)

5) State the absorption law of Boolean algebra.

The absorption law of Boolean algebra is given by X+XY=X, X(X+Y) =X.

6) State De Morgan's theorem.

De Morgan suggested two theorems that form important part of Boolean algebra. They are,

1) The complement of a product is equal to the sum of the complements. (AB)' = A' + B'

2) The complement of a sum term is equal to the product of the complements. (A + B)' = A'B'

7) Reduce A (A + B)

A (A + B) = AA + AB= A (1 + B) [1 + B = 1]= A.

8) Reduce A'B'C' + A'BC' + A'BC

A'B'C' + A'BC' + A'BC = A'C'(B' + B) + A'B'C

= A'C' + A'BC [A + A' = 1]

= A'(C' + BC)

= A'(C' + B) [A + A'B = A + B]

9) Reduce AB + (AC)' + AB'C (AB + C)

AB + (AC)' + AB'C (AB + C) = AB + (AC)' + AAB'BC + AB'CC

= AB + (AC)' + AB'CC [A.A' = 0]

= AB + (AC)' + AB'C [A.A = 1]

= AB + A' + C' =AB'C [(AB)' = A' + B']

= A' + B + C' + AB'C [A + AB' = A + B]

= A' + B'C + B + C' [A + A'B = A + B]

$= A' + B + C' + B'C$
$=A' + B + C' + B'$
$=A' + C' + 1$
$= 1$ [A + 1 =1]

10) Simplify the following expression Y = (A + B) (A + C') (B' + C')

$Y = (A + B) (A + C') (B' + C')$
$= (AA' + AC +A'B +BC) (B' + C')$ [A.A' = 0]
$= (AC + A'B + BC) (B' + C')$
$= AB'C + ACC' + A'BB' + A'BC' + BB'C + BCC'$
$= AB'C + A'BC'$

11) Show that (X + Y' + XY) (X + Y') (X'Y) = 0

$(X + Y' + XY)(X + Y')(X'Y) = (X + Y' + X) (X + Y') (X' + Y)$ [A + A'B = A + B]
$= (X + Y') (X + Y') (X'Y)$ [A + A = 1]
$= (X + Y') (X'Y)$ [A.A = 1]
$= X.X' + Y'.X'.Y$
$= 0$ [A.A' = 0]

12) Prove that ABC + ABC' + AB'C + A'BC = AB + AC + BC

$ABC + ABC' + AB'C + A'BC=AB(C + C') + AB'C + A'BC$
$=AB + AB'C + A'BC$
$=A(B + B'C) + A'BC$
$=A(B + C) + A'BC$
$=AB + AC + A'BC$
$=B(A + C) + AC$
$=AB + BC + AC$
$=AB + AC +BC$ ...Proved

13) Convert the given expression in canonical SOP form Y = AC + AB + BC

$Y = AC + AB + BC$
$=AC (B + B') + AB (C + C') + (A + A') BC$
$=ABC + ABC' + AB'C + AB'C' + ABC + ABC' + ABC$
$=ABC + ABC' +AB'C + AB'C'$ [A + A =1]

14) Define duality property.

Duality property states that every algebraic expression deducible from the postulates Of Boolean algebra remains valid if the operators and identity elements are interchanged. If the dual of an algebraic expression is desired, we simply interchange OR and AND operators and replace 1's by 0's and 0's by 1's.

15) Find the complement of the functions F1 = x'yz' + x'y'z and F2 = x (y'z' + yz). By applying De-Morgan's theorem.

$F1' = (x'yz' + x'y'z)' = (x'yz')'(x'y'z)' = (x + y' + z)(x + y +z')$

$F2' = [x (y'z' + yz)]' = x' + (y'z' + yz)'$
$= x' + (y'z')'(yz)'$
$= x' + (y + z) (y' + z')$

16) Simplify the following expression

Y = (A + B) (A = C) (B + C)
$= (A A + A C + A B + B C) (B + C)$
$= (A C + A B + B C) (B + C)$
$= A B C + A C C + A B B + A B C + B B C + B C C = A B C$

17) What are the methods adopted to reduce Boolean function?

i) Karnaug map ii) Tabular method or Quine Mc-Cluskey method
iii) Variable entered map technique.

18) State the limitations of karnaugh map.

i) Generally it is limited to six variable map (i.e) more then six variable involving expression are not reduced.

ii) The map method is restricted in its capability since they are useful for simplifying only Boolean expression represented in standard form.

19) What is a karnaugh map?

A karnaugh map or k map is a pictorial form of truth table, in which the map diagram is made up of squares, with each squares representing one minterm of the function.44) Find the minterms of the logical expression

$Y = A'B'C' + A'B'C + A'BC + ABC'$
$Y = A'B'C' + A'B'C + A'BC + ABC'$
$=m0 + m1 +m3 +m6$
=_m (0, 1, 3, 6)

20) Write the maxterms corresponding to the logical expression

Y = (A + B + C') (A + B' + C') (A' + B' + C)
$= (A + B + C') (A + B' + C') (A' + B' + C)$
=M1.M3.M6
= M (1, 3, 6)

<u>PART-B</u>

1. Design a 4-bit binary adder/ subtractor circuit.
a) Basic equations. (4)
b) Comparison of equations. (4)
c) Design using twos complement Circuit diagram. (8)
2. Design a half adder using NAND – NAND logic. (16)
3. Explain how a full adder can be built using two half adders. (16)
4. Design a half adder using at most three NOR gates. (16)
5. Using 8 to 1 multiplexer, realize the Boolean function
$T = f(w, x, y, z) = \Sigma(0,1,2,4,5,7,8,9,12,13)$ (16)
6. Design a 8421 to gray code converter. (16)

7. Draw the logic diagram of full subtractor and explain its operation. (16)
8. Draw the circuit diagram of NMOS NAND gate and explain its operation. (16)
9. a) Design a full adder circuit using only NOR gates. (4)
b) Draw the circuit of a CMOS two inputs NAND gate (12)

UNIT-II
COMBINATIONAL CIRCUITS

1) What are called don't care conditions?

In some logic circuits certain input conditions never occur, therefore the Corresponding output never appears. In such cases the output level is not defined, it can be either high or low. These output levels are indicated by 'X' or'd' in the truth tables and are called don't care conditions or incompletely specified functions.

2) What is a prime implicant?

A prime implicant is a product term obtained by combining the maximum possible number of adjacent squares in the map.

3) What is an essential implicant?

If a min term is covered by only one prime implicant, the prime implicant is said to be Essential.

4) Define combinational logic.

When logic gates are connected together to produce a specified output for certain specified combinations of input variables, with no storage involved, the resulting circuit is called combinational logic.

5) Write the design procedure for combinational circuits.

- The problem definition
- Determine the number of available input variables & required O/P variables.
- Assigning letter symbols to I/O variables
- Obtain simplified Boolean expression for each O/P.
- Obtain the logic diagram.

6) Define half adder and full adder.

The logic circuit that performs the addition of two bits is a half adder. The circuit that Performs the addition of three bits is a full adder.

7) Define Decoder.

A decoder is a multiple - input multiple output logic circuit that converts coded inputs into coded outputs where the input and output codes are different.

8) What is binary decoder?

A decoder is a combinational circuit that converts binary information from n input lines to a maximum of 2n out puts lines.

9) Define Encoder.

An encoder has 2n input lines and n output lines. In encoder the output lines generate the binary code corresponding to the input value.

10) What is priority Encoder?

A priority encoder is an encoder circuit that includes the priority function. In priority encoder, if 2 or more inputs are equal to 1 at the same time, the input having the highest priority will take precedence.

12) Define multiplexer.

Multiplexer is a digital switch. If allows digital information from several sources to be routed onto a single output line.

13) What do you mean by comparator?

A comparator is a special combinational circuit designed primarily to compare the relative magnitude of two binary numbers.

14) Write down the steps in implementing a Boolean function with levels of NAND Gates.

- Simplify the function and express it in sum of products.
- Draw a NAND gate for each product term of the expression that has at least two Literals.
- The inputs to each NAND gate are the literals of the term.
- This constitutes a group of first level gates.
- Draw a single gate using the AND-invert or the invert- OR graphic symbol in the second level, with inputs coming from outputs of first level gates.
- A term with a single literal requires an inverter in the first level. How ever if the single literal is complemented, it can be connected directly to an input of the second level NAND gate.

15) Give the general procedure for converting a Boolean expression in to multilevel NAND diagram?

- Draw the AND-OR diagram of the Boolean expression.
- Convert all AND gates to NAND gates with AND-invert graphic symbols.
- Convert all OR gates to NAND gates with invert-OR graphic symbols.
- Check all the bubbles in the same diagram. For every bubble that is not compensated by another circle along the same line, insert an inverter or complement the input literal.

PART-B

1) i) Realize a JK flip flop using SR flip flop. (8)
ii) Realize a SR flip flop using NAND gates and explain its operation. (8)
2) Explain various steps in the analysis of synchronous sequential circuits with suitable example.
3) i) Distinguish between a combinational logic circuit and a sequential logic circuit. (4)
ii) Derive the characteristic equation of SR flip flop T1 PG 257. (8)
iii) Using a JK flip flop, explain how a D flip flop can be obtained. (4)
4) Design a four state down counter using T flip flop. (16)
5) Design a 4-bit synchronous 8421 decade counter with ripple carry. (16)

6) Design a synchronous 3-bit gray code up counter with the help of excitation table. (16)
7) Describe the input and output action of JK master/slave flip flops. (16)
8) Design a MOD-10 synchronous counter using JK flip flops. (16)
9) Realize SR neither flip flop using NOR gates and explain its operation. (16)

UNIT-III
SYNCHRONOUS SEQUENTIAL CIRCUITS

1. What are the classifications of sequential circuits?

The sequential circuits are classified on the basis of timing of their signals into two types. They are, 1) Synchronous sequential circuit. 2) Asynchronous sequential circuit.

2. Define Flip flop.

The basic unit for storage is flip flop. A flip-flop maintains its output state either at 1 or 0 until directed by an input signal to change its state.

3. What are the different types of flip-flop?

There are various types of flip flops. Some of them are mentioned below they are,

(1) RS flip-flop (2) SR flip-flop (3) D flip-flop
(4) JK flip-flop (5) T flip-flop

4. What is the operation of RS flip-flop?

- When R input is low and S input is high the Q output of flip-flop is set.
- When R input is high and S input is low the Q output of flip-flop is reset.
- When both the inputs R and S are low the output does not change
- When both the inputs R and S are high the output is unpredictable.

5. What is the operation of SR flip-flop?

- When R input is low and S input is high the Q output of flip-flop is set.
- When R input is high and S input is low the Q output of flip-flop is reset.
- When both the inputs R and S are low the output does not change.
- When both the inputs R and S are high the output is unpredictable.

6. What is the operation of D flip-flop?

In D flip-flop during the occurrence of clock pulse if D=1, the output Q is set and if D=0, the output is reset.

7. What is the operation of JK flip-flop?

- When K input is low and J input is high the Q output of flip-flop is set.
- When K input is high and J input is low the Q output of flip-flop is reset.
- When both the inputs K and J are low the output does not change
- When both the inputs K and J are high it is possible to set or reset the Flip-flop (ie) the output toggle on the next positive clock edge.

8. What is the operation of T flip-flop?

T flip-flop is also known as Toggle flip-flop.

- When T=0 there is no change in the output.
- When T=1 the output switch to the complement state (ie) the output toggles.

9. Define race around condition.

In JK flip-flop output is fed back to the input. Therefore change in the output results change in the input. Due to this in the positive half of the clock pulse if both J and K are high then output toggles continuously. This condition is called race around condition'.

10. What is edge-triggered flip-flop?

The problem of race around condition can solved by edge triggering flip flop. The term edge triggering means that the flip-flop changes state either at the positive edge or negative edge of the clock pulse and it is sensitive to its inputs only at this transition of the clock.

11. What is a master-slave flip-flop?

A master-slave flip-flop consists of two flip-flops where one circuit serves as a master and the other as a slave.

12. Explain the flip-flop excitation tables for RS FF.

In RS flip-flop there are four possible transitions from the present state to the next state. They are,

- _ 0_0 transition: This can happen either when R=S=0 or when R=1 and S=0.
- _ 0_1 transition: This can happen only when S=1 and R=0.
- _ 1_0 transition: This can happen only when S=0 and R=1.
- _ 1_1 transition: This can happen either when S=1 and R=0 or S=0 and R=0.

13. Explain the flip-flop excitation tables for JK flip-flop

In JK flip-flop also there are four possible transitions from present state to next state. They are,

- _ 0_0 transition: This can happen when J=0 and K=1 or K=0.
- _ 0_1 transition: This can happen either when J=1 and K=0 or when J=K=1.
- _ 1_0 transition: This can happen either when J=0 and K=1 or when J=K=1.
- _ 1_1 transition: This can happen when K=0 and J=0 or J=1.

14. Explain the flip-flop excitation tables for D flip-flop

In D flip-flop the next state is always equal to the D input and it is independent of the present state. Therefore D must be 0 if Qn+1 has to 0, and if Qn+1 has to be 1 regardless the value of Qn.

15. Explain the flip-flop excitation tables for T flip-flop

When input T=1 the state of the flip-flop is complemented; when T=0, the state of the Flip-flop remains unchanged. Therefore, for 0_0 and 1_1 transitions T must be 0 and for 0_1 and 1_0 transitions must be 1.

16. Define sequential circuit.

In sequential circuits the output variables dependent not only on the present input variables but they also depend up on the past history of these input variables.

17. Give the comparison between combinational circuits and sequential circuits.

Combinational circuits Sequential circuits Memory unit is not required Memory unity is Required Parallel adder is a combinational circuit Serial adder is a sequential circuit.

18. What do you mean by present state?

The information stored in the memory elements at any given time define.s the present state of the sequential circuit.

19. What do you mean by next state?

The present state and the external inputs determine the outputs and the next state of the sequential circuit.

20. State the types of sequential circuits?

1. Synchronous sequential circuits 2. Asynchronous sequential circuits

21. Define synchronous sequential circuit

In synchronous sequential circuits, signals can affect the memory elements only at discrete instant of time.

22. Define Asynchronous sequential circuit?

In asynchronous sequential circuits change in input signals can affect memory element at any instant of time.

23. Give the comparison between synchronous & Asynchronous sequential circuits?

Synchronous sequential circuits Asynchronous sequential circuits. Memory elements are locked flip-flops Memory elements are either unlocked flip - flops or time delay elements.

24. What is race around condition?

In the JK latch, the output is feedback to the input, and therefore changes in the output results change in the input. Due to this in the positive half of the clock pulse if J and K are both high then output toggles continuously. This condition is known as race around condition.

25. Give the comparison between synchronous & Asynchronous counters.

Asynchronous counters

- In this type of counter flip-flops are Connected in such a way that output of 1st Flip-flop drives the clock for the next Flipflop
- All the flip-flops are not clocked Simultaneously

Synchronous counters

- In this type there is no connection between output of first flip-flop and clock input of the next flip – flop
- All the flip-flops are clocked simultaneously

PART B

1. Explain with neat diagram the different hazards and the way to eliminate them. (16)
2. State with a neat example the method for the minimization of primitive flow table. (16)
3. a) Explain in detail about Races. (6)
b) Explain the different methods of state assignment . (10)
4. a) Explain the fundamental mode asynchronous sequential circuit. (8)
b) Briefly explain the pulse mode asynchronous sequential circuit. (8)
5.What are the steps in the analysis and design of asynchronous sequential circuits? Explain with an example. (16)

UNIT-IV
ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES

1. What is ROM?

A read only memory (ROM) is a device that includes both the decoder and the OR gates within a single IC package. It consists of n input lines and m output lines. Each bit Combination of the input variables is called an address. Each bit combination that comes out of the output lines is called a word. The number of distinct addresses possible with n input variables is 2n.

2. What are the types of ROM?

1. PROM 2. EPROM 3. EEPROM

3. What is PROM?

PROM (Programmable Read Only Memory) it allows user to store data or program. PROMs use the fuses with materiallike nichrome and polycrystalline. The user can blow these fuses by passing around 20 to 50 mA of current for the period 5 to 20μs.The blowing of fuses is called programming of ROM. The PROMs are one time programmable. Once programmed, the information is stored permanent.

4. What is EPROM?

EPROM (Erasable Programmable Read Only Memory) EPROM use MOS circuitry. They store 1's and 0's as a packet of charge in a buried layer of the IC chip. We can erase the stored data in the EPROMs by exposing the chip to ultraviolet light via its quartz window for 15 to 20 minutes. It is not possible to erase selective information. The chip can be reprogrammed.

5. What is EEPROM?

EEPROM (Electrically Erasable Programmable Read Only Memory). EEPROM also use MOS circuitry. Data is stored as charge or no charge on an insulated layer or an insulated floating gate in the device. EEPROM allows selective erasing at the register level rather than erasing all the information since the information can be changed by using electrical signals.

6**. Define address and word:**

In a ROM, each bit combination of the input variable is called on address. Each bit combination that comes out of the output lines is called a word.

7. What are the types of ROM.?

1. Masked ROM. 2. Programmable Read only Memory
3. Erasable Programmable Read only memory.
4. Electrically Erasable Programmable Read only Memory.

8. What is programmable logic array? How it differs from ROM?

In some cases the number of don't care conditions is excessive, it is more economical to use a second type of LSI component called a PLA. A PLA is similar to a ROM in concept; however it does not provide full decoding of the variables and does not generates all the min terms as in the ROM.

9. What is mask - programmable?

With a mask programmable PLA, the user must submit a PLA program table to the manufacturer.

10. What is field programmable logic array?

The second type of PLA is called a field programmable logic array. The user by means of certain recommended procedures can program the EPLA.

11. List the major differences between PLA and PAL

PLA: Both AND and OR arrays are programmable and Complex Costlier than PAL

PAL:AND arrays are programmable OR arrays are fixed Cheaper and Simpler

12. Define PLD.

Programmable Logic Devices consist of a large array of AND gates and OR gates that Can be programmed to achieve specific logic functions.

13. Give the classification of PLDs.

PLDs are classified as PROM (Programmable Read Only Memory), Programmable Logic Array (PLA), Programmable Array Logic (PAL), and Generic Array Logic (GAL)

14. Define PROM.

PROM is Programmable Read Only Memory. It consists of a set of fixed AND gates Connected to a decoder and a programmable OR array.

15. Define PLA.

PLA is Programmable Logic Array (PLA). The PLA is a PLD that consists of a Programmable AND array and a programmable OR array.

16. Define PAL.

PAL is Programmable Array Logic. PAL consists of a programmable AND array and a fixed OR array with output logic.

17. Why was PAL developed?

It is a PLD that was developed to overcome certain disadvantages of PLA, such as longer delays due to additional fusible links that result from using two programmable arrays and more circuit complexity.

18. Define GAL.

GAL is Generic Array Logic. GAL consists of a programmable AND array and a fixed OR array with output logic.

19. Why the input variables to a PAL are buffered

The input variables to a PAL are buffered to prevent loading by the large number of AND gate inputs to which available or its complement can be connected.

20. What does PAL 10L8 specify?

PAL - Programmable Logic Array
10 - Ten inputs
L - Active LOW Ouput
8 - Eight Outputs

21. What is CPLD?

CPLDs are Complex Programmable Logic Devices. They are larger versions of PLDs with a centralized internal interconnect matrix used to connect the device macro cells together.

22. Define bit, byte and word.

The smallest unit of binary data is bit. Data are handled in a 8 bit unit called byte. A complete unit of information is called a word which consists of one or more bytes.

23. How many words can a 16x8 memory can store?

A 16x8 memory can store 16,384 words of eight bits each

24. Define address of a memory.

The location of a unit of data in a memory is called address.

25. What is Read and Write operation?

The Write operation stores data into a specified address into the memory and the Read operation takes data out of a specified address in the memory.

26. Why RAMs are called as Volatile?

RAMs are called as Volatile memories because RAMs lose stored data when the power is turned OFF.

27. Define ROM.

ROM is a type of memory in which data are stored permanently or semi permanently. Data can be read from a ROM, but there is no write operation.

28. Define RAM.

RAM is Random Access Memory. It is a random access read/write memory. The data can be read or written into from any selected address in any sequence.

29. Define Static RAM and dynamic RAM.

Static RAM use flip flops as storage elements and therefore store data indefinitely as long as dc power is applied. Dynamic RAMs use capacitors as storage elements and cannot retain data very long without capacitors being recharged by a process called refreshing.

30. List the two types of SRAM.

Asynchronous SRAMs and Synhronous Burst SRAMs

31. List the basic types of DRAMs.

Fast Page Mode DRAM,Extended Data Out DRAM(EDO DRAM),Burst EDO DRAM and Synchronous DRAM.

32. Define a bus.

A bus is a set of conductive paths that serve to interconnect two or more functional components of a system or several diverse systems.

33. Define Cache memory.

It is a relatively small, high-speed memory that can store the most recently used instructions or data from larger but slower main memory.

34. What is the technique adopted by DRAMs.

DRAMs use a technique called address multiplexing to reduce the number of address lines.

35.Give the feature of UV EPROM.

UV EPROM is electrically programmable by the user, but the store data must be erased by exposure to ultra violet light over a period of several minutes.

36. Give the feature of flash memory.

The ideal memory has high storage capacity, non-volatility; in-system read and write capability, comparatively fast operation. The traditional memory technologies such as ROM, PROM, EEPROM individually exhibits one of these characteristics, but no single technology has all of them except the flash memory.

37. What are Flash memories?

They are high density read/write memories that are non-volatile, which means data can be stored indefinitely with out power.

38. List the three major operations in a flash memory.

Programming, Read and Erase operation

39. What is a FIFO memory?

The term FIFO refers to the basic operation of this type of memory in which the first data bit written into the memory is to first to be read out.

40. List basic types of programmable logic devices.

1. Read only memory 2. Programmable logic Array 3. Programmable Array Logic

PART B

1. a) Explain the operation of bipolar Ram cell with suitable diagram.
   b) Explain the different types of ROM.
2. What is Ram? Explain the different types of RAM in detail.
3. Draw the circuit of a NMOS two input NOR gate and explain its operation.
4. Discuss about the TTL parameters. Draw the TTL inverter circuit.
5. a) Draw the circuit of TTL NAND gate and explain its operation.
   b) Draw the circuit of NMOS NAND gate and explain its operation.
6. Draw the ECL circuit and explain its operation clearly.
7. Explain the totem circuit of TTL logic family.

UNIT-V
VHDL

1. What is Verilog?

Verilog is a general purpose hardware descriptor language. It is similar in syntax to the C programming language. It can be used to model a digital system at many levels of abstraction anging from the algorithmic level to the switch level.

2. What are the various modeling used in Verilog?

1. Gate-level modeling 2. Data-flow modeling
3. Switch-level modeling 4. Behavioral modeling

3. What is the structural gate-level modeling?

Structural modeling describes a digital logic networks in terms of the components that wake up the system. Gate-level modeling is based on using primitive logic gates and specifying how they are wired together.

4. What is Switch-level modeling?

Verilog allows switch-level modeling that is based on the behavior of MOSFETs. Digital circuits at the MOS-transistor level are described using the MOSFET switches.

5. What are identifiers?

Identifiers are names of modules, variables and other objects that we can reference in the design. Identifiers consists of upper and lower case letters, digits 0 through 9, the underscore character(_) and the dollar sign($). It must be a single group of characters. Examples: A014, a, b, in_o, s_out

6. What are the value sets in Verilog?

Verilog supports four levels for the values needed to describe hardware referred to as value sets.

Value levels Condition in hardware circuits

- 0 Logic zero, false condition
- 1 Logic one, true condition
- X Unknown logic value
- Z High impedance, floating state

7. What are the types of gate arrays in ASIC?

1) Channeled gate arrays 2) Channel less gate arrays 3) Structured gate arrays

8. Give the classifications of timing control

Methods of timing control:

1. Delay-based timing control 2. Event-based timing control
3. Level-sensitive timing control

Types of delay-based timing control:

1. Regular delay control 2. Intra-assignment delay control
3. Zero delay control

Types of event-based timing control:

1. Regular event control 2. Named event control
3. Event OR control 4. Level-sensitive timing control

9 .Give the different arithmetic operators?

Operator symbol Operation performed Number of operands

* Multiply Two
/ Divide Two
+ Add Two
- Subtract Two
% Modulus Two
** Power (exponent) Two

10. Give the different bitwise operators.

Operator symbol Operation performed Number of operands

~ Bitwise negation One
& Bitwise and Two
| Bitwise or Two
^ Bitwise xor Two
^~ or ~^ Bitwise xnor Two
~& Bitwise nand Two
~| Bitwise nor Two

11. What are gate primitives?

Verilog supports basic logic gates as predefined primitives. Primitive logic function keyword provides the basics for structural modeling at gate level. These primitives are instantiated like modules except that they are predefined in verilog and do not need a module definition. The important operations are and, nand, or, xor, xnor, and buf(non-inverting drive buffer).

12. Give the two blocks in behavioral modeling.

1. An initial block executes once in the simulation and is used to set up initial conditions and step-by-step data flow.
2. An always block executes in a loop and repeats during the simulation.

13. What are the types of conditional statements?

1. No else statement
   Syntax: if ([expression]) true – statement;
2. One else statement
   Syntax: if ([expression]) true – statement;
   else false-statement;
3. Nested if-else-if
   Syntax : if ([expression1]) true statement 1;
   else if ([expression2]) true-statement 2;
   else if ([expression3]) true-statement 3;
   else default-statement;

PART B

1. Explain the various modeling methods used in VHDL with an example. (16)
2. Explain in detail about the principal of operation of VHDL Simulator. (16)
3. Write the VHDL program for 4 bit counter. (16)
4. Write the VHDL program for full adder in all three types of modeling? (16)
5. Write VHDL program for 4:1 MUX using behavioral modeling. (16)
6. Write VHDL program for encoder and decoder using structural modeling. (16)
7. With an example explain in detail the test bench creation. (16)
8. Write a verilog program for

1) Full Adder. (8)
2) Shift Register. (8)

ELECTROMAGNETIC THEORY

UNIT I

INTRODUCTION

1. Define scalar field?

A field is a system in which a particular physical function has a value at each and every point in that region. The distribution of a scalar quantity with a defined position in a space is called scalar field.

Ex: Temperature of atmosphere.

2. Define Vector field?

If a quantity which is specified in a region to defined a field is a vector then the corresponding field is called vector field.

3. Define scaling of a vector?

This is nothing but, multiplication of a scalar with a vector. Such a multiplication changes the magnitude of a vector but not the direction.

4. What are co-planar vector?

The vectors which lie in the same plane are called co-planar vectors.

5. What is an identical vector?

Two vectors are said to be identical if there difference is zero. Thus A and B are

identical if A B 0, *i.e*, A B . Such two vectors are also called as equal vectors.

6. Define base vectors?

The base vectors are the unit vectors which are strictly oriented along the directions

of the coordinate axes of the given coordinate system.

7. What is a position vector?

Consider a point $p(x, y, z)$ are Cartesian coordinate system. Then the position vector of point p is represented by the distance of point p from the origin directed from origin to point. This is also called as radius vector.

8. Define scalar product of vectors?

The scalar of the two vectors $A$and B is denoted as $A.B$ and defined as the product of the magnitude of A and magnitude of B and the cosine of angle between them.

$A.B \quad A \| B \cos AB$

9. Define Divergence.

Divergence is defined as the net outward flow of the flux per unit volume over a closed incremental surface.

10. State Divergence Theorem.

The integral of the normal component of any vector field over a closed surface is equal to the integral of the divergence of this vector field throughout the volume enclosed that closed surface.

13. What is physical significance of curl of a vector field?

Curl gives rate of rotation. Curl F gives work done per unit area.

14. What is physical significance of divergence?

Divergence of current density gives net outflow of current per unit volume .Divergence of flux density gives net outflow per unit volume. In general, divergence of any field density gives net outflow of that field per unit volume.

15. State the conditions for a field to be a) solenoidal b) irrotational.

a) Divergence of the field has to be zero.

b) Curl of the field has to be zero.

16. Define scalar and vector quantity?

The scalar is a quantity whose value may be represented by a single real number which may be positive or negative.e.g, temperature, mass, volume, density

A quantity which has both a magnitude and a specified direction in space is called a vector.e.g.force, velocity, displacement, acceleration.

17. How to represent a vector.

A vector can be represented by a straight line with an arrow in a plane. The length of the segment is the magnitude of a vector while the arrow indicates the direction of a vector. $\overline{OA}$

18. What is a unit vector? What is its function while representing a vector?

A unit vector has a function to indicate the direction. Its magnitude is always unity, irrespective of the direction which it indicates and the coordinate system under consideration.

19. Name 3 coordinate systems used in electromagnetic engineering?
    1) Cartesian or rectangular coordinate system.
    2) Cylindrical coordinate system.
    3) Spherical coordinate system.

20. How to represent a point in a Cartesian system?

A point in rectangular coordinate system is located by three coordinates namely x, y and z coordinates. The point can be reached by moving from origin, the distance x in x direction then the distance y in y direction and finally z in z direction.

21. What is separation of vector?

The distance vector is also called as separation vector. Distance vector is nothing but the length of the vector.

22. State the relation between Cartesian and cylindrical coordinate system?

$x\ r \cos$

$y\ r \sin$

$z\ z$

23. Show how a point p represented in a spherical coordinate system.

The point p can be defined as the intersection of three surfaces in spherical coordinate system.

r - Constant which is a sphere with centre as origin

θ – Constant which is a right circular cone with apex as origin and axis as z axis. Φ – Constant is a plane perpendicular to xy plane.

24. State the relationship between Cartesian and spherical system?

x=r sin θ cos Φ

y= r sin θ sin

Φ z=r cos θ

Now r can be expressed as

$x^2 + y^{2+} z2 = r^2 \sin^2 \theta \cos2 \Phi + r^2 \sin^2 \theta \sin^2 \Phi + r^2 \cos^2 \theta$

$= r^2 \sin^2 \theta [\sin^2 \Phi + \cos^2 \Phi] + r^2 \cos^2 \theta$
$= r^2 [\sin^2 \theta + \cos^2 \theta]$
$= r^2$

25. What is dot product?

Dot product is also called as scalar product. It is defined as the product of the magnitude of *A* and magnitude of *B* and cosine of the smallest angle between them.

$A.B \quad |A||B| \cos ABan$

26. State dot product properties.

1) It obeys commutative law. $A.B \quad B.A$

2) It obeys distributive law. $A.(B \quad C) \quad A.B \quad A.C$

3) If the dot product with itself is performed the result is square of the magnitude of that vector $A.A\,|A|^2$

4) Any unit vector dotted with itself is unity. $ax.axay.ay \quad 1$

27. What is called as cross product?

Cross product is also called as vector product. It is defined as the product of the magnitude of *A* and magnitude of *B* and sine of the smallest angle between them.

$A \quad B \quad |A||B| \sin \; ABan$

28. State cross product properties.

1) Cross product is not cumulative i.e. $A\ B\ B\ A$

2) Reversing the order of vectors, reverse its direction. $A\ B\ |B||A|$

29. Give the application of dot products.

1. To determine the angle between the two vectors,
   $\cos \qquad A.B$

$|A||B|$

2. To find the component of a vector in a given direction.

30. Give the application of cross product.
   1) The cross product is used to determine the direction of force.
   2) Another physical quantity which can be represented by cross product is moment of force.

31. State scalar triple product properties.
   1) The scalar triple product is distributive.
   2) If two of the three vectors are equal then the result of the scalar triple product is zero.

32. Define vector triple product.

The vector triple product of the three vectors *A*, *B*, *C* are mathematically defined as,

33. Convert Cartesian to cylindrical system.

Ar cos sin 0 *Ax*

0 *A*

A sin cos *y*

1_z

A

Az 0 0

34. Transform the Cartesian system into spherical system.

Ar sin cos sin sin cos *Ax*

A cos cos cos sin sin *Ay*

sin cos

Az 0 *Az*

35. What are the types of integral related to electromagnetic theory?
    1. Line integral
    2. Surface integral
    3. Volume integral

UNIT II

ELECTROSTATICS

1. Define point charge.

A point charge means that electric charge which is separated on a surface or space whose geometrical dimensions are very very small compared to other dimensions, in which the effect of electric field to be studied.

2. Define one coulomb.

One coulomb of charge is defined as the charge possessed by ($1/1.602x10^{-9}$) i.e $6x10^{18}$ number of electrons.

3. State Coulomb's law.

The coulomb's law states that force between the two point charges Q1 and Q2

i) Acts along the line joining the two point charges
ii) is directly proportional to the product of the charges
iii) is inversely proportional to the square of the distance between them.

$$F = \frac{Q1Q2}{R^2}$$

4. Define constant of proportionality (K).

It is defined as $k_4{}^1$ where is the permittivity of medium in which charges are located. where 0 r. Where p-position of any other charge around Q_1

5. What is an equipotential surface?

An equipotential surface is an imaginary surface in an electric field of a given charge distribution, in which all points on the surface are at the same electric potential.

6. What is an electric flux?

The total number of lines of force in any particular electric field is called electric flux.

It is represented by the symbol Similar to the charge, unit of electric flux is also Coulomb.

7. Define electric flux density.

The net flux passing normal through the unit surface area is called electric flux density. It

is denoted as D . It has a specified direction which is normal to the surface area under consideration hence it is a vector field.

8. State Gauss's Law.

The electric flux passing through any closed surface is equal to the total charge enclosed by that surface.

9. State the application of Gauss's law.

1) The Gauss's law can be used to find E and D for symmetrical charge distributions.
2) It is used to find the charge enclosed or the flux passing through the closed surface.

10. State the applications of Poisson's equation and Laplace's equation.

1) To obtain potential distribution over the region.
2) To obtain E in the region.
3) To check whether given region is free of charge or not.
4) To obtain the charge induced on the surface of the region.

11. Define current density.

The current density is defined as the current passing through the unit surface area, when

the surface is held normal to the direction of the current. The current density is measured in A/m^2.

12. Define a current and its unit Ampere.

The current is defined as the rate of flow of charge and is measured as Ampere's.

A current of 1 Ampere is said to be flowing across the surface when the charge of 1 coulomb is passing across the surface in 1 second.

13. What is drift current and convection current?

The current constituted due to the drifting of electrons in metallic conductor is called drift current.

While in dielectrics, there can be flow of charges, under the influence of electric field intensity. Such a current is called convection current.

14. What is Polarization?

The applied field *E* shifts the charges inside the dielectric to induce the electric dipoles.

This process is called Polarization.

15. What is Polarization of Dielectrics?

Polarization of dielectric means, when an electron cloud has a centre separated from the nucleus. This forms an electric dipole. The dipole gets aligned with the applied field.

16. State the point form of Ohm's law.

The relationship between $\bar{J}$ and $\bar{E}$ can also be expressed in terms of conductivity of the material. Thus for metallic conductor,

Where - conductivity of material. And the equation is called point form of Ohm's law.

17. What is Boundary conditions means?

The conditions existing at the boundary of the two media when field passes from one medium to other are called boundary conditions.

18. How is electric energy stored in a capacitor?

In a capacitor, the work done in charging a capacitor is stored in the form of electric energy.

19. What is a capacitor?

A capacitor is an electrical device composed of two conductors which are separated through a dielectric medium and which can store equal and opposite charges ,independent of whether other conductors in the system are charged or not.

20. Define dielectric strength of a dielectric?

The minimum value of the applied electric field at which the dielectric breaks down is called dielectric strength of that dielectric.

UNIT III

MAGNETOSTATICS

1. Define Magnetic flux density.

The total magnetic lines of force i.e. magnetic flux crossing a unit area in a plane at right angles to the direction of flux is called magnetic flux density. It is denoted as *B* .Unit Wb/m^2.

2. State Ampere's circuital law.

The line integral of magnetic field intensity *H* around a closed path is exactly equal to the direct current enclosed by that path.

The mathematical representation is $\oint H.dL = I$.

3. Define Magnetic field Intensity.

Magnetic Field intensity at any point in the magnetic field is defined as the force experienced by a unit north pole of one Weber strength, when placed at that point. Unit: N/Wb

(or) AT /m.It is denoted as *H* .

4. Define Inductance.

In general, inductance is also referred as self inductance as the flux produced by the current flowing through the coil links with the coil itself.

5. What is fringing effect?

If there is an air gap in between the path of the magnetic flux, it spreads and bulges out.

This effect is called fringing effect.

6. What are boundary conditions?

The conditions of the magnetic field existing at the magnetic field existing at the boundary of the two media when the magnetic field passes from one medium to other are called boundary conditions.

7.Define self inductance.

Self inductance is defined as the rate of total magnetic flux linkage to the currentthrough the coil.

8. State Biot Savart Law.

The Biot Savart law states that, The magnetic field intensity *dH* produced at a point p due to a differential current element IdL is

1) Proportional to the product of the current I and differential length dL
2) The sine of the angle between the element and the line joining point p to the element
3) And inversely proportional to the square of the distance R between point p and the element

9. What is Magnetostatics?

The study of steady magnetic field, existing in a given space, produced due to the flow of direct current through a conductor is called Magnetostatics.

10. What is Magnetic Field?

The region around a magnet within which influence of the magnet can be experienced is called Magnetic Field.

11. What are Magnetic Lines of Force?

The existence of Magnetic Field can be experienced with the help of compass field. Such a field is represented by imaginary lines around the magnet which are called Magnetic Lines of Force.

12. Give the relation between Magnetic flux and Flux density.

The relation between Magnetic flux and flux density is obtained through the property of medium and permeability . This is given by,

13. Give Gauss's law in differential form for magnetic fields.

The divergence of magnetic flux density is always zero.

14. Define scalar magnetic Potential.

The scalar magnetic potential V_m can be defined for source free region where J i.e. current density is zero.

15. Define Mutual inductance.

The mutual inductance between the two coils is defined as the ratio of flux linkage of one coil to the current in other coil. Thus the mutual inductance between circuit 1 and circuit 2 is given by

16. What is Magnetization?

The field produced due to the movement of bound charges is called Magnetization represented by M .

17. Define Reluctance.

Reluctance R is defined as the ratio of the magneto motive force to the total flux.

$R \quad \frac{em}{}$ And it is measured as Ampere-turn/Weber.

18. What is Lorentz force equation?

Lorentz force equation relates mechanical force to the electrical force. It is given as the total force on a moving charge in the presence of both electric and magnetic fields.

$F \; F_e \quad F_m \; N$.

19. Define Moment of force.

The Moment of a force or torque about a specified point is defined as the vector product of the moment arm R and the force F . It is measured in Nm.

$T \; R \; FNm$.
U

20. Define Magnetic dipole moment.

The Magnetic dipole moment of a current loop is defined as the product of current through the loop and the area of the loop, directed normal to the current loop.

21. Give any two dissimilarities between electric and magnetic circuits.

1) In electric circuit the current actually flows i.e. there is a movement of electrons whereas in magnetic circuit, due to m.m.f, flux gets established and doesn't flow in the sense in which current flows.

2) The electric lines of flux are not closed. They start from positive charge and end on negative charge and the magnetic lines of flux are closed lines.

22. Define current density.

Current density is defined as the current per unit area.

J= I/A Amp/m2

UNIT IV

ELECTRODYNAMIC FIELDS

1. State Ampere's Circuital law.

The line integral of magnetic field intensity H around a closed path is exactly equal to the direct current enclosed by that path.

The mathematical representation is

2..State Maxwell equation I.

The MMF around a closed path is equal to the sum of the conduction current and displacement current enclosed by the path.

3.State Maxwell's Equation II.

The EMF around a closed path is equal to the magnetic displacement(flux density) through that closed path.

4.Define Electric Gauss law.

It states that electric flux through any closed surface is equal to the charge enclosed by the surface.

5. State Maxwell's Equation III.

The total electric displacement through the surface enclosing a volume is equal to the total charge within the volume.

6.Define Magnetic Gauss law.

It states that the total magnetic flux through any closed surface is equal to zero.
o

7.Define conduction current density.

The conduction current current per unit area is known as conduction current density.

8.What is displacement flux density?

The electric displacement per unit area is known as electric displacement flux density or electric flux density.

9.State poynting Theorem.

The net power flowing out of a given volume is equal to the time rate of decrease of the energy stored within the volume conduction losses.

10.Define pointing Vector.

The poynting vector is defined as rate of flow of energy of a wave as it propagates. P=ExH

UNIT V

ELECTROMAGNETIC WAVES

1. Define a wave.

If a physical phenomenon that occurs at one place at a given time is reproduced at other places at later times , the time delay being proportional to the space separation from the first location then the group of phenomena constitutes a wave.

2. Mention the properties of uniform plane wave.

i) At every point in space ,the electric field E and magnetic field H are perpendicular to each other.

ii)The fields vary harmonically with time and at the same frequency everywhere in space. 3.Define intrinsic impedance or characteristic impedance.

It is the ratio of electric field to magnetic field. or It is the ratio of square root of permeability to permittivity of medium.

3.Define propagation constant.

Propagation constant is a complex number, Where is propagation constant

4.Define skin depth

It is defined as that depth in which the wave has been attenuated to 1/e or approximately 37% of its original value.

5.Define Poynting vector.

The pointing vector is defined as rate of flow of energy of a wave as it propagates. P =E X H

6. State Poyntings Theorem.

The net power flowing out of a given volume is equal to the time rate of decrease of the the energy stored within the volume- conduction losses.

7. State Maxwell's fourth equation.

The net magnetic flux emerging through any closed surface is zero.

8. State Maxwell's Third equation

The total electric displacement through the surface enclosing a volume is equal to the total charge within the volume.

9. Define loss tangent.

Loss tangent is the ratio of the magnitude of conduction current density to displacement current density of the medium.

10.What will happen when the wave is incident obliquely over dielectric – dielectric boundary?

When a plane wave is incident obliquely on the surface of a perfect dielectric part of the energy is transmitted and part of it is reflected .But in this case the transmitted wave will be refracted, that is the direction of propagation is altered.

11.What is the fundamental difference between static electric and magnetic field lines?

There is a fundamental difference between static electric and magnetic field lines. The tubes of electric flux originate and terminates on charges, whereas magnetic flux tubes are continuous.

12.What are uniform plane waves?

Electromagnetic waves which consist of electric and magnetic fields that are perpendicular to each other and to the direction of propagation and are uniform in plane perpendicular to the direction of propagation are known as uniform plane waves.

13.What is the significant feature of wave propagation in an imperfect dielectric ?

The only significant feature of wave propagation in an imperfect dielectric compared to that in a perfect dielectric is the attenuation undergone by the wave.

14. Define power density.

The power density is defined as the ratio of power to unit area.

Power density=power/unit area.

15. What is called wave velocity?

The velocity of propagation is called as wave velocity. It is denoted as .

For free space it is denoted by c and its value is $3x10^8$m/s.

16. What is called as intrinsic impedance?

The ratio of amplitudes of *EandH* of the waves in either direction is called intrinsic impedance of the material in which wave is travelling. It is denoted by .

17. Why dielectric medium is lossless dielectric.

For perfect dielectric medium, both the fields *EandH* are in phase. Hence there is no attenuation .Hence there is no loss.

18. What is mean by lossy dielectric?

The presence of attenuation indicates there is a loss in the medium. Hence such medium is called as lossy dielectric.

19. What is mean by skin depth?

The distance through which the amplitude of the travelling wave decreases to 37% of the original amplitude is called skin depth or depth of penetration.

20. What is called skin effect?

For the frequencies in the microwave range, the skin depth or depth of penetration is very small for good conductors and all the fields and currents may be considered as confined to a thin layer near the surface of the conductor. This thin layer is nothing but the skin of the conductor and hence it is called skin effect.

21. What is Normal Incidence?

When a uniform plane wave incidences normally to the boundary between the media, then it is known as normal incidence.

22. What is normal Incidence?

When a uniform plane wave incidences obliquely to the boundary between the media, then it is known as normal incidence.

23. What is called attenuation constant?

When a wave propagates in the medium, it gets attenuated. The amplitude of the signal reduces. This is represented by attenuation constant . It is measured in neper per meter (NP/m). But practically it is expressed in decibel (dB).

24. What is phase constant?

When a wave propagates, phase change also takes place. Such a phase change is expressed by a phase constant . It is measured in radian per meter (rad/m).

25. Define standing wave ratio.

The standing wave ratio is defined as the ratio of maximum to minimum amplitudes of voltage.

$$s = \frac{E_{1s\,max}}{E_{1s\,min}}.$$

26. What is the condition for practical dielectric?

Fir practical dielectric, there is some conductivity, that is its value is not zero and hence there is some loss in practical dielectric but its value is very small.

QUESTION BANK

UNIT-I INTRODUCTION

1. What are the different types of Coordinate systems? Explain any one of them.

2. Define Divergence Theorem and Prove the Theorem.

3. Define Stokes Theorem and Prove the Theorem.

4. Explain briefly about the Sources and effects of electromagnetic fields.

5. i) Show that the Vector $H = 3y^4za^2{}_x \quad 4x^3z^2a_y \quad 3x^2y^2a_z$ is solenoid .

ii) Show that the Vector 2xy a_x+(x^2 +2yz) a_y+(y^2 +1) a_z is irrotational.

6 i) Prove that $. xH \quad 0$

ii) Prove that $x \ V0$

7. Prove the identity $x \ xH(\ .H)^2H$,Where H is a Vector.
8. Transform the vector field $W10$ a_x- 8a_y6a_z to cylindrical coordinate system at point P (10,-8, 6).

UNIT-II ELECTROSTATICS

1. Derive the expression for electric field intensity due to infinite line charge.
2. Derive the expression for electric field intensity due to infinite charge.
3. Derive the expression for electric field intensity due to infinite circular ring of charge.
4. State Gauss" s law and explain any two applications.

5 .i) Derive the expression for energy stored in a Capacitor.

ii) Explain Poisson" s and Laplace equations.

6. Derive the boundary conditions at the charge interface of two dielectric media.
7. The charge is distributed along the z-axis from z=-5 m to -∞ and from z=+5 m to +∞ with a charge density of 20nC/m. Find electric field intensity at (2,0,0)m.
8. Four point charges each of 10μC are placed in free space at the points (1, 0, 0),

(-1,0,0),(0,1,0) and (0,-1,0)m respectively. Determine the force on a point charge o 30 μC located at a point (0,0,1)m.

9. Derive the expression for composite parallel plate capacitor.
10. Derive the expression for energy stored and energy density in electrostatic fields.
11. Derive the expression for capacitance between two co-axial cylinders of radii "a"(inner) and "b" (outer) respectively.

UNIT-III MAGNETOSTATICS

1. Derive an expression for the magnetic field intensity at a point „P‟ in a medium of permeability „ „due to an infinitely long current carrying conductor at a distance „r‟ meters from the point.

2. State Ampere‟ s Circuital law and explain any two applications.
3. Obtain the boundary conditions of normal and tangential components of magnetic field at the interface of two media with different dielectrics.
4. Explain Biot‟ s Savart law in vector form.
5. Derive the expression for Magnetic Scalar and Vector Potential.
6. Derive the expression for inductance of solenoid and toroid.
7. Derive the expression for magnetic force between two parallel conductors.
8. Derive the expression for energy stored in magnetic fields and its energy.

UNIT-IV ELECTRODYNAMIC FIELDS

1. Briefly explain Maxwell‟ s Equation-I
2. Explain the Maxwell‟ s Equation derived from Faraday‟ s Law
3. Explain Maxwell‟ s Equation-III and Maxwell‟ s Equation-IV.
4. Compare Field Theory and Circuit Theory.
5. Derive the expression for Displacement Current .
6. Derive the Maxwell‟ s Equations in Free space.
7. Derive the Maxwell‟ s Equations in phasor form.
8. For 1A conductor current in copper wire find the corresponding displacement current at 100MHz.Assume for copper $5.8x10^7 mho/m$.

UNIT-V ELECTROMAGNETIC WAVES

1. Derive the electromagnetic wave equation for electric fields and magnetic fields.
2. Explain the Wave propagation in Lossy medium.
3. Explain the Wave propagation in Lossless medium.
4. State and prove Poynting theorem.
5. Define Brewster angle and derive its expression.

6. Obtain the expression for the reflection co-efficient and transmission coefficient for a wave normally incident on the surface of the dielectric.
7. Find the skin depth at a frequency of 2MHz in aluminum where $38.2x10^6 mho/m$ and μ_r=1.

8. Obtain the expression for the reflection co-efficient and transmission coefficient for a wave incident obliquely on the surface of the dielectric.

TRANSMISSION LINE PARAMETERS
PART A

1. Write the transmission and distribution voltage levels in India. **APRIL/MAY 2015** (R8) **(or)** Mention the transmission voltages that followed in tamilnadu. **(May 2017)**

    The voltage levels in use in TNEB are 400KV, 230 KV, 110 KV, 66 KV,33 KV, 22 KV and 11 KV. In order to evacuate bulk power from one region to another region, there is a more scope for enhancing transmission capability to 765 KV level and setting up of 800 KV High Voltage DC system.

2. Write the various factors affecting the corona loss. **NOV/DEC 2011 (R8)**

    Corona loss depends upon numerous factors like system frequency, system voltage, air density; surface and size of conductor etc. .. When potential difference increase the electric field increases and therefore powerloss due to corona increases.

3. Differentiate between bundled conductors and stranded conductors. **NOV/DEC 2007**

Stranded conductors	Bundled conductors
Stranded conductors are composed of two or more elements of strands electrically in parallel with alternate layers spiralled in opposite direction to prevent unwinding.	A bundled conductor is a conductor made up of two or more sub-conductors and is used as single phase conductor. Bundled conductors are separated from each other by 30 cm or more and conductors of each phase are connected by connecting wires at particular length.
It is used for voltages less than 230 kV.	It is used for voltages above 230 kV.

4. Define ACSR.

    ACSR is aluminium conductor with steel reinforcement. This conductor is low tensile strength of aluminium conductors is made up by providing central strands of high tensile strength galavanised steel.such conductor is known as ACSR. Therefore this conductor reduces the corona losses and used in long transmission lines.

5. Explain the advantages of ACSR conductors when used for overhead lines.

    - Cheaper and lighter than copper.
    - Low density and low conductivity, which increases diameter of conductor.
    - Increases flexibility.

6. State the skin effect in transmission line .mention its effect on the resistance of the line. **(May 2017)** What is skin effect? **(Dec 2016)**

    Skin effect is the tendency for alternating current (AC) to flow mostly neat the outer surface of a conductor which causes non-uniform distribution of current. Thus the current density is largest near the surface of the conductor and decreases with greater depth inside the conductor .the effect becomes more and more apparent as the frequency increases

Due to reduction in effective area of cross section offered to the follow of the current through the conductor, the resistance of the conductor increases.

7. State the different types of overheads conductors. **(May 2017)**
   - Hard drawn copper conductor
   - Steel cored copper conductor
   - Cadmium copper conductor.
   - Copper welded conductor.
   - All aluminium conductors.
   - Aluminium conductor with steel reinforcement
   - All Aluminium alloy conductor
   - ACAR conductor
   - Phosphor bronze conductor
   - Alumoweld conductor
   - Galvanized steel conductor
8. What are the advantages of bundled conductors ?**(Dec 2016)**
   - Increases the capacitance.
   - Increases the power capability of the line.
   - Reduces the voltage surface gradient.
   - Reduces corona loss.
   - Reduces radio interference.
9. What is transposition? Why are the transmission line transposed? **(Dec 2017)**
   Define transposition? **(May 2016)**
   Transposition is the periodic swapping of position of the conductors of a transmission lines, so that each conductor occupies the original position of every other conductor over a equal distance so as to achieve balance in the three phases
10. What is corona? **(May 2016)**
    When the potential difference is increased, a potential gradient is set up. If the potential gradient is above 30 kV/cm, the conductor gets ionized. The phenomenon of faint violet glow, hissing noise and production of ozone gas is known as corona.

11. Define proximity effect on conductor? **(May 2015)**
    The alternating magnetic flux in a conductor caused by the current flowing in a neighboring conductor gives rise to circulating currents which cause non-uniformity of current and an apparent increase in the resistance of the conductor. This phenomenon is known as proximity effect.

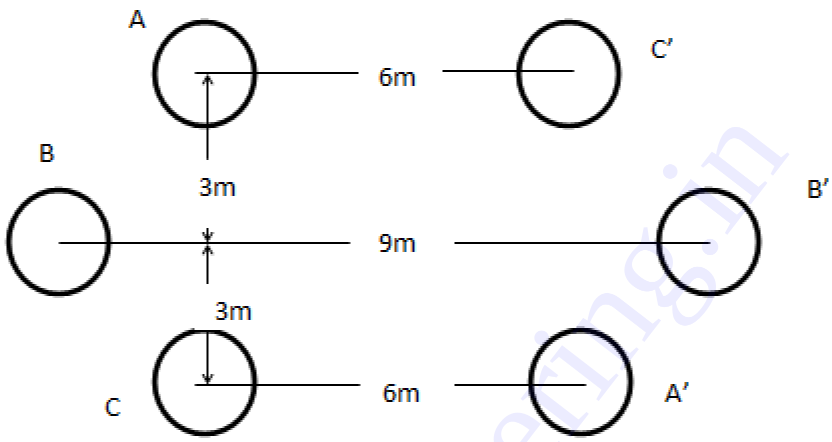
12. Define the term critical disruptive voltage?**(Dec 2011, Dec 2013)**
    The potential difference between conductors, at which the electric field intensity at the surface of the conductor exceeds the critical value and occurs corona is known as critical disruptive voltage.
13. What are the factors affects the corona?
    The factors affecting the corona are;
    - Atmosphere.
    - Conductor size
    - Spacing between the conductors.
    - Line voltage.
14. Define visual critical voltage ?**(Dec 2009, May 2013)**
    Minimum phase to neutral voltage at which corna glow appears and visible all along the conductors is called visual critical voltage.

15. What are the factors depend upon the skin effect?
    The skin effect depends upon the following factors;
    - Nature of material.
    - Resistivity.
    - Frequency.
    - Conductor size.

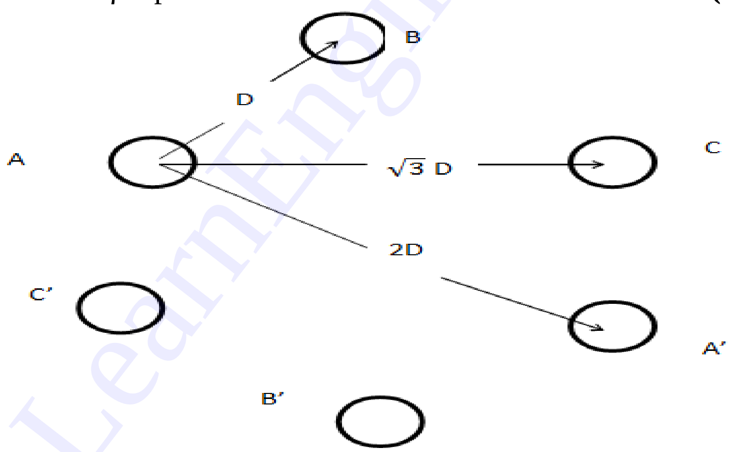
PART B

1. Draw and explain the structure of electric power system indicating the voltage level in each transmission levels. **MAY/JUNE 2011,12,13,14,16, NOV/DEC 2013, 2007**
2. Explain the following with respect to corona (i) corona (ii) effects of corona (iii) disruptive critical voltage (iv) visual critical voltage (v) corona power loss (vi) interference with neighboring communication circuits (vii) advantages, disadvantages and methods to reduce the effect of corona. **APRIL/MAY 2015 (R13, R8), NOV/DEC 2012, 13,16, MAY/JUNE 2013**
3. Derive the capacitance of a single phase and three-phase overhead line for symmetrical spacing. **MAY/JUNE 2013, 14 (R8)**
4. Deduce an expression for capacitance of three phase transmission line with unsymmetrical spacing. (Transposed conductors) **NOV/DEC 2012, 13,14,15, MAY/JUNE 2016**
5. Starting from fundamental derivation of flux linkages with conductor per phase **(derivation for loop inductance of a single phase system),** Derive the expression for the inductance per phase for a 3-phase overhead transmission system when conductors are symmetrically placed. **APRIL/MAY 2015 (R8), DEC -2015, 13.**
6. Derive an expression for the inductance per phase for a 3-phase overhead transmission system with unsymmetrical spacing. **MAY-13, NOV/DEC 2016**
7. Derive an expression for the inductance per phase for a 3-phase overhead transmission system with unsymmetrical spacing with transposed conductors.

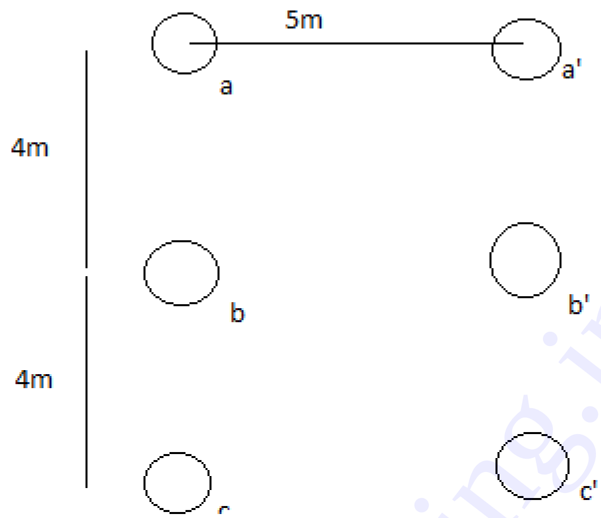
8. A three phase circuit line consists of 7/4.5 mm hard drawn copper conductors. The arrangement of the conductors shown in Fig. The line is completely transposed. Calculate inductive reactance per phase per km of the system. **APRIL/MAY 2015 (R13), NOV/DEC 2011,13 (R8), MAY/JUNE 2016**



9. If the double circuit 3-phase line in Fig. has conductors of diameter 2.5 cm and distance of separation (D) is 2m in the hexagonal spacing arrangement, calculate the phase-to-neutral capacitance in µF per 100km of the line. **APRIL/MAY 2015 (R8)**



10. A 3-phase 80km long transmission line has its conductor of 1.0 cm diameter spaced at the corners of the equatorial triangle of 100 cm side. Find the inductance per phase of the system. **APRIL/MAY 2015 (R8)**
11. Estimate the corona loss for a three-phase, 110Kv, 50Hz, 150Km long transmission line consisting of three conductors each of 10 mm diameter and spaced 2.5m apart in a equatorial triangle formation. The temperature of air is $30^0 C$ and the atmospheric pressure is 750mm of mercury. Assume the irregularity factor as 0.85. Ionization of air may be assumed to take place at a maximum voltage gradient of 30Kv/cm. **MAY/JUNE 2014 (R8)**
12. Determine the capacitance/ phase of the double circuit line as shown in the fig. the diameter is 2.1793cm.



UNIT II
MODELLING AND PERFORMANCE OF TRANSMISSION LINES
PART A

1. **How are transmission lines classified ?[Nov 2017]**

   Based on the line length and voltage, the overhead transmission lines are classified as
   - Short transmission lines (length > 80km , voltage >20kV)
   - Medium transmission line (length <80km and > 200km, voltage<20kV and >100kV)
   - Long transmission line(length <200km , voltage <100kV)

2. **How are transmission lines classified ?[Nov 2017]**

   Based on the line length and voltage, the overhead transmission lines are classified as
   - Short transmission lines (length > 80km , voltage >20kV)
   - Medium transmission line (length <80km and > 200km, voltage<20kV and >100kV)
   - Long transmission line(length <200km , voltage <100kV)

3. **What is Ferranti effect? [Nov 2017] [May 2017][May 2015]**
   Define Ferranti effect? [May 2016]

   In long transmission lines, receiving end voltage is greater than sending end voltage during light load or no-load operation. Under no load or light, the capacitance associated with the line generate more reactive power than the reactive power which is absorbed, hence $V_R > V_S$. This effect is known as Ferranti effect.

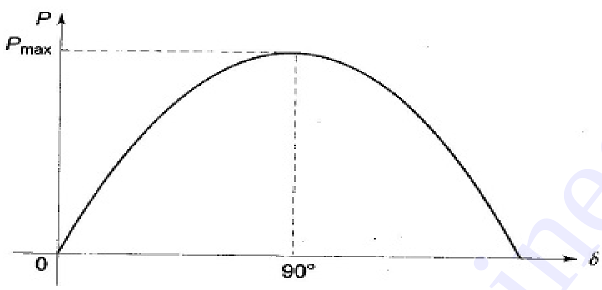
4. Write down the significance of SIL on transmission line. [May 2017]
Mention the significance of surge impedance loading. [May 2016]

- The surge impedance loading of a line is defined as the power delivered by a line to a pure resistive load equal to its surge impedance.
- SIL is also called as natural power of the line
- The permissible loading of a transmission line can be expressed as a fraction of its SIL and provides a comparison of load carrying capabilities of lines

5. State the condition for maximum power delivered and draw the power angle diagram.

[Nov 2016]

The maximum power delivered when power angle ∂=90 degree



6. Mention the various methods of voltage control transmission lines. [Nov 2016] NOV/DEC 2011 (R8)

Voltage control of transmission lines can achieved following methods

- Use of series capacitors
- Use of shunt capacitors
- Use of static VAR sources
- Use of shunt reactors
- Tap changing transformer

7. Define transmission efficiency. [Nov 2015]

The transmission line efficiency is defined as the ratio of power at the receiving end to the power at sending end.

% transmission efficiency = (P_R) / (P_S) *100

Where P_S – Sending end voltage

P_R – Receiving End Voltage

8. Write the formula for finding surge impedance of transmission line. [Nov 2015]

$Z_c = \sqrt{Z/Y} = \sqrt{L/C}$ is pure resistance.
$P_R = |V_{RL}|^2/Z_c$
Where V_{RL} = Line voltage at the receiving end.

Z_c = Surge impedance = $\sqrt{L/C}$.
P_R = Surge impedance loading.

9. What is the importance of voltage control.[May2015]

The voltage variation from generation station to consumer end are undesirable and suppliers are required to maintain the voltage at prescribed limit so that voltage control are important in transmission lines

10. Define voltage regulation in connection with transmission line. MAY/JUNE 2014, NOV/DEC 2013, 2012.

Regulation of a transmission line is defined as the change in voltage at the receiving end,from no load to full load, the sending end voltage remaining the same.
Mathematically it can be expressed as,
% Regulation = $(V_S - V_R) / V_R * 100$
Where V_S – Sending end voltage
V_R – Receiving End Voltage

11. How the capacitance effects are taken into account in a long transmission line?

Long transmission lines have length > 250km and operate at voltage higher than 100 kV the effects of capacitance cannot be neglected. Therefore in order to obtain reasonable accuracy in long transmission line calculations, the capacitance effects must be taken into account.

12. Define attenuation constant. NOV/DEC 2011

The real part of the propagation constant is α. It determines the change in magnitude per unit length of the line of the wave is termed as attenuation constant. It is expressed in nepers per unit length

13. Define propagation constant. NOV/DEC 2011

The magnitude and the phase of a travelling wave is governed by the complex quantity γ. In other wards γ governs the propagation of component wave.
Propagation constant $\gamma = \sqrt{ZY} = \alpha + j\beta$
Where α = Attenuation Constant
β = Phase Constant.

14. What is the use of power circle diagram?

The use of power circle diagram is to determine the maximum power that can be transmitted over the line both at the receiving and the sending end.

15. What are the main objectives of compensation?

The main objectives of compensation are

- To improve the system stability.
- To produce substantially flat voltage profile.
- To meet economically way for reactive power requirement.
- To increase power transfer capability.

16. What are the devices used for compensation of transmission lines?

The devices used for compensation of transmission lines are

- Shunt reactor.
- Shunt capacitor.
- Static VAR system.
- Synchronous condensers.
- Series capacitors

.

17. What is shunt compensation?

Shunt reactors are used to compensate for the undesirable voltage effects associated with line capacitance. The amount of reactor compensation required to maintain the receiving end voltage at the specified value.

PART B

1. A balanced three phase load of 30Mw is supplied at 132kV, 50 Hz and 0.85 p.f. lagging by means of transmission line. The series impedance of a single conductor is (20+j52) Ω and the total phase neutral admittance is 315 x $10^{-6} Siemen$. Using nominal T method, Determine (i) A, B, C and D constants of the line (ii) sending end voltage (iii) regulation of the line. **APRIL/MAY 2015 (R13)**
2. Explain the real and reactive power flow in lines. Also explain the methods of voltage control. **APRIL/MAY 2015 (R13), NOV/DEC 2011, 2015,16**
3. (i) Explain the classification of transmission lines with their characteristics. (6m) **NOV/DEC 2014 (R8)**
   (ii) Define the following:
      (1) Surge impedance
      (2) Attenuation constant
      (3) Voltage regulation
      (4) Transmission efficiency
      (5) Concept of surge impedance loading. **NOV/DEC 2012,13 (R8)**
4. Perform the analysis of long transmission line using RIGOROUS method. **NOV/DEC 2012 (R8)**
5. What is power circle diagram? Explain the method of drawing sending end and receiving end power circle diagram **MAY/JUNE 2014 (R8), APRIL/MAY 2015 (R8)**
6. Draw the nominal T circuit of a medium length transmission line and derive expressions for sending end voltage and current. Also draw the respective phasor diagram. **NOV/DEC 2015**
7. Draw the nominal π and end condenser circuit of a medium length transmission line and derive expressions for sending end voltage and current. Also draw the respective phasor diagram. **MAY/JUNE 2013**

8. A 3-phase, 50Hz power transmission line has line resistance of 30 Ω and inductive resistance of 70 Ω per phase. The capacitive susceptance is 4 x 10^{-4} mho per phase. If the load at receiving end is 50 MW at 0.8 pf lagging with 132kV line voltage, calculate (i) sending end voltage and current (ii) regulation and (iii) efficiency (iv) p.f. of the line for this load. Use nominal π method. **APRIL/MAY 2015 (R8), NOV/DEC 2016, MAY/JUNE 2012**
9. A 50Hz, three-phase transmission line is 250Km long. It has a total series impedance of (40+j100) ohms and a shunt admittance of 914 x 10^{-6} ohms. It delivers 50MW at 220KV with a power factor of 0.9 lag. Find the :
   (i) Sending end voltage and current
   (ii) Sending end power factor
   (iii) Voltage regulation
   (iii) Transmission efficiency by nominal-T method. **MAY/JUNE 2014 ,16**
10. The constants of three phase line are A=0.91 and B= 140 ohms/ phase. The line delivers 60 MVA at 132kV and 0.8 pf lagging. Draw power circle diagrams and find **(a)** sending eng voltage and power angle **(b)** the max power which the line can deliver with the above values of sending and receiving end voltages **(c)** sending end power and pf **(d)** line losses **MAY/JUNE 2016**
11. A balanced 3 phase load of 30MW is supplied at 132 kV, 50 Hz and 0.85 P.F lagging by means of transmission line. The series impedance of a single conductor is (20+j52) ohms and the total phase-neutral admittance is 315 x 10^{-6} mho. Using nominal –T method , determine:
    (i) The A, B, C and D constants of the line.
    (ii) Sending end voltage.
    (iii) Regulation of the line. **NOV/DEC 2011 (R8)**
12. A three phase, 50Hz transmission line, 40km long delivers 36 MW at 0.8 power factor lagging at 60KV (phase). The line constants per conductor are R = 2.5 Ω, L = 0.1 H, C = 0.25 μF. Shunt leakage may be neglected. Determine the voltage, current, power factor, active power and reactive voltamperes at the sending end. Also determine the efficiency and regulation of the line using nominal π mehod. **NOV/DEC 2013(R8)**
13. A 15km long 3 phase overhead line delivers 5MW at 11 kv at 0.8 lagging p.f. line loss is 12% of power delivered. Line inductance is 1.1 mH/km/phase. Find the sending end voltage and regulation. **DEC-2012**

UNIT III
UNIT III MECHANICAL DESIGN OF LINES
PART A

1. What are the desirable properties of insulators? [Nov 2017]

The properties of an insulator are;

- It should be mechanically strong to bear the conductor load.

- It should have high dielectric strength.
- High ratio of puncture strength to flash over voltage.
- It should be non-porous.

It should not affected by the changes in the temperature.

2. Specify the different types of insulator? [may 2017]

The different types of insulators used for overhead lines are;

- Pin type insulators.
- Suspension type insulators.
- Strain type insulators.
- Shackle insulators.
- Stay insulators.

3. What are the methods of improving string efficiency in line insulators? [nov 2016]

The methods for improving string efficiency are;

- By reducing the value of K
- By grading of insulators.
- By using guard ring or static shielding.

4. What are the tests performed on the insulators? [May 2016]

The following tests are performed on insulators:

1. Mechanical tests
2. Electrical insulation tests
3. Environmental tests
4. Temporary cycle tests
5. Corona and radio interference tests

5. Define string efficiency. [nov 2015]

String efficiency is defined as the ratio of total voltage across the string to the product of number of units and the voltage across the unit adjacent to the line conductor. Mathematically it can be expressed as,

$$\text{String efficiency} = \frac{\text{Voltage across the string}}{\text{(Number of insulators)} \times \text{(Voltage across the unit nearest to the line conductor)}}$$

6. What is the purpose of insulator? [may2015]

Insulators are the elements which provide necessary insulation between line conductors and supports and thus prevent any leakage current from conductors to earth.

7. **What is meant by tower spotting? [nov 2015]**

The art of locating structures of towers in a right way and selecting their type and height so as to meet all the necessary electrical requirements is called tower spotting. The sag template is used for tower spotting.

8. **What is meant by sag template? [nov 2015]**

For normal spans and for standard towers, the sag and the nature of the conductor curve are calculated under expected load conditions and plotted on a thin stiff plastic sheet. Such a graph is called sag template.

9. **What are the materials mainly used in bus bars? [may2015]**

The bus bars are either rigid type or strain type.

- For rigid type bus bars, copper or aluminium bars are used. Such bars are used for low and medium voltage levels.
- For strain type bus bars mainly stranded aluminium (ACSR) conductors are used which are supported by strain insulators. The strain type bus bars are used for high voltage levels.

PART B

1. What are various properties of insulators? Also briefly explain various types of insulators (suspension type and pin type are important). Draw the schematic diagram. Compare their merits and demerits. **APRIL/MAY 2015 (R13), MAY/JUNE 2012, 14 (R8), NOV/DEC 2014,2016**
2. Define string efficiency of suspension insulator string. List the methods to improve it. **APRIL/MAY 2015, NOV/DEC 2012, 15,16, MAY/JUNE 2013, 16**
3. What is sag-template? Explain how this is useful for location of towers and stringing of power conductors? Explain the factors affecting sag. **NOV/DEC 2013 (R8), NOV/DEC 2014 (R8)**
4. Deduce an approximate expression for sag in overhead lines when supports are approximated by a parabola. How can the effect of wind and ice loading be taken into account? **NOV/DEC 2013 (R8), NOV/DEC 2015**
5. Derive an expression for sag of a line supported between two supports of the different height. **NOV/DEC 2012 (R8)**
6. Explain in detail about the types of towers.
7. A transmission line has a span of 275 m between level supports. The conductor has effective diameter of 1.96 cm and weights 0.865 kg/m. Its ultimate strength is 8060 kg. If the conductor has ice coating of radial thickness 1.27 cm and is subjected to a wind pressure of 39kg/m^2 of projected area, calculate the maximum sag. Assume that the safety factor is 2 and ice weighs 910 kg/m^3 **NOV/DEC 2014 (R8), MAY/JUNE 2016**
8. An overhead line has a span of 150m between level supports. The conductor has a cross sectional area of 2 cm^2. The ultimate strength is 5000 kg/cm^2 and safety factor is 5. The

specific gravity of the material is 8.9 gm/cc. The wind pressure is 1.5 kg/m. calculate the height of the conductor above the ground level at which it should be supported if a minimum clearance of 7 m is to be left between the ground and the conductor. **APRIL/MAY 2015 (R8)**

9. A transmission line conductor at a river crossing is supported from two towers at a height of 50 and 80 meters above water level. The horizontal distance between the towers is 300 meters. If the tension in the conductor is 2000 kg. Find the clearance between the conductor and water at a point midway between the towers. Weight of conductor per meter = 0.844 kg. Derive the formula used. **NOV/DEC 2011,16, APRIL/MAY 2015 (R8)**

UNIT IV

UNDER GROUND CABLES

PART A

1. **Mention any four materials used for underground cables. [Nov 2016]**

   Various insulating materials used in cable construction are Rubber, Paper & PVC.

2. **Define grading of cables. (Dec 2004,Dec 2010, Dec 2012)**

   The process of achieving uniform electrostatic stress in the dielectric of the cables is called grading of cables.

3. **What is the main purpose of armouring ? (may2015)**

   It provides protection to the cable from mechanical injury. It consists of layers of galvanized steel wires.

4. **Give the relation for insulation resistance of a cable.(Dec 2003,2006,2009, May 2013)**

   Insulation resistance of a single core cable is given by,

$$R_{ins} = \frac{\rho}{2\pi l} * \ln(R/r) \quad \Omega$$

   r =diameter of core
   R =diameter of sheath
   l =length of cable

5. **What is dielectric stress?(May 2014)**

   The insulation of a cable is subjected to electrostatic force under operating conditions is known as dielectric stress.

6. **Classify the cables used for three phase service. [may 2016]**

   - Low tension (L.T) cables used up to 6.6 KV
   - Medium and high tension (H.T) cables up to 66 KV

   The H.T. cables are further classified as :

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- Belted cables up to 11 KV
- Screened cables for 22 and 33 KV
- Pressure cables from 33 KV to 66 KV also called extra high tension cables
- Super tension (S.T.) cables for 132 KV to 275 KV which are further classified as
- Oil filled cables
- Gas pressure cables

7. **What is belted cables?[Nov 2017]**
   These types of cables used for the voltage levels up to 11kV. Here the cores are insulated from each other by use of impregnated paper and grouped together with paper belt.

PART B

1. Define Grading of cables. Discuss the capacitance grading and intersheath grading of underground cables. **MAY/JUNE 2013,14,16 (R8), NOV/DEC 2012**
2. Derive an expression for capacitance of a single core and three core cables. **NOV/DEC 2013, 14 (R8)**
3. Describe the general construction of an underground cable with a neat sketch. And also explain the types of underground cables. **APRIL/MAY 2015 (R8), NOV/DEC 2011, 12, 13 (R8)**
4. **(i)** Explain any four insulating materials used in manufacturing of cables. **NOV/DEC 2015**
   (ii) A string of eight suspension insulators is to be graded to obtain uniform distribution of voltage across the string. If the capacitance of the top unit is 10 times the capacitance to ground of each unit, determine the capacitance of the remaining seven units. **NOV/DEC 2015**
5. In a 3 unit insulator, the joint to tower capacitance is 20% of the capacitance of earth unit. By how much should the capacitance of the lowest unit be increased to get a string efficiency of 90%? The remaining two units are left unchanged. **APRIL/MAY 2015 (R13)**
6. Each line of a 3-phase system is suspended by a string of three identical insulators of self-capacitance C farad. The shunt capacitance of connecting metal work of each insulator is 0.2 C to earth and 0.1 C to line. Calculate the string efficiency of the system if a guard ring increases the capacitance to the line of metal work of the lowest insulator to 0.3 C. **NOV/DEC 2014 (R8), APRIL/MAY 2015 (R8)**
7. An insulating string for 66KV lines has 4discs. The shunt capacitance between each joint and metal work is 10% of the capacitance of each disc. Find the voltage across the different disc and string efficiency. **NOV/DEC 2013 (R8)**
8. A 3 phase overhead transmission line is being supported by three disc insulators. The potential across top unit and middle unit are 9 kV and 11 kV respectively. Calculate (i) the ratio of capacitance between pin and earth to the self-capacitance of each unit. (ii) The line voltage and (iii) string efficiency. **NOV/DEC 2011 (R8)**

9. A three unit insulator string is fitted with a guard ring. The capacitance of the link pins to metal work and guard ring can be assumed to be a 15% and 5 % of the capacitance of each unit. Determine voltage distribution at each unit and string efficiency. **MAY/JUNE 2013,16**
10. A string of five insulator units has mutual capacitance equal to 10 times the pin to earth capacitance. Find voltage distribution across various units as the percentage of the total voltage across the string and string efficiency. **NOV/DEC 2016**
11. A 2km long 3 core cable has capacitance of 0.5mF/km between two conductors bunched with sheath and the third conductor. The capacitance between the conductors is also measured when bunched together and the sheath and found to be 0.75mF/km. Determine. (i) Capacitance between phases. (ii) Capacitance between the conductor and the sheath (iii) Effective per phase Capacitance (iv) Capacitance between two conductors connecting a third conductor to be sheath. (v) Charging current if the supply voltage is 11kV, 50Hz. **NOV/DEC 2016**
12. An insulator string consists of three units, insulator nearest to the line having a safe working voltage of 20kV. The ratio of self to shunt capacitance is 6:1. Find the line voltage and string efficiency. **MAY/JUNE 2012**

UNIT V

DISTRIBUTION SYSTEMS

PART A

1. List out the advantages of high voltage A.C. transmission. **MAY/JUNE 2016, NOV/DEC 2011 (OR)** Why is electrical power preferable to be transmitted at high voltage? **(May 2015)**
    - The volume of copper required is less at high voltage level
    - The efficiency is higher
    - Line drop becomes less
    - The power handling capacity of line increases
    - The total line cost per MW per km decreases
2. Define the terms feeders and Distributors. **APRIL/MAY 2015, NOV/DEC 2012, 16, NOV/DEC 2011,12, (May 2015)**
    - The feeders are the conductors which are of large current carrying capacity. The feeders connect the substation to the area where power is to be finally distributed to the consumers
    - Distributors are the conductors used to transfer power from distribution centre to the consumers
3. What are the objectives of FACTS? **(Dec 2017) MAY-2010**
    - The power transfer capability of transmission system is to be increased
    - The power flow is to kept over the designated routes.

4. What is ring main system?**(May 2017)**
   In this system the feeders covers the whole area of the supply in the ring fashion and finally terminates at the substations from where it is started .the feeders is in closed loop form and looks like a ring hence the name given to the system is ring main distribution system.
5. What is interconnected system?**(Dec 2017)**
   When a ring main system is supplied by two or more than two generating stations then it is called interconnected system.
6. State the application of HVDC transmission. **(Dec 2016)**
   - Long distance bulk power transmission, for connecting two different areas for exchange of power.
   - Power transmission through underground or submarine cables.
   - Connect D.C. transmission with A.C. distribution systems.
   - Control and stabilization of power flow in A.C. ties in an integrated power system.
7. What is meant by STATCOM? **(May 2007 ,May 2008)**
   STATCOM is a static synchronous generator operated as a shunt-connected static VAR compensator (SVC) whose capacitive or inductive output current can be controlled independently of the A.C. system voltage.
8. List out various devices used in FACTS. **(May 2006 Dec 2008)**

   - Static VAR compensators (SVC).
   - Thyristor controlled series compensator.
   - Thyristor switched series capacitors and reactors (TCSC).
   - Static Condensers (STATCOM).
   - Unified power flow control (UPFC).

9. Give any three HVDC lines in India.**(May 2004, Dec 2008)**
   - Rihand – Delhi HVDC transmission system.
   - Talcher – kolar HVDC transmission system.
   - Chandrapur – Padghe HVDC transmission system.
10. What is service mains?**(May 2005,Dec 2011)**
    Electrical power service is provided to a consumer from the distribution feeder through/at the service main.

11. Explain the term regional grid?(**Dec 2007)**
    The interconnected transmission system of a state or a region is called the grid of state or region. State grids are interconnected with the help of tie lines and form the regional grid.

12. Mention the types of HVDC links .**(Dec 2005, May 2013**)
    - Monopolar HVDC
    - Bipolor HVDC
    - Homopolor HVDC
    - Back to back HVDC coupling

- Multi terminal HVDC

13. Why transmission lines are 3 phase 3 wire while the distribution lines are 3 phase 4 wire circuit?**(Dec 2013)**
    - The transmission is at very high voltage level and such a balanced 3 phase system does not required neutral conductor.
    - For distribution it is necessary to supply single phase loads long with the three phase loads. For single phase distribution a neutral conductor is must.
14. **What are the major equipments of substation? [nov 2017]**

The various substation equipments are;

- ➢ Transformers.
- ➢ Circuit breakers.
- ➢ Isolators.
- ➢ Load break switch.
- ➢ Instrument transformers.
- ➢ Current transformers.
- ➢ Potential or Voltage transformers
- ➢ Busbars
- ➢ Protective relays
- ➢ Lightning arresters or surge arresters.
- ➢ Earthing switch.
- ➢ Shunt capacitors.
- ➢ Earthing
- ➢ Station battery and charging equipment.

15. **Enlist any two factors that affect the sag in transmission line. [may 2017] (or) What are the factors that affect the sag in transmission line? [nov 2016]**

The two important atmospheric factors affecting the sag in transmission line are,

- ➢ Ice coating on the conductor which increases the weight of conductor.
- ➢ Wind pressure due to which the conductor gets subjected to the additional forces

Apart from these two factors the span, weight of conductors and the tension in the conductor also affect the value of sag.

16. **Write down the types of grounding. [may 2017]**

The types of grounding are

- ➢ Solid or effective grounding
- ➢ Resistance grounding
- ➢ Reactance grounding
- ➢ Resonant grounding

17. **What is the need of earthing ? [nov 2016]**
    - To ensure that live parts should not assume a potential which is dangerously different from that of surroundings.
    - To allow sufficient current to flow safely for proper operation of protective devices like circuit breakers, etc.

- To limit overvoltage's between neutral and ground and between line and ground.
- To suppress dangerous potential gradients.

18. **Define sag. [may 2016]**
   - When a conductor is suspended between two points then it takes the shape of parabola or catenary and sags down.
   - The difference in levels between the point of support and the lowest point on the conductor
19. **What is meant by string chart? [may 2016]**
   Give the significance of string chart? [nov 2017]
   - The tension at the time of erection of a transmission line is given by a cubic equation hence it is time consuming to solve such equation.
   - Instead of solving such a equation the graph of tension in kg against the temperature in ^{0}C and the graph of sag in meters against the temperature in ^{0}C is obtained.
   - Such graphs are called stringing chart.
20. **What is substation?**
   Substations are the point in the power network where transmission lines and distribution feeders are connected together through circuit breakers or switches namely busbars and transformers.
21. **How will you select an ideal location for a distribution substation?**
   Distribution substations are connected between primary distribution and secondary distribution. The primary distribution voltages such as 11kV or 6.6kV are to be stepped down to the supply voltage. These substations transfer power to the consumers through distributors and service mains.
22. **What is the role of circuit breaker in power system?**

   When a fault occurs in the bus bar the relay sense the fault and gives command signal to the circuit breaker. The circuit breakers disconnect and isolate the faulty section thereby protecting the equipments.

23. **Write down the difference between disconnector switch and isolator.**

   Whenever maintenance or repair work is to be carried out on equipment in a substation, it is disconnected from the supply by the isolators. It is operated under no load. Isolators are interlocked with circuit breakers and earthing switches. To open isolators, circuit breakers are to be opened first.

24. **What are the classifications of substation according to the service? [may2015]**
   According to service, the substations are classified as:
   - Transformer substations

   These are further classified as

   - Transmission or primary substation

- Sub transmission or secondary substation
- Step down or distribution substation

- Industrial substations
- Switching substations
- Synchronous substations
- Frequency change substations
- Converting substations

PART B

1. Discuss in detail about substation layout GIS and AIS. **MAY/JUNE 2012**
2. write short notes on :
   (i) Sub mains
   (ii) Stepped and tapered mains
   (iii) Grounding grids **APRIL/MAY 2015 (R13), NOV/DEC 2012 (R8)**
3. Explain the following:
   (i) Neutral grounding
   (ii) Resistance grounding
   (iii) Resonant grounding
   (iv)Reactance earthing. **APRIL/MAY 2015, MAY/JUNE 2013, 16, NOV/DEC 2015,16**
4. Discuss in detail the advantages and disadvantages and application of HVDC transmission. **APRIL/MAY 2015 (R13), NOV/DEC 2016**
5. Explain with a neat layout the modern EHV system. What is the highest voltage level available in India for EHV transmission? Also discuss the advantages of EHVAC. **NOV/DEC 2012,13, APRIL/MAY 2015 (R13)**
6. Discuss in detail the problem associated with EHV AC transmission. State how these problems are being solved. Also explain the effect of high voltage on volume of copper and on efficiency. **NOV/DEC 2013, 14, 16, MAY/JUNE 2012**
7. What are the various types of HVDC links? Explain them in detail. **NOV/DEC 2011,12,16, MAY/JUNE 2008,10,13, 16**
8. List out the adjectives of FACTS. What are the basic types of FACTS controllers? And explain about FACTS controllers. **NOV/DEC 2012,13, 14 (R8), MAY/JUNE 2010,12,16**
9. Discuss the various FACTS devices. **DEC 09, MAY-12, MAY/JUNE 2012**
10. Explain the following system of distribution: **APRIL/MAY 2015 (R13), 11**, **NOV/DEC 2010,12,13**
    (i) Radial system
    (ii) Ring main distribution system/ Ring main distributor
    (iii) Interconnected system
    (iv) Design consideration in distribution system.

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(v) Stepped (or) tapered distributor
(vi) DC distributor fed at one end
(vii) DC distributor fed at both ends.

(Question no. 9 covers also the explanation of types of AC and DC distributors)

11. **(i)** Derive suitable expressions, draw current loading diagram and voltage drop diagram for uniformly loaded distributor of length 'l' fed at one end. How is power loss in the whole distributor computed? **NOV/DEC 2015,16**

    (ii) A uniform two wire DC distributor 250m long is loaded with 0.4 A/m and is fed at one end. If the maximum permissible voltage drop is not to exceed 10V, find the cross sectional area of the distributor conductor. Take $\rho = 1.78*10^{-8}\ \Omega m$. **NOV/DEC 2015**

12. **(i)** Consider a distributor loaded with uniform loading of i ampere/m run and are fed from two end feeding points at different voltages. Find the point of minimum potential occurrence in the distributor. **NOV/DEC 2015**

    (ii) A 800m long, two wire DC distributor fed from both ends, is loaded uniformly at the rate of 1.2A/m run. If the resistance of the distributor is 0.1 Ω/km (go and return) and feed points are maintained at 245V and 240V respectively. Calculate the min voltage, its point of occurrence and current supplied from two feeding points. **NOV/DEC 2015**

13. A two wire dc ring main distributor ABCDEA is fed at point A with 230V supply. The resistance of go and return conductors of each section AB,BC,CD,DE,AE are 0.1 ohm. The main supplies the loads of 10A at B, 20A at C, 10A at D, 30A at E. find the voltage at each load point. **MAY/JUNE 2016**

OBJECTIVES:

- To introduce the basic functional elements of instrumentation
- To introduce the fundamentals of electrical and electronic instruments
- To educate on the comparison between various measurement techniques
- To introduce various storage and display devices
- To introduce various transducers and the data acquisition systems

UNIT I INTRODUCTION 9

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement –Statistical evaluation of measurement data – Standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS 9

Principle and types of analog and digital voltmeters, ammeters, multimeters – Single and three phase wattmeters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III COMPARISON METHODS OF MEASUREMENTS 9

D.C & A.C potentiometers, D.C & A.C bridges, transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – A/D, D/A converters – Smart sensors.

TOTAL :45 PERIODS

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. A.K. Sawhney, ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, 2004.
2. J. B. Gupta, ‘A Course in Electronic and Electrical Measurements’, S. K. Kataria & Sons, Delhi, 2003.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2007.

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1. H.S. Kalsi, ‘Electronic Instrumentation’, Tata McGraw Hill, II Edition 2004.
2. D.V.S. Moorthy, ‘Transducers and Instrumentation’, Prentice Hall of India Pvt Ltd, 2007.
3. A.J. Bouwens, ‘Digital Instrumentation’, Tata McGraw Hill, 1997.
4. Martin Reissland, ‘Electrical Measurements’, New Age International (P) Ltd., Delhi, 2001.

UNIT I INTRODUCTION

MEASUREMENTS:

The measurement of a given quantity is essentially an act or the result of comparison between the quantity (whose magnitude is unknown) & a predefined standard. Since two quantities are compared, the result is expressed in numerical values.

BASICREQUIREMENTSOFMEASUREMENT:

i) The standard used for comparison purposes must be accurately defined & should be commonly accepted

ii) The apparatus used & the method adopted must be provable.

MEASURINGINSTRUMENT:

It may be defined as a device for determining the value or magnitude of a quantity or variable.

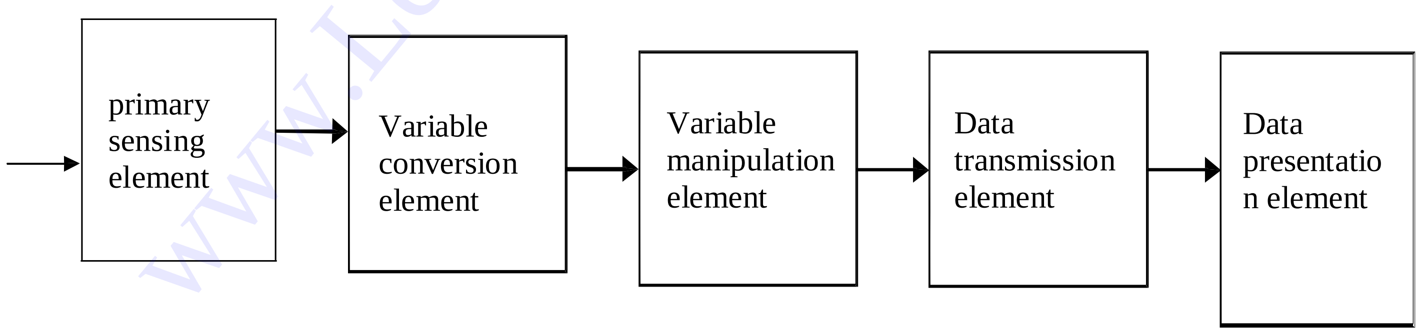
1.1 FUNCTIONAL ELEMENTS OF AN INSTRUMENT:

Most of the measurement systems contain three main functional elements. They are:

i) Primary sensing element

ii) Variable conversion element &

iii) Data presentation element.



Primarysensingelement:

The quantity under measurement makes its first contact with the primary sensing element of a measurement system. i.e., the measurand- (the unknown quantity which is to be measured) is first detected by primary sensor which gives the output in a different analogous form This output is then converted into an eelectrical signal by a transducer - (which converts energy from one form to another). The first stage of a measurement system is known as a **detector transducer stage'.**

Variableconversionelement:

The output of the primary sensing element may be electrical signal of any form , it may be voltage, a frequency or some other electrical parameter
For the instrument to perform the desired function, it may be necessary to convert this output to some other suitable form.

Variablemanipulationelement:

The function of this element is to manipulate the signal presented to it preserving the original nature of the signal. It is not necessary that a variable manipulation element should follow the variable conversion element Some non -linear processes like modulation, detection, sampling , filtering, chopping etc.,are performed on the signal to bring it to the desired form to be accepted by the next stage of measurement system This process of conversion is called **signal conditioning'**
The term signal conditioning includes many other functions in addition to Variable conversion & Variable manipulation In fact the element that follows the primary sensing element in any instrument or measurement system is called **conditioning element'**

NOTE: When the elements of an instrument are actually physically separated, it becomes necessary to transmit data from one to another. The element that performs this function is called a **data tran smission element'.**

Datapresentationelement:

The information about the quantity under measurement has to be conveyed to the personnel handling the instrument or the system for monitoring, control, or analysis purposes. This function is done by data presentation element

In case data is to be monitored, visual display devices are needed These devices may be analog or digital indicating instruments like ammeters, voltmeters etc. In case data is to be recorded, recorders like magnetic tapes, high speed camera & TV equipment, CRT, printers may be used. For control & analysis is purpose microprocessor or computers may be used. The final stage in a measurement system is known as **terminating stage'**

1.2 STATIC & DYNAMIC CHARACTERISTICS

The performance characteristics of an instrument are mainly divided into two categories:

i) Static characteristics
ii) Dynamic characteristics

Static characteristics:

The set of criteria defined for the instruments, which are used to measure the quantities which are slowly varying with time or mostly constant, i.e., do not vary with time, is called **'static characteristics'.**

The various static characteristics are:

i) Accuracy
ii) Precision
iii) Sensitivity
iv) Linearity
v) Reproducibility
vi) Repeatability
vii) Resolution
viii) Threshold
ix) Drift
x) Stability
xi) Tolerance
xii) Range or span

Accuracy:

It is the degree of closeness with which the reading approaches the true value of the quantity to be measured. The accuracy can be expressed in following ways:

a) Point accuracy:

Such an accuracy is specified at only one particular point of scale. It does not give any information about the accuracy at any other point on the scale.

b) Accuracy as percentage of scale span:

When an instrument as uniform scale, its accuracy may be expressed in terms of scale range.

c) Accuracy as percentage of true value:

The best way to conceive the idea of accuracy is to specify it in terms of the true value of the quantity being measured.

Precision:

It is the measure of reproducibility i.e., given a fixed value of a quantity, precision is a measure of the degree of agreement within a group of measurements. The precision is composed of two characteristics:

a) Conformity:

Consider a resistor having true value as 2385692 , which is being measured by an ohmmeter. But the reader can read consistently, a value as 2.4 M due to the nonavailability of proper scale. The error created due to the limitation of the scale reading is a precision error.

b) Number of significant figures:

The precision of the measurement is obtained from the number of significant figures, in which the reading is expressed. The significant figures convey the actual information about the magnitude & the measurement precision of the quantity.

The precision can be mathematically expressed as: P=1-

$$\left|\frac{X_n - \bar{X}_n}{\bar{X}_n}\right|$$

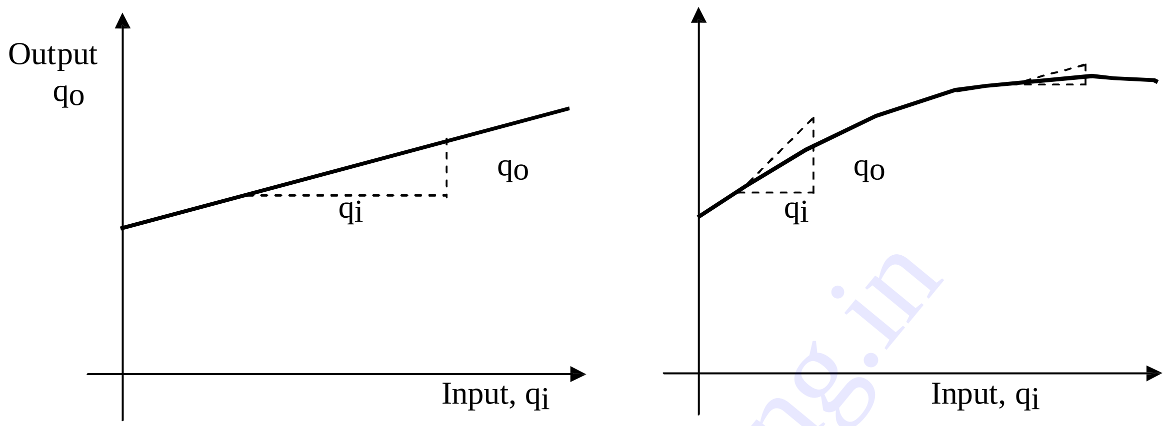
Where, P = precision

X_n = Value of n^{th} measurement

$\bar{X}_n$ = Average value the set of measurement values

Sensitivity:

The sensitivity denotes the smallest change in the measured variable to which the instrument responds. It is defined as the ratio of the changes in the output of an instrument to a change in the value of the quantity to be measured. Mathematically it is expressed as,



Sensitivity= $\dfrac{\text{Infinitesimal change in output}}{\text{Infinitesimal change in input}}$

$= \dfrac{\text{ǻqo}}{\text{ǻqi}}$

Thus, if the calibration curve is liner, as shown, the sensitivity of the instrument is the slope of the calibration curve.
If the calibration curve is not linear as shown, then the sensitivity varies with the input.
Inverse sensitivity or deflection factor is defined as the reciprocal of sensitivity.

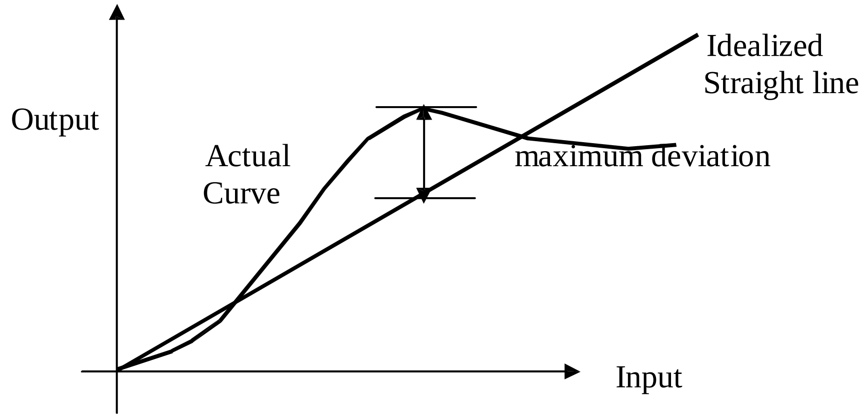
Inverse sensitivity or deflection factor = 1/ sensitivity

$= \dfrac{\text{ǻqi}}{\text{ǻqo}}$

Linearity:

The linearity is defined as the ability to reproduce the input characteristics symmetrically & linearly.

The curve shows the actual calibration curve & idealized straight line.



$$\% \text{ non-linearity} = \frac{\text{Max. deviation of output from idealized straight line}}{\text{Full scale reading}}$$

<u>Reproducibility:</u>

It is the degree of closeness with which a given value may be repeatedly measured. It is specified in terms of scale readings over a given period of time.

<u>Repeatability:</u>

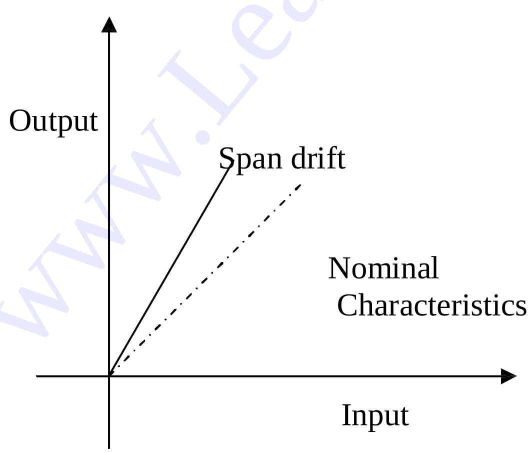
It is defined as the variation of scale reading & random in nature.

<u>Drift:</u>

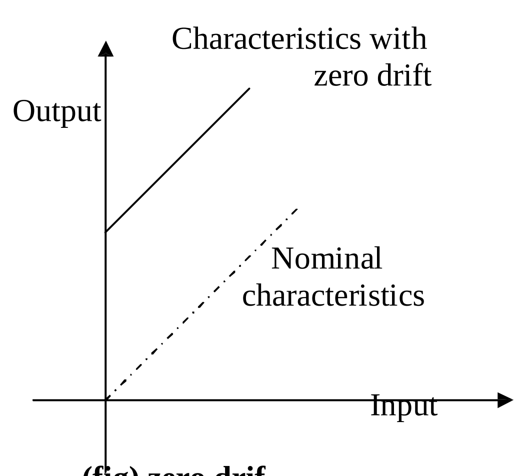
Drift may be classified into three categories:

a) zero drift:

If the whole calibration gradually shifts due to slippage, permanent set, or due to undue warming up of electronic tube circuits, zero drift sets in.



(Fig) span drift



(fig) zero drif

b) span drift or sensitivity drift

If there is proportional change in the indication all along the upward scale, the drifts is called span drift or sensitivity drift.

c) Zonal drift:

In case the drift occurs only a portion of span of an instrument, it is called zonal drift.

Resolution:

If the input is slowly increased from some arbitrary input value, it will again be found that output does not change at all until a certain increment is exceeded.
This increment is called resolution.

Threshold:

If the instrument input is increased very gradually from zero there will be some minimum value below which no output change can be detected. This
minimum value defines the threshold of the instrument.

Stability:

It is the ability of an instrument to retain its performance throughout is specified operating life.

Tolerance:

The maximum allowable error in the measurement is specified in terms of some value which is called tolerance.

Rangeorspan:

The minimum & maximum values of a quantity for which an instrument is designed to measure is called its range or span.

Dynamic characteristics:

The set of criteria defined for the instruments, which are changes rapidly with time, is called **'dynamic characteristics'.**

The various static characteristics are:

i) Speed of response ii)Measuring lag
iii) Fidelity
iv) Dynamic error

Speedofresponse:

It is defined as the rapidity with which a measurement system responds to changes in the measured quantity.

Measuringlag:

It is the retardation or delay in the response of a measurement system to changes in the measured quantity. The measuring lags are of two types:

a) Retardation type:
In this case the response of the measurement system begins immediately after the change in measured quantity has occurred.

b) Time delay lag:
In this case the response of the measurement system begins after a dead time after the application of the input.

Fidelity:

It is defined as the degree to which a measurement system indicates changes in the measurand quantity without dynamic error.

Dynamicerror:

It is the difference between the true value of the quantity changing with time & the value indicated by the measurement system if no static error is assumed. It is also called measurement error.

1.3 ERRORS IN MEASUREMENT

The types of errors are follows

i) Gross errors
ii) Systematic errors
iii) Random errors

GrossErrors:

The gross errors mainly occur due to carelessness or lack of experience of a human begin
These errors also occur due to incorrect adjustments of instruments
These errors cannot be treated mathematically
These errors are also called **personal errors'.**

Waystominimizegrosserrors:

The complete elimination of g r o s s errors is not possible but one c a n minimize them by the following ways:

Taking great care while taking the reading, recording the r e a d i n g & calculating the result
Without depending on only one reading, at least three or more readings must be taken * preferably by different persons.

Systematicerrors:

A constant uniform deviation of the operation of an instrument is known as a Systematic error
The Systematic errors are mainlydue to the short comings of the instrument & the characteristics of the material used in the instrument, such as defective or worn parts, ageing effects, environmental effects, etc.

TypesofSystematicerrors:

There are three types of Systematic errors as:
i) Instrumental errors
ii) Environmental errors iii) Observational errors

Instrumentalerrors:
These errors can be mainly due to the following three reasons:

a) Shortcomingsofinstruments:

These are because of the mechanical structure of the instruments. For example friction in the bearings of various moving parts; irregular spring tensions, reductions in due to improper handling , hysteresis, gear backlash, stretching of spring, variations in air gap, etc .,

Waystominimizethiserror:

These errors can be avoided by the following methods:

Selecting a proper instrument and planning the proper procedure for the measurement recognizing the effect of such errors and applying the proper correction factors calibrating the instrument carefully against a standard

b) Misuseofinstruments:

A good instrument if used in abnormal way gives misleading results. Poor initial adjustment, Improper zero setting, using leads of high resistance etc., are the examples of misusing a good instrument. Such things do not cause the permanent damage to the instruments but definitely cause the serious errors.

C) Loadingeffects

Loading effects due to improper way of using the instrument cause the serious errors. The best example of such loading effect error is connecting a well calibrated volt meter across the two points of high resistance circuit. The same volt meter connected in a low resistance circuit gives accurate reading.

Waystominimizethiserror:

Thus the errors due to the loading effect can be avoided by using an instrument intelligently and correctly.

Environmentalerrors:

These errors are due to the conditions external to the measuring instrument. The various factors resulting these environmental errors are temperature changes, pressure changes, thermal emf, ageing of equipment and frequency sensitivity of an instrument.

Waystominimizethiserror:

The various methods which can be used to reduce these errors are:

i) Using the proper correction factors and using the information supplied by the manufacturer of the instrument
ii) Using the arrangement which will keep the surrounding conditions Constant
iii) Reducing the effect of dust ,humidity on the components by hermetically sealing the components in the instruments
iv) The effects of external fields can be minimized by using the magnetic or electro static shields or screens
v) Using the equipment which is immune to such environmental effects.

Observationalerrors:

These are the errors introduced by the observer.
These are many sources of observational errors such as parallax error while reading a meter, wrong scale selection, etc.

Waystominimizethiserror

To eliminate such errors one should use the instruments with mirrors, knife edged pointers, etc.,

The systematic errors can be subdivided as static and dynamic errors. The static errors are caused by the limitations of the measuring device while the dynamic errors are caused by the instrument not responding fast enough to follow the changes in the variable to be measured.

Randomerrors:

Some errors still result, though the systematic and instrumental errors are reduced or atleast accounted for.The causes of such errors are unknown and hence the errors are called random errors.

Waystominimizethiserror

The only way to reduce these errors is by increasing the number of observations and using the statistical methods to obtain the best approximation of the reading.

1.4 STATISTICAL EVALUATION OF MEASUREMENT DATA

Out of the various possible errors, the random errors cannot be determined in the ordinary process of measurements. Such errors are treated mathematically

The mathematical analysis of the various measurements is called **statistical analysis of the data'.**

For such statistical analysis, the same reading is taken number of times, generally using different observers, different instruments & by different ways of measurement. The statistial a alysis helps to determine analytically the uncertainty of the final test results.

Arithmeticmean&median:

When the number of readings of the same measurement are taken, the most likely value from the set of measured value is the arithmetic mean of the number of readings taken.

The arithmetic mean value can be mathematically obtained as,

$$\overline{X} = \frac{X_1 \quad X_2 \quad .... \quad Xn}{n} =$$

This mean is very close to true value, if number of readings is very large.

But when the number of readings is large, calculation of mean value is complicated. In such a case, a median value is obtained which is obtained which is a close approximation to the arithmetic mean value. For a set of measurements X1, X2, X3.Xn written down in the ascending order of magnitudes, the median value is given by,

Xmedian=X (n+1)/2

Averagedeviation:

The deviation tells us about the departure of a given reading from the arithmetic mean of the data set

-

$$di=xi-\overline{X}$$

Where

di = deviation of ith reading

Xi= value of ith reading

$\overline{X}$ = arithmetic mean

The average deviation is defined as the sum of the absolute values of deviations divided by the number of readings. This is also called mean deviation

1.5 STANDARD & CALIBRATION

CALIBRATION

Calibration is the process of making an adjustment or marking a scale so that the readings of an instrument agree with the accepted & the certified standard.

In other words, it is the procedure for determining the correct values of measurand by comparison with the measured or standard ones.

The calibration offers a guarantee to the device or instrument that it is operating with required accuracy, under stipulated environmental conditions.

The calibration procedure involves the steps like visual inspection for various defects, installation according to the specifications, zero adjustment etc.,

The calibration is the procedure for determining the correct values of measurand by comparison with standard ones. The standard of device with which comparison is made is called a **standard instrument**. The instrument which is unknown & is to be calibrated is called **test instrument.** Thus in calibration, test instrument is compared with standard instrument.

Typesofcalibrationmethodologies:

There are two methodologies for obtaining the comparison between test instrument & standard instrument. These methodologies are

i) Direct comparisons
ii) Indirect comparisons

Directcomparisons:

In a direct comparison, a source or generator applies a known input to the meter under test. The ratio of what meter is indicating & the known generator values gives the meter's error. In such case the meter is the test instrument while the generator is the standard instrument. The deviation of meter from the standard value is compared with the allowable performance limit.
With the help of direct comparison a generator or source also can be calibrated.

Indirectcomparisons:

In the indirect comparison, the test instrument is compared with the response standard instrument of same type i .e., if test instrument is meter, standard instrument is also meter, if test instrument is generator; the standard instrument is also generator & so on.
If the test instrument is a meter then the same input is applied to the test meter as well a standard meter.
In case of generator calibration, the output of the generator tester as well as standard, or set to same nominal levels.
Then the transfer meter is used which measures the outputs of both standard and test generator.

Standard

All the instruments are calibrated at the time of manufacturer against measurement standards.
A standard of measurement is a physical representation of a unit of measurement.
A standard means known accurate measure of physical quantity.

The different size of standards of measurement are classified as i) International standards

ii) Primary standards
iii) Secondary standards
iv) Working standards

Internationalstandards

International standards are defined as the international agreement. These standards,as mentioned above are maintained at the international bureau of weights an d measures and are periodically evaluated and checked by absolute measurements in term s of fundamental units of physics.
These international standards are not available to the ordinary users for the calibration purpose.
For the improvements in the accuracy of absolute measurements the international units are replaced by the absolute units in 1948.
Absolute units are more accurate than the international units.

Primarystandards

These are highly accurate absolute standards, which can be used as ultimate reference standards.These primary standards are maintained at national

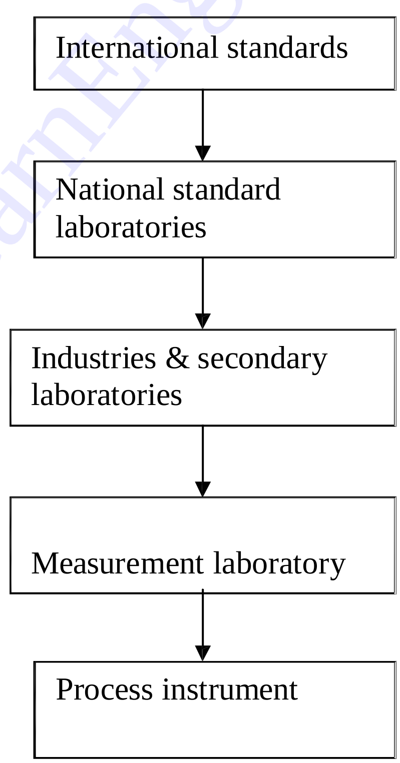
standard laboratories in different countries.
These standards representing fundamental units as well as some electrical and mechanical derived units are calibrated independently by absolute measurements at each of the national laboratories.
These are not available for use, outside the national laboratories.
The main function of the primary standards is the calibration and verification of secondary standards.

Secondarystandards

As mentioned above, the primary standards are not available for use outside the national laboratories.
The various industries need some reference standards. So, to protect highly accurate primary standards the secondary standards are maintained, which are designed and constructed from the absolute standards.
These are used by the measurement and calibration laboratories in industries and are maintained by the particular industry to which they belong. Each industry has its own standards.

Workingstandards

These are the basic tools of a measurement laboratory and are used to check an d calibrate the instruments used in laboratory for accuracy and the performance.



UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS

2.1 Principle And Types Of Analog And Digital Voltmeters

- Ø Basically an electrical indicating instrument is divided into two types. They are i) Analog instruments
  ii) Digital Instruments.
- Ø Analog instruments are nothing but its output is the deflection of pointer, which is proportional to its input.
- Ø Digital Instruments are its output is in decimal form.
- Ø Analog ammeters and voltmeters are classed together as there are no fundamental differences in their operating principles.
- Ø The action of all ammeters and voltmeters, with the exception of electrostatic type of instruments, depends upon a deflecting torque produced by an electric current.
- Ø In an ammeter this torque is produced by a current to be measured or by a definite fraction of it.
- Ø In a voltmeter this torque is produced by a current which is proportional to the voltage to be measured.
- Ø Thus all analog voltmeters and ammeters are essentially current measuring devices.

The essential requirements of a measuring instrument are

(i) That its introduction into the circuit, where measurements are to be made, does not alter the circuit conditions ;

(ii) The power consumed by them for their operation is small.

1.2Ammeters & Multimeters

Ammeters are connected in series

In the circuit whose current is to be measured. The power loss in an ammeter is I^2Ra where I is the current to be measured and R is the resistance of ammeter. Therefore, ammeters should have a low electrical resistance so that they cause a small voltage drop and consequently absorb small power.

Voltmeters are connected in parallel with the circuit whose voltage is to be measured. The power loss in voltmeters is V where V is the voltage U) be measured and R is the resistance of voltmeter. The voltmeters should have a high electrical resistance, in order that the current drawn by them is small and consequently the power consumed is small.

Types of instruments

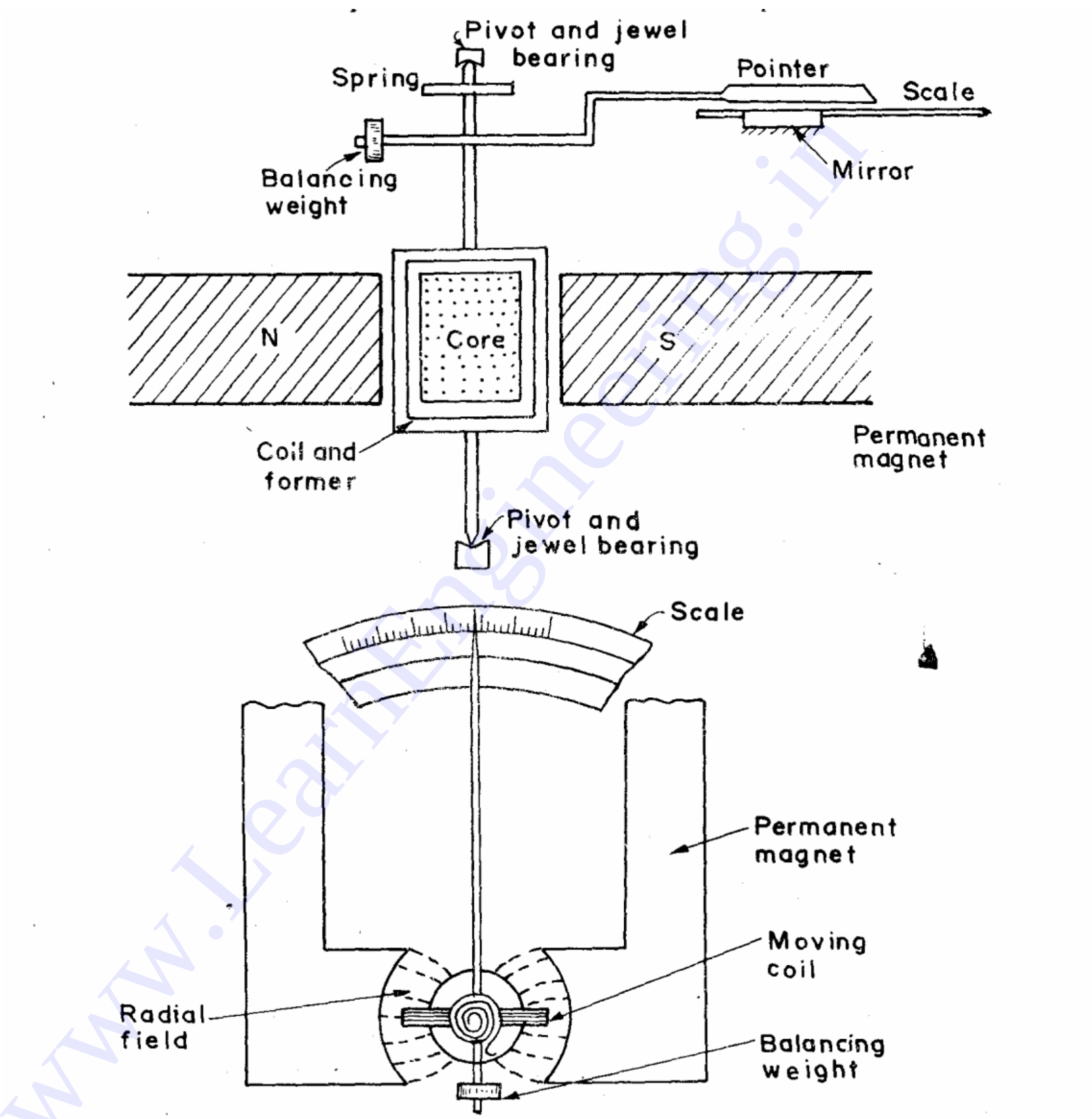
The main types of instruments used as an ammeters and voltmeters are

(i) Permanent magnet moving coil (PMMC)
(ii) Moving iron
(iii) Electro-dynamometer
(iv) Hot wire
(iv) Thermocouple
(vi) Induction
(vii) Electrostatic

(viii) Rectifier.

Permanent Magnet Moving Coil Instrument (PMMC)

The permanent magnet moving coil instrument is the most accurate type for **d.c. measurements**. The working principle of these instruments is the same as that of the d' Arsonval type of galvanometers, the difference being that a direct reading instrument is provided with a pointer and a scale.



(Fig) Permanent magnet moving coil instrument

Construction of PMMC Instruments

- The constructional features of this instrument are shown in Fig.
- The moving coil is wound with m any turns of enameled or silk covered copper wire.
- The coil is mounted on a rectangular aluminium former which is pivoted on jewelled bearings.
- The coils move freely in the field of a permanent magnet.
- Most vol tmeter coils are w ound on m etal frames to provide the re quired electro-magnetic damping.
- Most a mmeter coi ls, however, are wound on non -magnetic formers, because coil turns are effectively shorted by the ammeter shunt.
- The coil itself, therefore, provides electro magnetic damping.

Magnet Systems

- Old style m agnet syste m consisted of relatively long U shaped permanent magnets having soft iron pole pieces.
- Owing to development of materials like Alcomax and Alnico, which have a h igh co-ercive force, i t is possible to use smaller magnet lengths and high field intensities.
- The flux densities used in PMIMC instruments vary from 0.1 W b/m to 1 Wb/m.

Control

- When the coil is supported between two jewel bearings the control torque is provided by two phosphor bronze hair springs.
- These springs also serve to lead current in and out of the coil. The control torque is provided by the ribbon suspension as shown.
- This m ethod i s com paratively new and is c laimed to be advantageous as it eliminates bearing friction.

Damping

- Damping torque is produced by movement of the aluminium former moving in the magnetic field of the permanent magnet.

Pointer and Scale

- The pointer is carried by the spindle and moves over a graduated scale.
- The poin ter is of lig ht-weight constructi on and, apar t f rom those used i n some inexpensive instruments has the section over the scale twisted to form a fine blade.
- This helps to reduce parallax err ors i n the r eading of the scale. When the coil is supported between two jewel bearings the control torque is provided by two phosphor bronze hair springs.
- These springs also serve to lead current in and out of the coil.

Torque Equation.

The torque equation of a moving coil instrument is given by

Deflecting torque $T_d = NB\ l\ dI = GI$

where G = a constant = $NB\ ld$

The spring control provides a restoring (controlling) torque $T_c = K\theta$

where K = spring constant.

For final steady deflection $T_c = T_d$ or $GI = K\theta$

$\therefore$ Final steady deflection $\theta = (G/K)\ I$

or current $I = (K/G)\ \theta$

As the deflection is directly proportional to the current passing through the meter (K and G being constants) we get a uniform (linear) scale for the instrument.

Errors in PMMC Instruments

The main sources of errors in moving coil instruments are due to

- Weakening of permanent magnets due to ageing at temperature effects.
- Weakening of springs due to ageing and temperature effects.
- Change of resistance of the moving coil with temperature.

Advantages and Disadvantages of PMMC Instruments

The main advantages of PMMC instruments are

- The scale is uniformly divided.
- The power consumption is very low
- The torque-weight ratio is high which gives a high accuracy. The accuracy is of the order of generally 2 percent of full scale deflection.
- A single instrument may be used for many different current and voltage ranges by using different values for shunts and multipliers.
- Since the operating forces are large on account of large flux densities which may be as high as 0.5 Wb/m the errors due to stray magnetic fields are small.
- Self-shielding magnets make the core magnet mechanism particularly useful in aircraft and aerospace applications.

The chief disadvantages are

- These instruments are useful only for d.c. The torque reverses if the current reverses. If the instrument is connected to a.c., the pointer cannot follow the rapid reversals and the deflection corresponds to mean torque, which is zero. Hence these instruments cannot be used for a.c.
- The cost of these instruments is higher than that of moving iron instruments.

Moving Iron Instruments

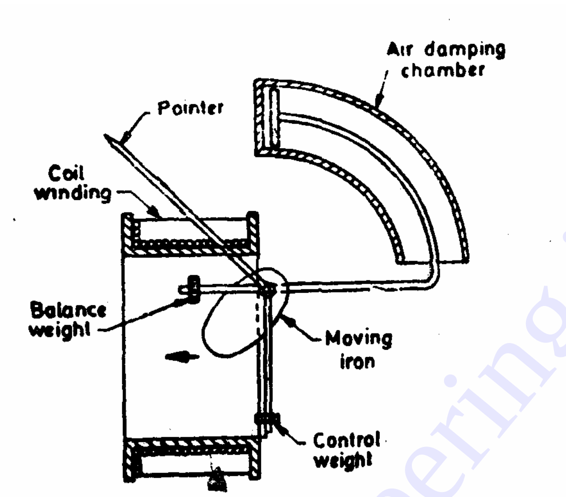
Classification of Moving Iron Instruments

Moving iron instruments are of two types

(i) Attraction type.

(ii) Repulsion type.

Attraction Type



- Ø The coil is flat and has a narrow slot like opening.
- Ø The moving iron is a flat disc or a sector eccentrically mounted.
- Ø When the current flows through the coil, a magnetic field is produced and the moving iron moves from the weaker field outside the coil to the Stronger field inside it or in other words the moving iron is attracted in.
- Ø The controlling torque is provide by springs hut gravity control can be used for panel type of instruments which are vertically mounted.
- Ø Damping is provided by air friction with the help of a light aluminium piston (attached to the moving system) which move in a fixed chamber closed at one end as shown in Fig. or with the help of a vane (attached to the moving system) which moves in a fixed sector shaped chamber a shown.

Repulsion Type

In the repulsion type, there are two vanes inside the coil one fixed and other movable. These are similarly magnetized when the current flows through the coil and there is a force of repulsion between the two vane s resulting in the movement of the moving vane. Two different designs are in common use

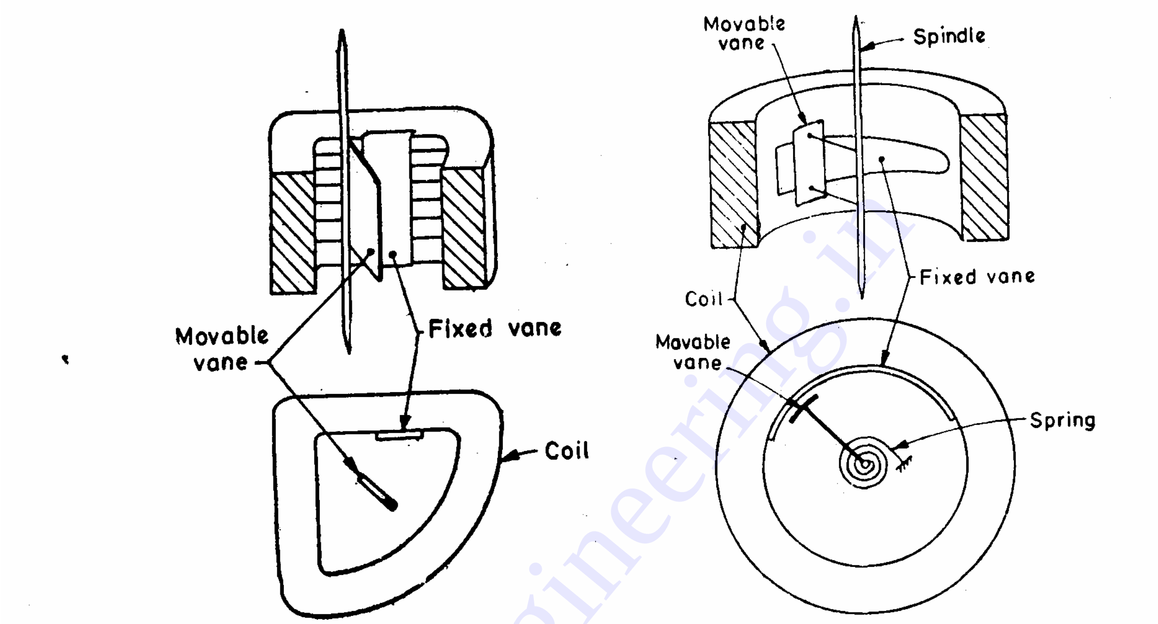
(I) Radial Vane Type

In this type, the vanes are radial strips of iron.

The strips are placed within the coil as shown in Fig.

The fixed vane is attached to the coil and the movable one to the spindle of the instrument.

(a) Radial vane type. **(b) Co-axial vane type**



(ii) Co-axial Vane Type

- Ø In this type of instrument, the fixed and moving vanes are sections of co axial cylinders as shown in Fig.
- Ø The controlling torque is provided by springs. Gravity control can also he used in vertically mounted instruments.
- Ø The damping torque is produced by air friction as in attraction type instruments.
- Ø The operating magnetic field in moving iron instruments is very weak and therefore eddy current damping is not used in them as introduction of a permanent magnet required for eddy current damping would destroy the operating magnetic field.
- Ø It is clear that whatever may be the direction of the current in the coil of the instrument, the iron vanes are so magnetized that there is always a force of attraction in the attraction type and repulsion in the repulsion type of instruments.
- Ø Thus moving iron instruments are unpolarised instruments i.e., they are independent of the direction in which the current passes.
- Ø Therefore, these instruments **can be used on both ac. and d.c.**

Torque Equation of Moving Iron Instrument:

An expression for the torque moving iron instrument may be derived by consid ring the energy relati ons when there is a small increment in current supplied to the instrument. When this happens there will be a small deflection dș a mechanical work will be done. Let Td be the deflecting torque.

Mechanical work done = Td. dș

Alongside there will be a change in the energy stored in the magnetic field owing to change in inductance.

Suppose the initial current is I, the instrument inductance L and the deflection ș. If the curr ent is increased by di then the defle ction chan ges by d ș and the inductance by dL. In order to affect a n increment the current there must be an increase in the applied voltage given by $e = \frac{d}{dt}(LI) = I\frac{dL}{dt} + L\frac{dI}{dt}$

The electrical energy supplied $eIdt = I^2dL + ILdI$

The stored energy changes from $= \frac{1}{2}I^2 L$ to $\frac{1}{2}(I + dI)^2 (L + dL)$.

Hence the change in stored energy $\frac{1}{2}(I^2 + 2IdI + dI^2)(L + dL) - \frac{1}{2}I^2L$.

Neglecting second and higher order terms in small quantities this becomes $ILdI + \frac{1}{2}I^2d$

From the principle of the conservation of energy,

Electrical energy supplied = increase in stored energy + mechanical work done

$$I^2dL + ILdI = ILdI = \frac{1}{2}I^2dL + T_d d\theta$$

Thus $T_d\, d\theta = \frac{1}{2}I^2dL$

or Deflecting torque $T_d = \frac{1}{2}I^2\frac{dL}{d\theta}$

T is in newton-metre, I in ampere, L in henry, and θ in radian.

The moving system is provided with control springs and it turns the deflecting torque T_d is balanced by the controlling torque $T_c = K\theta$

where K = control spring constant ; Nm/rad, θ = deflection ; rad.

At equilibrium (or final steady) position, $T_c = T_d$ or $K\theta = \frac{1}{2}I^2\frac{dL}{d\theta}$

∴ Deflection $\theta = \frac{1}{2}\frac{I^2}{K}\frac{dL}{d\theta}$

Hence the deflection is proportional to square of the rms value of the operating cur rent. The deflecting torq ue is, therefore, unidir ectional (acts in the same direction) whatever may be the polarity of the current.

Comparison between Attraction and Repulsion Types of Instruments

In general it may be said that attraction-type instruments possess the same advantages, and are subject to the limitations, described for the repulsion type.

An attraction type instrument will usually have a lower inductance than the corresponding repulsion type instrument, and voltmeters will therefore be accurate over a wider range of frequency and there is a greater possibility of using shunts with ammeters.

On the other hand, repulsion instruments are more suitable for economical production in manufacture, and a nearly uniform scale is more easily obtained; they are, therefore, much more common than the attraction type.

Errors in Moving Iron Instruments

There are two types of errors which occur in moving iron instruments — errors which occur with both a.c. and d.c. and the other which occur only with ac. only.

Errors with both D.C. and A.C

i) Hysteresis Error
ii) Temperature error
iii) Stray magnetic field

Errors with only A.C

Frequency errors

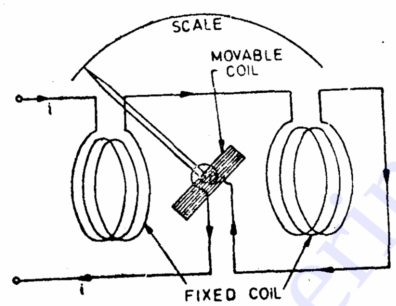
Advantages & Disadvantages

1) Universal use
(2) Less Friction Errors
(3) Cheapness
(4) Robustness
(5) Accuracy
(6) Scale
(7) Errors
(8) Waveform errors.

Electrodynamometer (Eelectrodynamic) Type Instruments

The necessity for the a.c. calibration of moving iron instruments as well as other types of instruments which cannot be correctly calibrated requires the use of a transfer type of instrument. A transfer instrument is one that may be calibrated with a d.c. source and then used without modification to measure a.c. This requires the transfer type instrument to have same accuracy for both d.c. and a.c., which the electrodynamometer instruments have.

These standards are precision resistors and the Weston standard cell (which is a d.c. cell).It is obvious, therefore, that it would be impossible to calibrate an a.c. instrument directly against the fundamental standards.The calibration of an a.c. instrument may be performed as follows. The transfer instrument is first calibrated on d.c.This calibration is then transferred to the a.c. instrument onalternating current, using operating conditions under which the latter operates properly. Electrodynamic instruments are capable of service as transfer instruments.Indeed, their principal use as ammeters and voltmeters in laboratory and measurement work is for the transfer calibration of working instruments and as standards for calibration of other nstruments as their accuracy is very high.Electrodynamometer types of instruments are used as a.c. voltmeters and ammeters both in the range of power frequencies and lower part of the audio power frequency range. They are used as watt-meters, and with some modification as power factor meters and frequency meters.



Operating Principle of Electrodynamometer Type Instrument

It would have a torque in one direction during one half of the cycle and an equal effect in the opposite direction during the other half of the cycle.If the frequency were very low, the pointer would swing back and forth around the zero point. However, for an ordinary meter, the inertia is so great that on power frequencies the pointer does not go very far in either direction but merely stays (vibrates slightly) around zero. If, however, we were to reverse the direction of the flux each time the current through the movable coil reverses, a unidirectional torque would be produced for both positive and negative halves of the cycle.

In electrodynamometer instruments the field can be made to reverse simultaneously with the current in the movable coil if the field (fixed) coil is connected in series with the movable coil.

Construction of Electrodynamometer type instrument

Fixed Coils

The field is produced by a fixed coil.

This coil is divided into two sections to give a more uniform field near the centre and to allow passage of the instrument shaft.

Moving Coil

A single element instrument has one moving coil.

The moving coil is wound either as a self-sustaining coil or else on a non-metallic former.

A metallic former cannot be used as eddy current would be induced in it by the alternating field.

Light but rigid construction is used for the moving coil.

It should be noted that both fixed and moving coils are air cored.

Control

The controlling torque is provided by two control springs.

These springs act as leads to the moving coil.

Moving System

The moving coil is mounted on an aluminum spindle.

The moving system also carries the counter weights and truss type pointer.

Sometimes a suspension may be used in case a high sensitivity is desired.

Damping

Air friction damping is employed for these instruments and is provided by a pair of aluminum vanes, attached to the spindle at the bottom.

These vanes move in sector shaped chambers.

Eddy current damping cannot be used in these instruments as the operating field is very weak (on account of the fact that the coils are air cored) and any introduction of a permanent magnet required for eddy current damping would distort the operating magnetic field of the instrument.

Shielding

The field produced by the fixed coils is somewhat weaker than in other types of instruments

It is nearly 0.005 to 0.006 Wb/m

In d.c. measurements even the earth magnetic field may affect the readings.

Thus it is necessary to shield an electrodynamometer type instrument from the effect of stray magnetic fields.

Air cored electrodynamometer type instruments are protected against external magnetic fields by enclosing them in a casing of high permeability alloy.

This shunts external magnetic fields around the instrument mechanism and minimizes their effects on the indication.

Cases and Scales

Laboratory standard instruments are usually contained in highly polished wooden cases.

These cases are so constructed as to remain dimensionally stable over long periods of time.

The glass is coated with some conducting material to completely remove the electrostatic effects.

The case is supported by adjustable leveling screws.

A spirit level is also provided to ensure proper leveling.

The scales are hand drawn, using machine sub-dividing equipment. Diagonal lines for fine sub-division are usually drawn for main markings on the scale.

Most of the high-precision instruments have a 300 mr scale with 100, 120 or 150 divisions.

Torque Equation

Let i1 = instantaneous value of current in the fixed coils: A.

i2 = instantaneous value of current in the moving coil: A. L1 = self-inductance of fixed coils: H.

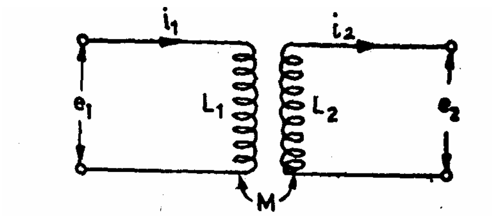
L2 = self-inductance of moving coils H,

M = mutual inductance between fixed and moving coils:

Flux linkages of coil 1, ψ_1 = L1 i1 + Mi2

Flux linkages f coil 2, ψ_2 = L2 i2 + Mi1

Electrical input energy = e1i1dt+e2i2dt



(Fig) circuit representation

$$= i_1L_1di_1 + i_1^2dL_1 + i_1i_2dM + i_1Mdi_2 + i_2L_2di_2 + i_2^2dL_2 + i_1i_2dM + i_2Mdi_1$$

Energy stored in the magnetic field $= \frac{1}{2}i_1^2L_1 + \frac{1}{2}i_2^2L_2 + i_1i_2M$

Change in energy stored $= d(\frac{1}{2}i_1^2L_1 + \frac{1}{2}i_2^2L_2 + i_1i_2M)$

$$= i_1L_1di_1 + (i_1^2/2)dL_1 + i_2L_2di_2 + (i_2^2/2)dL_2 + i_1Mdi_2 + i_2Mdi_1 + i_1i_2dM$$

From principle of conservation of energy,

Total electrical input energy = change in energy stored + mechanical energy.

$$\therefore \text{ Mechanical energy} = \frac{1}{2}i_1^2dL_1 + \frac{1}{2}i_2^2dL_2 + i_1i_2dM.$$

Now the self-inductances L and L are constant and therefore dL and dL are both equal to zero. Thus we have

$$T_id\theta = i_1i_2dM \text{ or } T_i = i_1i_2\ dM/d\theta$$

Errors in Electrodynamometer Instruments

i) Frequency error
ii) Eddy current error
iii) External magnetic field
iv) Temperature changes

Advantages

i) These instruments can be used on both a.c & d.c
ii) Accurate rms value

Disadvantages

(i) They have a low torque/weight ratio and hence have a low sensitivity. (ii) Low torque/weight ratio gives increased frictional losses.

(iii) They are more expensive than either the PMMC or the moving iron type instruments.

(iv) These instruments are sensitive to overloads and mechanical impacts. Therefore, they must be handled with great care.

(v) The operating current of these instruments is large owing to the fact that they have weak magnetic field. The flux density is about 0.006 Wb/m as against 0.1 to 0.5 Wb/m in PMCC instruments

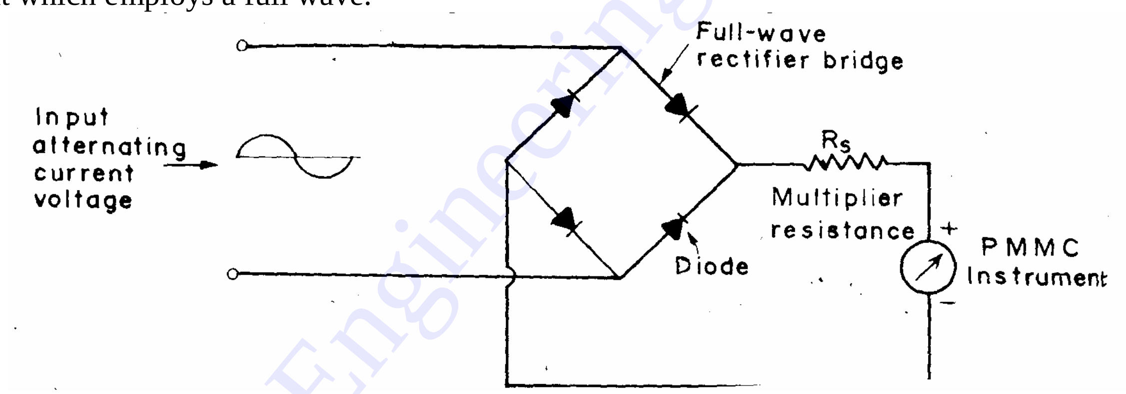
(vi) They have a non-uniform scale.

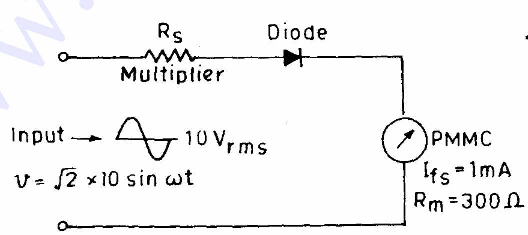
Rectifier Type Instruments

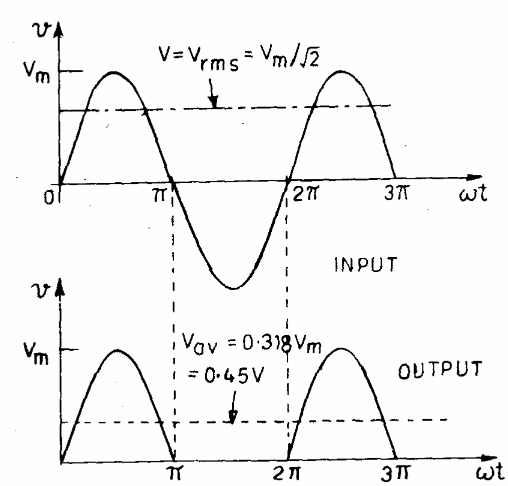
Rectifier type instruments are used for measurement of ac. voltages and currents by employing a rectifier element which converts a.c. to a unidirectional d.c. and then using a meter responsive to d.c. to indicate the value of rectified a.c.

The indicating instrument is PM MC instrument which uses a d 'Arsonval movement.

This method is very attractive since PM MC instruments have a higher sensitivity than the electrodynamometer or the moving iron instruments. The arrangement which employs a full wave.







(Fig) voltmeter using full wave rectifier

Digital Voltmeter

A digital voltmeter (DVM) displays the value of a.c. or d.c. voltage being measured directly as discrete numerals in the decimal number system. Numerical readout of DVMs is advantageous since it eliminates observational errors committed by operators.

The errors on account of parallax and approximations are entirely eliminated.

The use of digital voltmeters increases tile speed with which readings can be taken.

A digital voltmeter is a versatile and accurate voltmeter which has many laboratory applications.

On account of developments in the integrated circuit (IC) technology, it has been possible to reduce the size, power requirements and cost of digital voltmeters.

In fact, for the same accuracy, a digital voltmeter now is less costly than its analog counterpart.

The decrease in size of DVMs on account of use of ICs, the portability of the instruments has increased.

Types of DVMs

The increasing popularity of DVMs has brought forth a wide number of types employing different circuits. The various types of DVMs in general use are

(i) Ramp type DVM
(ii) Integrating type DVM
(iii) Potentiometric type DVM
(iv) Successive approximation type DVM
(v) Continuous balance type DVM

Ramp type Digital Voltmeter

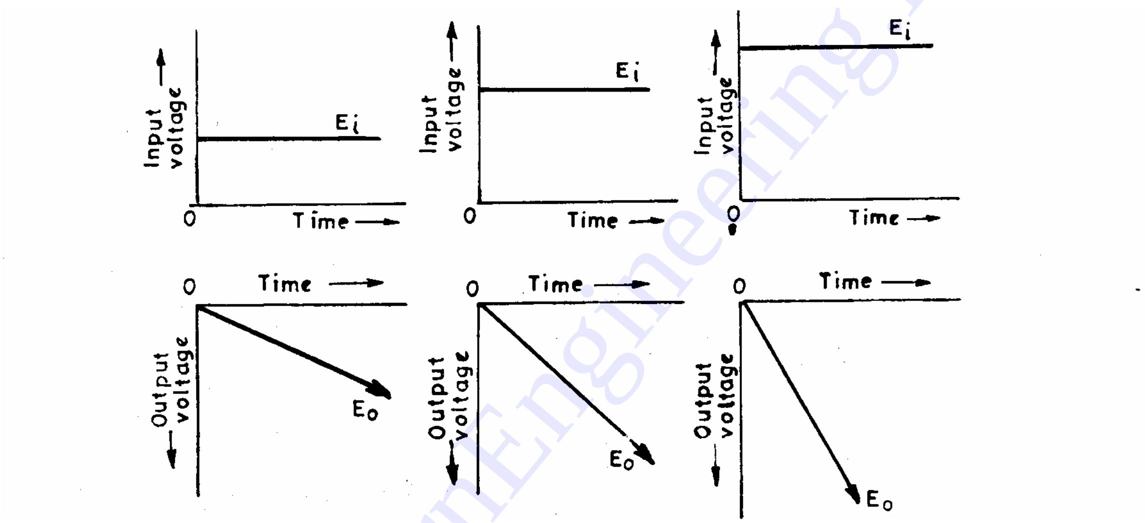
The operating principle of a ramp type digital voltmeter is to measure the time that a linear ramp voltage takes to change from level of input voltage to zero voltage (or vice versa).This time interval is measured with an electronic time interval counter and the count is displayed as a number of digits on electronic indicating tubes of the output readout of the voltmeter.The conversion of a voltage value of a time interval is shown in the timing diagram .A negative going ramp is shown in Fig. but a positive going ramp may also be used.The ramp voltage value is continuously compared with the voltage being measured (unknown voltage).At the instant the value of ramp voltage is equal to that of unknown voltage.The ramp voltage continues to decrease till it reaches ground level (zero voltage).At this instant another comparator called ground comparator generates. a pulse and closes the gate.The time elapsed between opening and closing of the gate is t as indicated in Fig.During this time interval pulses from a clock pulse generator pass through the gate and are counted and displayed.The decimal number as indicated by the readout is a measure of the value of input voltage.The sample rate multivibrator determines the rate at which the measurement cycles are initiated.The sample rate circuit provides an initiating pulse for the ramp generator to start its next ramp voltage.

At the same time it sends a pulse to the counters which set all of them to 0.

This momentarily removes the digital display of the readout.

Integrating Type Digital Voltmeter

The voltmeter measures the true average value of the input voltage over a fixed measuring period.In contrast the ramp type DVM samples the voltage at the end of the measuring period.This voltmeter employs an integration technique which uses a voltage to frequency conversion.The voltage to frequency (VIF) converter functions as a feedback control system which governs the rate of pulse generation in proportion to the magnitude of input voltage.



Actually when we employ the voltage to frequency conversion techniques, a train of pulses, whose frequency depends upon the voltage being measured, is generated.

Then the number of pulses appearing in a definite interval of time is counted.

Since the frequency of these pulses is a function of unknown voltage, the number of pulses counted in that period of time is an indication of the input (unknown) voltage.

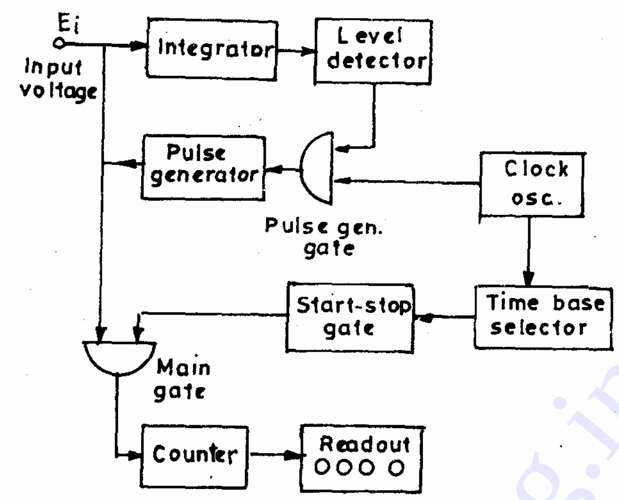
The heart of this technique is the operational amplifier acting as an Integrator.

Output voltage of integrator E = -Ei / RC*t

Thus if a constant input voltage E is applied, an output voltage E is produced which rises at a uniform rate and has a polarity opposite to that input voltage.

In other words, it is clear from the above relationship that for a constant input voltage the integrator produces a ramp output voltage of opposite polarity.

The basic block diagram of a typical integrating type of DVM is shown in



The unknown voltage is applied to the input of the integrator, and the output voltage starts to rise.The slope of output voltage is determined by the value of input voltage This voltage is fed a level detector, and when voltage reaches a certain reference level, the detector sends a pulse to the pulse generator gate. The level detector is a device similar to a voltage comparator. The output voltage from integrator is compared with the fixed voltage of an internal reference source, and, when voltage reaches that level, the detector produces an output pulse.

It is evident that greater then value of input voltage the sharper will be the slope of output voltage and quicker the output voltage will reach its reference level.
The output pulse of the level detector opens the pulse level gate, permitting pulses from a fixed frequency clock oscillator to pass through pulse generator.
The generator is a device such as a Schmitt trigger that produces an output pulse of fixed amplitude and width for every pulse it receives. This output pulse, whose polarity is opposite to that of and has greater amplitude, is fedback of the input of the integrator.Thus no more pulses from the clock oscillator can pass through to trigger the pulse generator.When the output voltage pulse from the pulse generator has passed, is restored to its original value and starts its rise again.When it reaches the level of reference voltage again, the pulse generator gate is opened.The pulse generator is trigger by a pulse from the clock generator and the entire cycle is repeated again.

Thus, the waveform of is a saw tooth wave whose rise time is dependent upon the value of output voltage and the fail time is determined by the width of the output pulse from the pulse generator.Thus the frequency of the saw tooth wave is a function of the value of the voltage being measured.Since one pulse from the pulse generator is produced for each cycle of the saw tooth wave, the number of pulses produced in a given time interval and hence the frequency of saw tooth wave is an indication of the voltage being measured.

Potentiometric Type Digital Voltmeter

A potentiometric type of DVM employs voltage comparison technique. In this DVM the unknown voltage is compared with reference voltage whose value is fixed by the setting of the calibrated potentiometer.

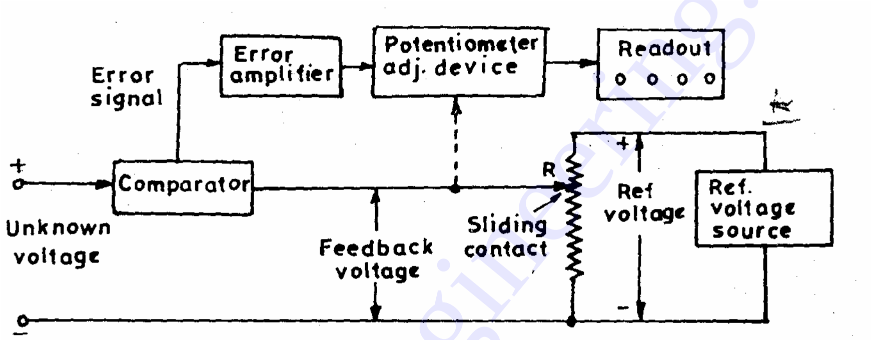
The potentiometer setting is changed to obtain balance (i.e. null conditions).

When null conditions are obtained the value of the unknown voltage, is indicated by the dial setting of the potentiometer.

In potentiometric type DVMs, the balance is not obtained manually but is arrived at automatically.

Thus, this DVM is in fact a self- balancing potentiometer.

The potentiometric DVM is provided with a readout which displays the voltage being measured.



(Fig.) Basic block diagram of a potentiometric DVM.

The block diagram of basic circuit of a potentiometric DVM is shown. The unknown voltage is filtered and attenuated to suitable level. This input voltage is applied to a comparator (also known as error detector).This error detector may be chopper.The reference voltage is obtained from a fixed voltage source. This voltage is applied to a potentiometer.The value of the feedback voltage depends up the position of the sliding contact.The feedback voltage is also applied to the comparator.The unknown voltage and the feedback voltages are compared in the comparator.The output voltage of the comparator is the difference of the above two voltages.The difference of voltage is called the error signal.The error signal is amplified and is fed to a potentiometer djustment device which moves the sliding contact of the potentiometer.This magnitude by which the sliding contact moves depends upon the magnitude of the error signal.

The direction of movement of slider depends upon whether the feedback voltage is larger or the input voltage is larger.The sliding contact moves to such a place where the feedback voltage equals the unknown voltage.In that case, there will not be any error voltage and hence there will be no input to the device adjusting the position of the sliding cont act and therefore it (sliding contact) will come to rest.The position of the potentiometer adjustment device at this point is indicated in numerical form on the digital readout device associated with it.

2.3Single And Three Phase Wattmeters And Energy Meters

Single Phase Induction Type Meters

The construction and principle of operation of Single Phase Energy Meters is explained below

Construction of Induction Type Energy Meters

There are four main parts of the operating mechanism

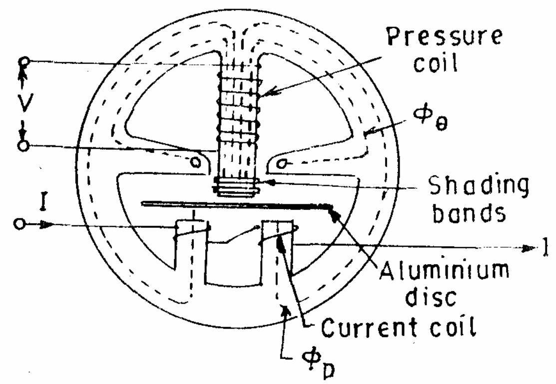
(i) Driving system
(ii) Moving system
(iii) Braking system
(iv) Registering system

Driving system

The driving system of the meter consists of two electro-magnets.
The core of these electromagnets is made up of silicon steel laminations. The coil of one of the electromagnets is excited by the load current. This coil is called the current coil.
The coil of second electromagnet is connected across the supply and, therefore, carries a current proportional to the supply voltage. This coil is called the pressure coil.
Consequently the two electromagnets are known as series and shunt magnets respectively.
Copper shading bands are provided on the central limb. The position of these bands is adjustable.
The function of these bands is to bring the flux produced by the shunt magnet exactly in quadrature with the applied voltage.

Moving System

This consists of an aluminum disc mounted on a light alloy shaft.
This disc is positioned in the air gap between series and shunt magnets. The upper bearing of the rotor (moving system) is a steel pin located in a hole in the bearing cap fixed to the top of the shaft.
The rotor runs on a hardened steel pivot, screwed to the foot of the shaft. The pivot is supported by a jewel bearing.
A pinion engages the shaft with the counting or registering mechanism.

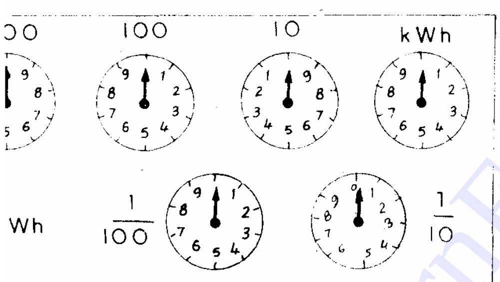


(Fig) single phase energy meter

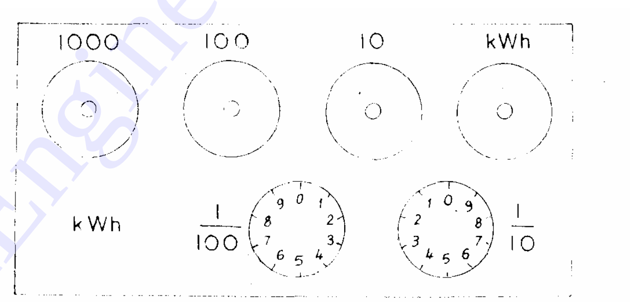
Braking System

A permanent magnet positioned near the edge of the aluminium disc forms the braking system. The aluminium disc moves in the field of this magnet and thus provides a braking torque.

The position of the permanent magnet is adjustable, and therefore braking torque can be adjusted by shifting the permanent magnet to different radial positions as explained earlier.



(fig) Pointer type



(fig) cyclometer register

Registering (counting) Mechanism

The function of a registering or counting mechanism is to record continuously a number which is proportional to the revolutions made by the moving system.

By a suitable system, a train of reduction gears the pinion on the rotor shaft drives a series of five or six pointers.

These rotate on round dials which are marked with ten equal divisions.

The pointer type of register is shown in Fig. Cyclo-meter register as shown in Fig can also he used.

Errors in Single Phase Energy Meters

The errors caused by the driving system are

(i) Incorrect magnitude of fluxes.

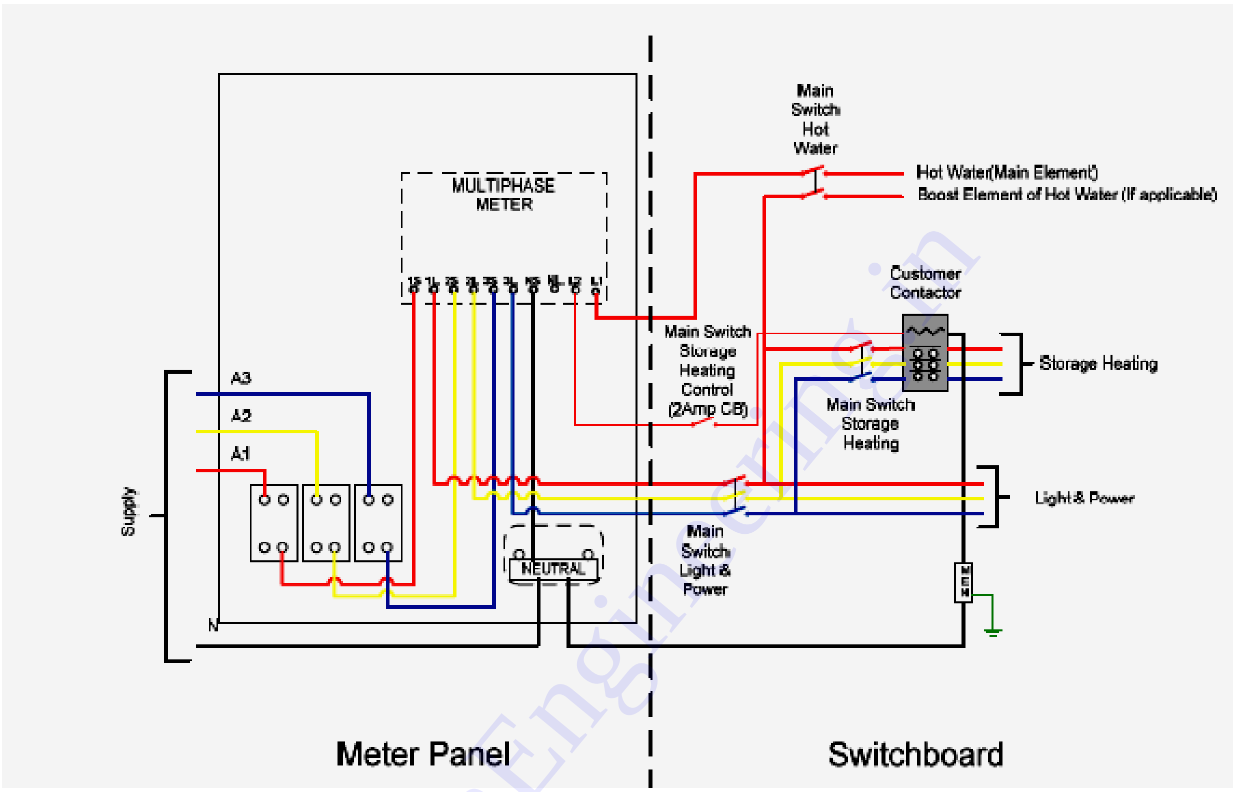
(ii) Incorrect phase angles.

(iii) Lack of Symmetry in magnetic circuit.

The errors caused by the braking system are

i) changes in strength of brake magnet
ii) changes in disc resistance
iii) abnormal friction
iv) self braking effect

Three Phase General Supply with Controlled Load



- L1 – 30A Load Control (Hot Water)
- L2 – Maximum 2A Load Control (Storage Heating)
- 2.5mm² with 7 strands for conductors to control customer contactor
- Load carrying conductors not less than 4mm² or greater than 35mm²
- All metering neutrals to be black colour 4mm² or 6 mm² with minimum 7 stranded conductors.
- Not less than 18 strand for 25 & 35mm² conductors
- Refer to SIR's for metering obligations
- Comply with Electrical Safety (Installations) Regulations 2009 and AS/NZS 3000
- Customer needs to provide 2A circuit breaker as a Main Switch and their load control contactor
- Within customer's switchboard
- Meter panel fuse not required for an overhead supply.
- Off Peak controlled load only includes single phase hot water & single or multi-phase storage heating
- Wiring diagram applicable for Solar

- Metering diagram is applicable for 2 or 3 phase load.
  For 2 phase loads – Red and Blue phase is preferred.

WATTMETER

Electrodynamometer Wattmeters

These instruments are similar in design and construction to electrodynamometer type ammeters and voltmeters.

The two coils are connected in different circuits for measurement of power.

The fixed coils or " field coils" arc connected in series with the load and so carry the current in the circuit.

The fixed coils, therefore, form the current coil or simply C.C. of the wattmeter.

The moving coil is connected across the voltage and, therefore, carries a current proportional to the voltage.

A high non-inductive resistance is connected in series with the moving coil to limit the current to a small value.

Since the moving coil carries a current proportional to the voltage, it is called the '' pressure coil'' or " voltage coil" or simply called P.C. of the wattmeter.

Construction of Electrodynamometer Wattmeter

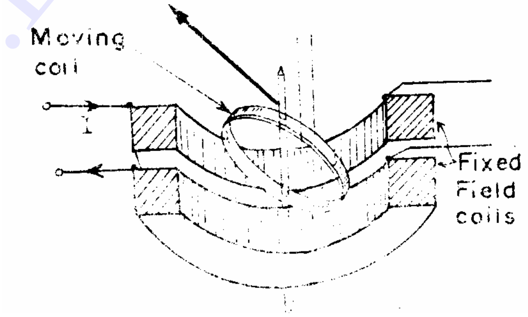
Fixed Coils

The fixed coils carry the current of the circuit.

They are divided into two halves.

The reason for using fixed coils as current coils is that they can be made more massive and can be easily constructed to carry considerable current since they present no problem of leading the current in or out.

The fixed coils are wound with heavy wire. This wire is stranded or laminated especially when carrying heavy currents in order to avoid eddy current losses in conductors. The fixed coils of earlier wattmeters were designed to carry a current of 100 A but modem designs usually limit the maximum current ranges of wattmeters to about 20 A. For power measurements involving large load currents, it is usually better to use a 5 A wattmeter in conjunction with a current transformer of suitable range.



(Fig) Dynamometer wattmeter

Damping

Air friction damping is used.

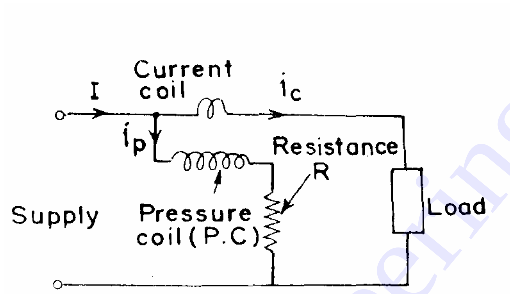
The moving system carries a light aluminium vane which moves in a sector shaped box.

Electromagnetic or eddy current damping is not used as introduction of a permanent magnet (for damping purposes) will greatly distort the weak operating magnetic field.

Scales and Pointers

They are equipped with mirror type scales and knife edge pointers to remove reading errors due to parallax.

Theory of Electrodynamometer Watt-meters



(Fig) circuit of electrodynamometer

It is clear from above that there is a component of power which varies as twice the frequency of current and voltage (mark the term containing 2At).

Average deflecting torque

$$T_d = \frac{1}{T}\int_0^T T_i \, d(\omega t) = \frac{1}{T}\int_0^T I_p \, I \,[\cos\phi - \cos(2\omega t - \phi)]\,\frac{dM}{d\theta}\,.\,d(\omega t)$$

$$= I_p \, I \cos\phi \,.\, dM/d\theta$$

$$= (VI/R_p)\cos\phi \,.\, dM/d\theta$$

Controlling torque exerted by springs Tc= Kş

Where, K = spring constant; ş= final steady deflection.

Errors in electrodynamometer

i) Errors due to inductance effects ii) Stray magnetic field errors

iii) Eddy current errors

iv) Temperature error

Ferrodynamic Wattmeters

The operating torque can be considerably increased by using iron cores for the coils.

Ferrodynamic wattmeters employ cores of low loss iron so that there is a large increase in the flux density and consequently an increase in operating torque with little loss in accuracy.

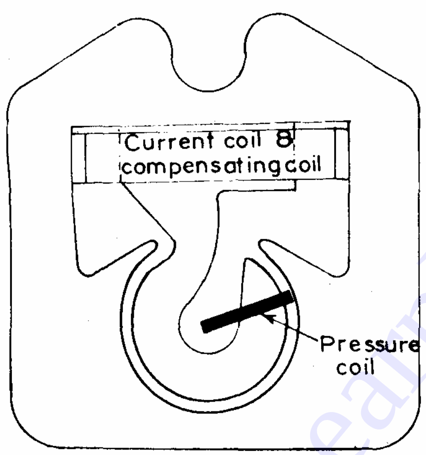
The fixed coil is wound on a laminated core having pole pieces designed to give a uniform radial field throughout the air gap.

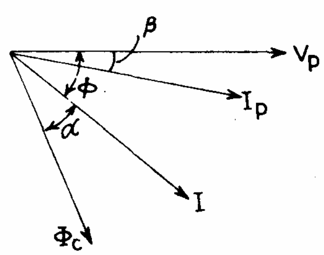
The moving coil is asymmetrically pivoted and is placed over a hook shaped pole piece.

This type of construction permits the use of a long scale up to about 270° and gives a deflecting torque which is almost proportional to the average power.

With this construction there is a tendency on the part of the pressure coil to creep (move further on the hook) when only the pressure coil is energized.

This is due to the fact that a coil tries to take up a position where it links with maximum flux. The creep causes errors and a compensating coil is put to compensate for this voltage creep.





The use of ferromagnetic core makes it possible to employ a robust construction for the moving element.

Also the Instrument is less sensitive to external magnetic fields. On the other hand, this construction introduces non-linearity of magnetization curve and introduction of large eddy current & hysteresis losses in the core.

Three Phase Wattmeters

A dynamometer type three-phase wattmeter consists of two separate wattmeter movements mounted together in one case with the two moving coils mounted on the same spindle.

The arrangement is shown in Fig.

There are two current coils and two pressure coils.

A current coil together with its pressure coil is known as an element.

Therefore, a three phase wattmeter has two elements.

The connections of two elements of a 3 phase wattmeter are the same as that for two wattmeter method using two single phase wattmeter.

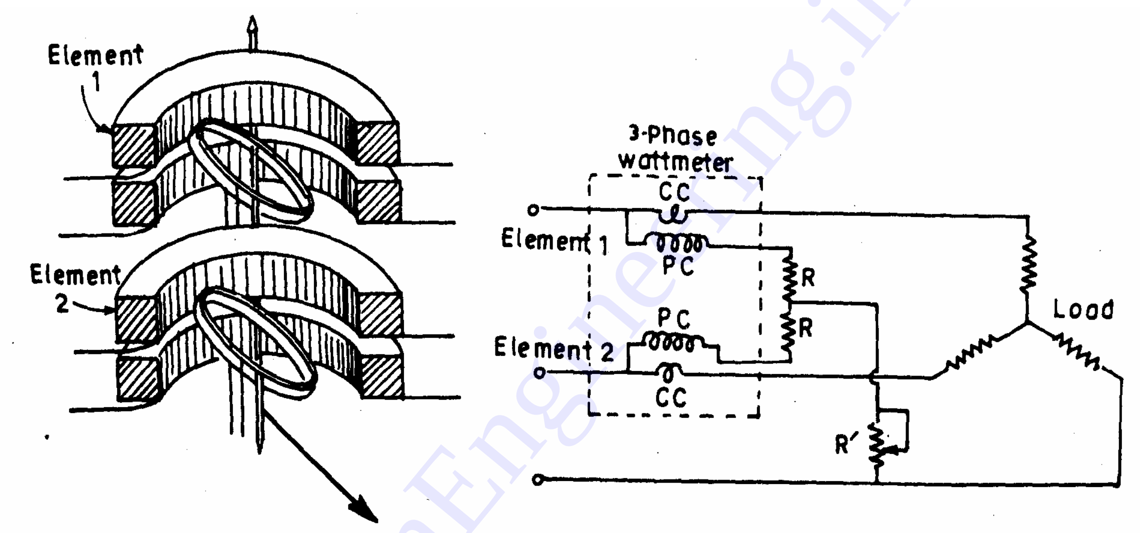
The torque on each element is proportional to the power being measured by it.

The total torque deflecting the moving system is the sum of the deflecting torque of the two elements.

Hence the total deflecting torque on the moving system is proportional to the total Power.

In order that a 3 phase wattmeter read correctly, there should not be any mutual interference between the two elements.

A laminated iron shield may be placed between the two elements to eliminate the mutual effects.



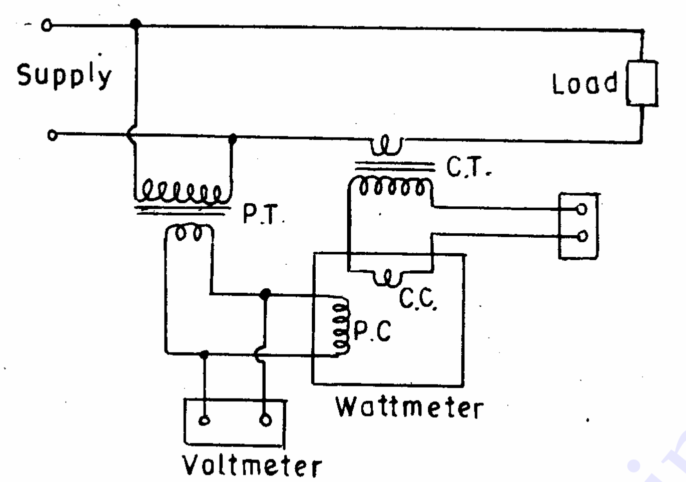
(fig) three phase wattmeter

2.4 InstrumentTransformers

Power measurements are made in high voltage circuits connecting the wattmeter to the circuit through current and potential transformers as shown.

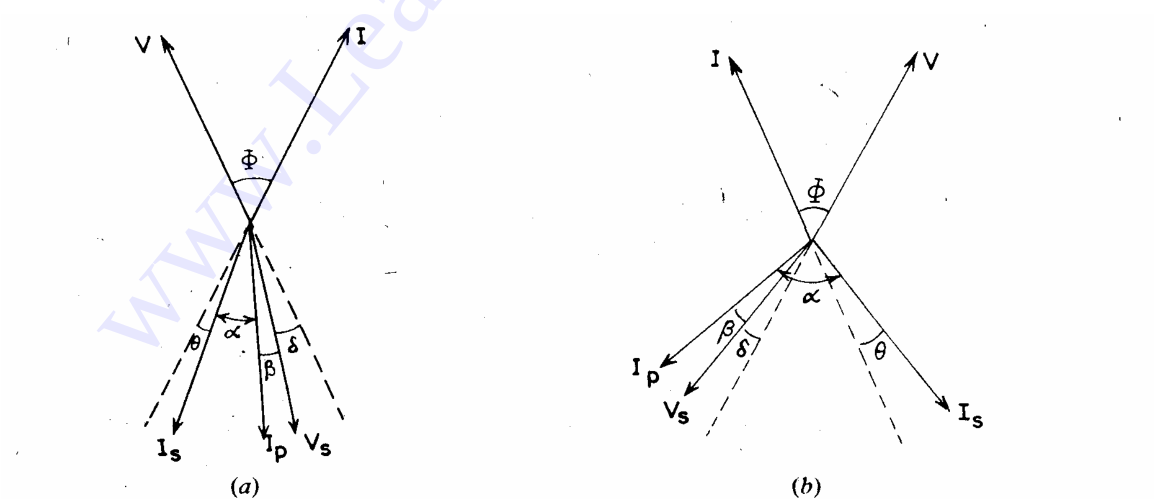
The primary winding of the C.T. is connected in series with the load and the secondary winding is connected in series with an ammeter and the current coil of a wattmeter.

The primary winding of the potential transformer is connected across the supply lines and a voltmeter and the potential coil circuit of the wattmeter are connected in parallel with the secondary winding of the transformer. One secondary terminal of each transformer and the casings are earthed.



The errors in good modem instrument transformers are small and may be ignored for many purposes.
However, they must be considered in precision work. Also in some power measurements these errors, if not taken into account, may lead to very inaccurate results.
Voltmeters and ammeters are effected by only ratio errors while wattmeters are influenced in addition by phase angle errors. Corrections can be made for these errors if test information is available about the instrument transformers and their burdens.

Phasor diagrams for the current and voltages of load, and in the wattmeter coils.



2.5 MAGNETICMEASUREMENTS

The operating characteristics of electrical machines, apparatus and instruments are greatly influenced by the properties of Ferro-magnetic materials used for their construction. Therefore, magnetic measurements and a thorough knowledge of characteristics of magnetic materials are of utmost importance in designing and manufacturing electrical equipment.

The principal requirements in magnetic measurements are
(i) The measurement of magnetic field strength in air.
(ii) The determination of B-H curve and hysteresis loop for soft Ferro-magnetic materials.
(iii) The determination of eddy current and hysteresis losses of soft Ferro-magnetic materials subjected to alternating magnetic fields.
(iv) The testing of permanent magnets.
Magnetic measurements have some inherent inaccuracies due to which the measured values depart considerably from the true values. The inaccuracies are due to the following reasons
(i) The conditions in the magnetic specimen under test are different from those assumed in calculations;
(ii) The magnetic materials are not homogeneous
(iv)There is no uniformity between different batches of test specimens even if such batches are of the same composition.

Types of Tests
Many methods of testing magnetic materials have been devised wherein attempts have been made to eliminate the inaccuracies. However, attention will be confined to a few basic methods of‘ Testing Ferro-magnetic materials. They are:
(i) Ballistic Tests: These tests are generally employed for the determination of B- H curves and hysteresis loops of Ferro-magnetic materials.
(ii) A. C. Testing. These tests may be carried at power, audio or radio frequencies. They give information about eddy current and hysteresis losses in magnetic materials.
(iii) Steady State Tests. These are performed to obtain the steady value of flux density existing in the air gap of a magnetic circuit.

Ballistic Tests: These tests are used for determination of flux density in a specimen, **determination of B-H curves and plotting of hysteresis loop**.

Measurement of Flux Density

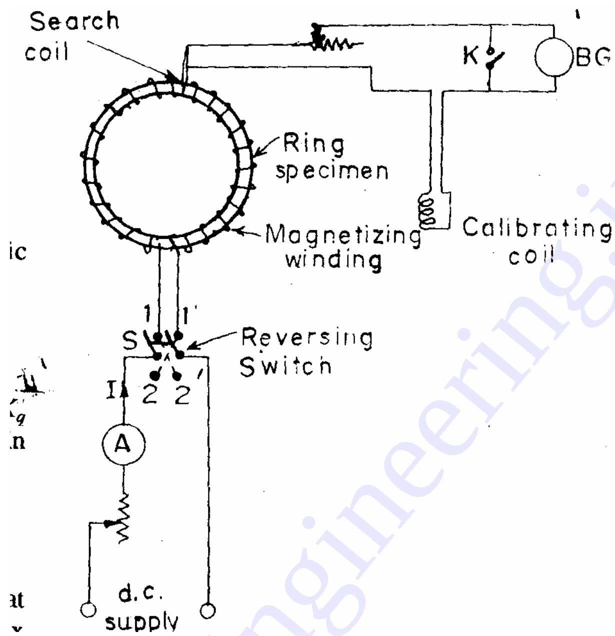
The measurement of flux density inside a specimen can be done by winding a search coil over the specimen.
This search coil is known as a“ B coil”.
This search coil is then connected to a ballistic galvanometer or to a flux meter.
Let us consider that we have to measure the flux density in a ring specimen shown in Fig.
The ring specimen is wound with a magnetizing winding which carries a

current I.

A search coil of convenient number of turns is wound on the specimen and connected through a resistance and calibrating coil, to a ballistic galvanometer as shown.

The current through the magnetizing coil is reversed and therefore the flux linkages of the search coil change inducing an emf in it.

Thus emf sends a current through the ballistic galvanometer causing it to deflect.



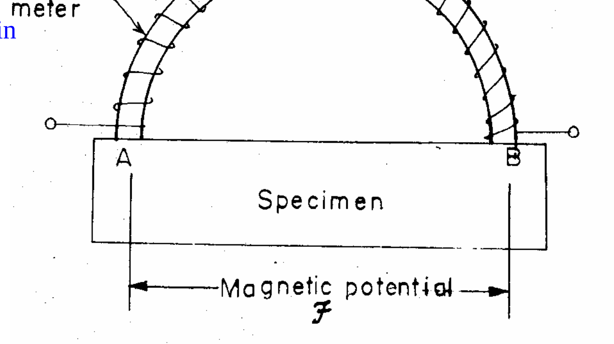
Magnetic Potentiometer

This is a device for measurement of magnetic potential difference between two points.

It can be shown that the line integral of magnetizing force H produced by a coil of N concentrated turns carrying a current I is:

$$\int Hdl = NI$$

around any closed path linking the coil.



(Fig) Magnetic potentiometer

This is the circuital law of the magnetic field and forms the basis of magnetic potentiometer.

A magnetic potentiometer may be used to determine the mmf around a closed path, or the magnetic potential difference between two points in a magnetic circuit.

A magnetic potentiometer consists of a one metre long flat and uniform coil made of two or four layers of thin wire wound unidirectional on a strip of flexible non-magnetic material.

The coil ends are brought out at the middle of the strip as shown in Fig. and connected to a ballistic galvanometer.

The magnetic potential difference between points A and B of the field is measured by placing the ends of the strip at these points and observing the throw of the ballistic galvanometer when the flux through the specimen is changed.

2.6 Determination of B-H curve

Method of reversals

A ring shaped specimen whose dimensions are known is used for the purpose

After demagnetizing the test is started by setting the magnetising current to its lowest test vlane.

With galvanometer key K closed, the iron specimen is brought into a 'reproducible cyclic magnetic state' by throwing the reversing switch S backward and forward about twenty times.

Key K is now opened and the value of flux corresponding to this value of H is measured by reversing the switch S and noting the throw of galvanometer.

The value of flux density corresponding to this H can be calculated by dividing the flux by the area of the specimen.

The above procedure is repeated for various values of H up to the maximum testing point.

The B-H curve may be plotted from the measured values of B corresponding to the various values of H.

Step by step method

The circuit for this test is shown in Fig.

The magnetizing winding is supplied through a potential divider having a large number of tapping.

The tappings are arranged so that the magnetizing force H may be increased, in a number of suitable steps, up to the desired maximum value.

The specimen before being tested is demagnetized.

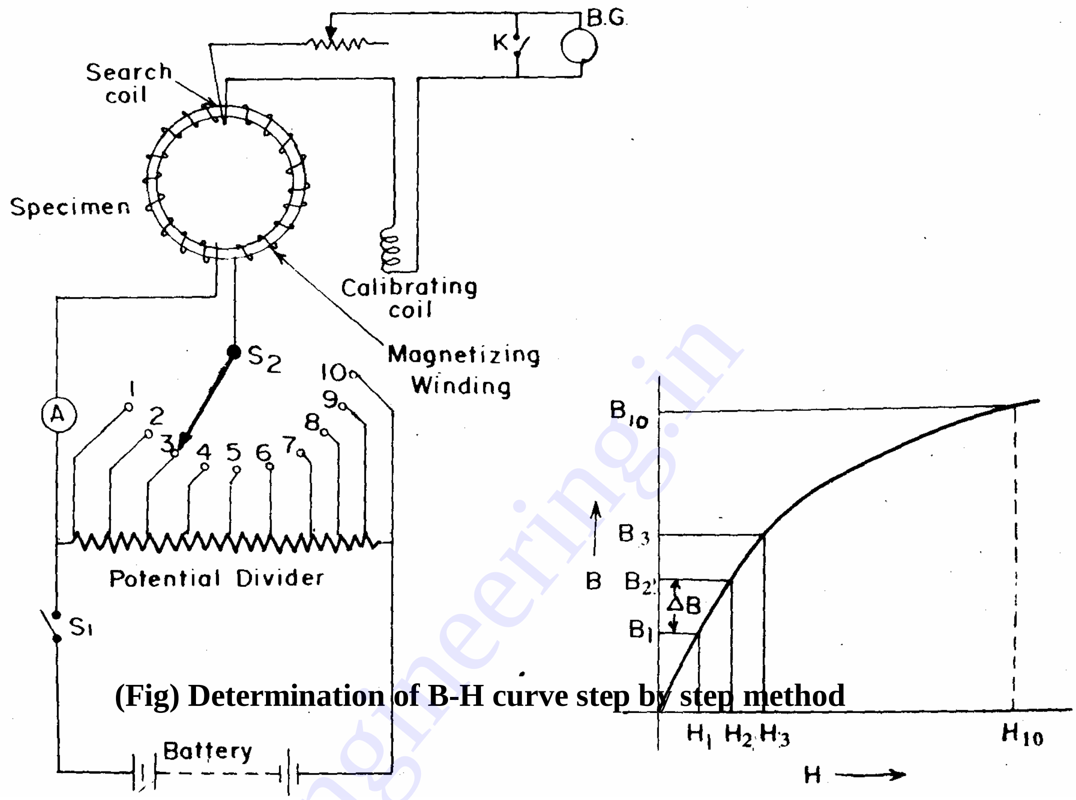
The tapping switch S is set on tapping I and the switch S is closed.

The throw of the galvanometer corresponding to this increase in flux density in the specimen, form zero to some value B, is observed.

Step by step method

After reaching the point of maximum H i.e... when switch S is at tapping 10, the magnetizing current is next reduced, in steps to zero by moving switch 2 down through the tapping points 9, 8, 7 3, 2, 1.

After reduction of magnetizing force to zero, negative values of H are obtained by reversing the supply to potential divider and then moving the switch S up again in order 1, 2, 3 7, 8. 9, 1O.



(Fig) Determination of B-H curve step by step method

Determination of Hysteresis Loop

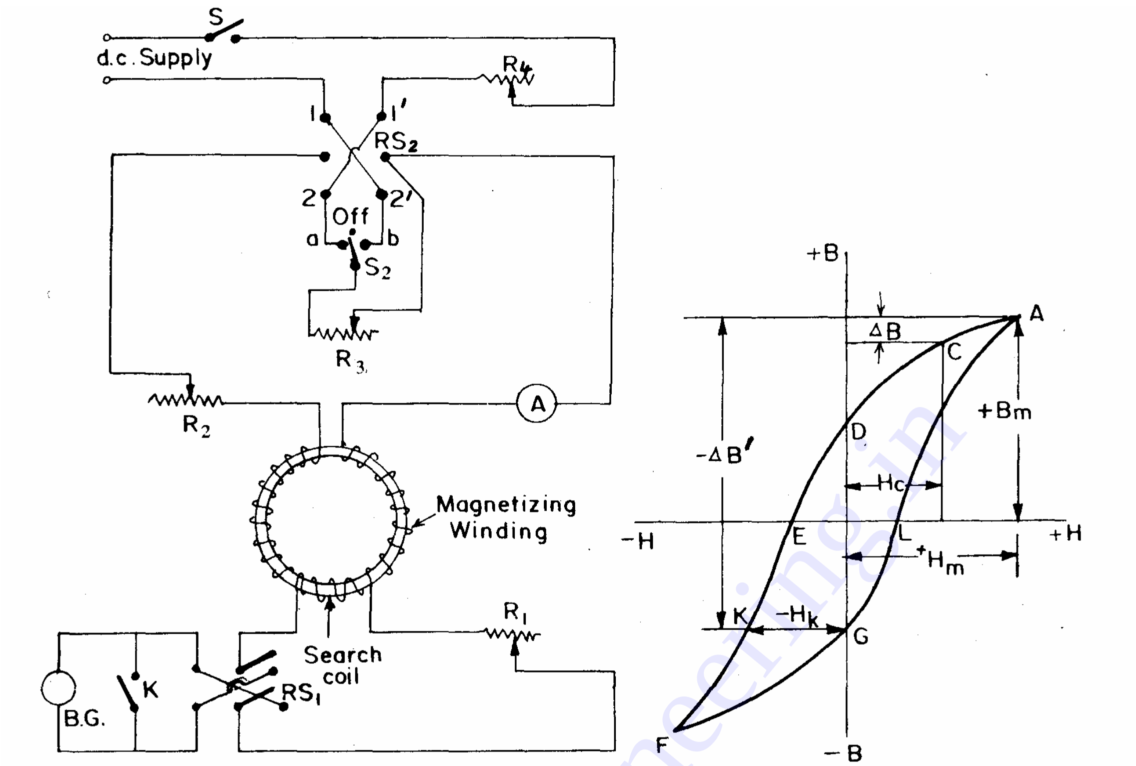
Method of reversals

This test is done by means of a number of steps, but the change in flux density measured at each step is the change from the maximum value + Bm down to some lower value.

But before the next step is commenced the iron specimen is passed through the remainder of the cycle of magnetization back to the flux density + Bm.

Thus the cyclic state of magnetization is preserved.

The connections for the method of reversals are shown in Fig.



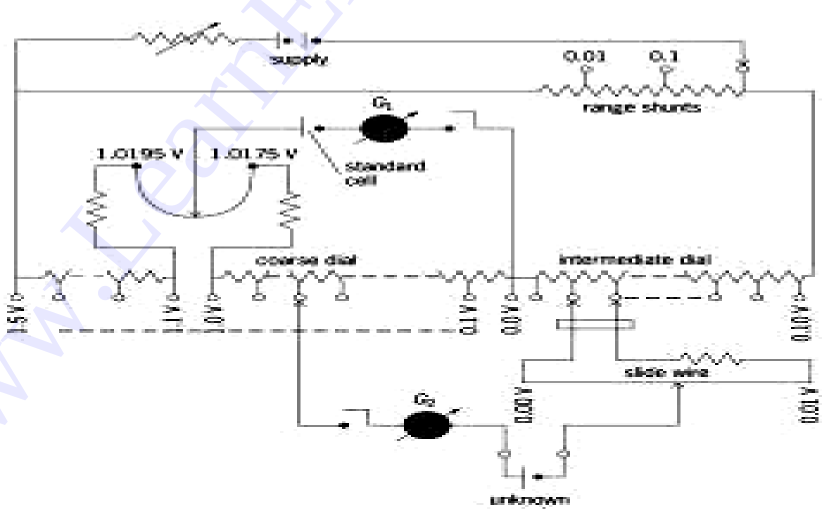
(fig) Method of reversal

UNIT III COMPARISON METHODS OF MEASUREMENTS

D.C & A.C Potentiometers

An instrument that precisely measures an electromotive force (emf) or a voltage by opposing to it a known potential drop established by passing a definite current through a resistor of known characteristics. (A three-terminal resistive voltage divider is sometimes also called a potentiometer.) There are two ways of accomplishing this balance: (1) the current *I* may be held at a fixed value and the resistance *R* across which the *IR* drop is opposed to the unknown may be varied; (2) current may be varied across a fixed resistance to achieve the needed *IR* drop.

The essential features of a general-purpose constant-current instrument are shown in the illustration. The value of the current is first fixed to match an *IR* drop to the emf of a reference standard cell. With the standard-cell dial set to read the emf of the reference cell, and the galvanometer (balance detector) in position G_1, the resistance of the supply branch of the circuit is adjusted until the *IR* drop in 10 steps of the coarse dial plus the set portion of the standard-cell dial balances the known reference emf, indicated by a null reading of the galvanometer. This adjustment permits the potentiometer to be read directly in volts. Then, with the galvanometer in position G_2, the coarse, intermediate, and slide-wire dials are adjusted until the galvanometer again reads null. If the potentiometer current has not changed, the emf of the unknown can be read directly from the dial settings. There is usually a switching arrangement so that the galvanometer can be quickly shifted between positions 1 and 2 to check that the current has not drifted from its set value.



Circuit diagram of a general-purpose constant-current potentiometer, showing essential features

Potentiometer techniques may also be used for current measurement, the unknown current being sent through a known resistance and the *IR* drop opposed by balancing it at the voltage terminals of the potentiometer. Here, of course, internal heating and consequent resistance change of the current-carrying resistor (shunt) may be a critical factor in measurement accuracy; and the shunt design may require attention to dissipation of heat resulting from its I^2R power consumption.

Potentiometer techniques have been extended to alternating-voltage measurements, but generally at a reduced accuracy level (usually 0.1% or so). Current is set on an ammeter which must have the same response on ac as on dc, where it may be calibrated with a potentiometer and shunt combination. Balance in opposing an unknown voltage is achieved in one of two ways: (1) a slide-wire and phase-adjustable supply; (2) separate in-phase and quadrature adjustments on slide wires supplied from sources that have a 90° phase difference. Such potentiometers have limited use in magnetic testing.

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limited use in magnetic testing

(1) An electrical measuring device used in determining the electromotive force (emf) or voltage by means of the compensation method. When used with calibrated standard resistors, a potentiometer can be employed to measure current, power, and other electrical quantites; when used with the appropriate measuring transducer, it can be used to gauge various non-electrical quantities, such as temperature, pressure, and the composition of gases.
distinction is made between DC and AC potentiometers. In DC potentiometers, the voltage being measured is compared to the emf of a standard cell. Since at the instant of compensation the current in the circuit of the voltage being measured equals zero, measurements can be made without reductions in this voltage. For this type of potentiometer, accuracy can exceed 0.01 percent. DC potentiometers are categorized as either high-resistance, with a slide-wire resistance ranging from The higher resistance class can measure up to 2 volts (V) and is used in testing highly accurate apparatus. The low-resistance class is used in measuring voltage up to 100 mV. To measure higher voltages, up to 600 V, and to test voltmeters, voltage dividers are connected to potentiometers. Here the voltage drop across one of the resistances of the voltage divider is compensated; this constitutes a known fraction of the total voltage being measured.

In AC potentiometers, the unknown voltage is compared with the voltage drop produced by a current of the same frequency across a known resistance. The voltage being measured is then adjusted both for amplitude and phase. The accuracy of AC potentiometers is of the order of 0.2 percent. In electronic automatic DC and AC potentiometers, the measurements of voltage are carried out automatically. In this case, the compensation of the unknown voltage is achieved with the aid of a servomechanism that moves the slide along the resistor, or rheostat. The servomechanism is actuated by the imbalance of the two voltages, that is, by the difference between the compensating voltage and the voltage that is being compensated. In electronic automatic potentiometers, the results of measurements are read on dial indicators, traced on recorder charts or received as numerical data. The last method makes it possible to input the data directly into a computer. In addition to measurement, electronic automatic potentiometers are also capable of regulating various parameters of industrial processes. In this case, the slide of the rheostat is set in a position that predetermines, for instance, the temperature of the object to be regulated. The voltage imbalance of the potentiometer drives the servomechanism, which then increases or decreases the electric heating or regulates the fuel supply.

A voltage divider with a uniform variation of resistance, a device that allows some fraction of a given voltage to be applied to an electric circuit. In the simplest case, the device consists of a conductor of high resistance equipped with a sliding contact. Such dividers are used in electrical engineering, radio engineering, and measurement technology. They can also be utilized in analog computers and in automation systems, where, for example, they function as sensors for linear or angular displacement

3.2 D.C & A.C Bridges

Bridge circuits are used very commonly as a variable conversion element in measurement systems and produce an output in the form of a voltage level that changes as the measured physical quantity changes. They provide an accurate method of measuring resistance, inductance and capacitance values, and enable the detection of very small changes in these quantities about a nominal value. They are of immense importance in measurement system technology because so many transducers measuring physical quantities have an output that is expressed as a change in resistance, inductance or capacitance. The displacement-measuring strain gauge, which has a varying resistance output, is but one example of this class of transducers. Normally, excitation of the bridge is by a d.c. voltage for resistance measurement and by an a.c. voltage for inductance or capacitance measurement. Both null and deflection types of bridge exist, and, in a like manner to instruments in general, null types are mainly employed for calibration purposes and deflection types are used within closed-loop automatic control schemes.

Null-type, d.c. bridge (Wheatstone bridge)

A null-type bridge with d.c. excitation, commonly known as a Wheatstone bridge, has the form shown in Figure 7.1. The four arms of the bridge consist of the unknown resistance R_u, two equal value resistors R_2 and R_3 and a variable resistor R_v (usually a decade resistance box). A d.c. voltage V_i is applied across the points AC and the resistance R_v is varied until the voltage measured across points BD is zero. This null point is usually measured with a high sensitivity galvanometer.

To analyses the Whetstone bridge, define the current flowing in each arm to be $I_1 \ldots I_4$ as shown in Figure 7.1. Normally, if a high impedance voltage-measuring instrument is used, the current I_m drawn by the measuring instrument will be very small and can be approximated to zero. If this assumption is made, then, for I_m D 0:

$$I_1 = I_3 \text{ and } I_2 = I_4$$

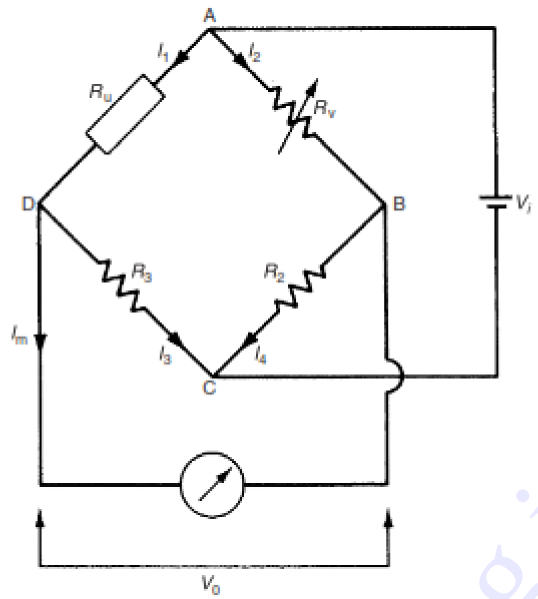
$$I_1 = I_3 \quad \text{and} \quad I_2 = I_4$$

Looking at path ADC, we have a voltage V_i applied across a resistance $R_u + R_3$ and by Ohm's law:

$$I_1 = \frac{V_i}{R_u + R_3}$$

Similarly for path ABC:

$$I_2 = \frac{V_i}{R_v + R_2}$$



Now we can calculate the voltage drop across AD and AB:

$$V_{AD} = I_1 R_v = \frac{V_i R_u}{R_u + R_3}; \quad V_{AB} = I_2 R_v = \frac{V_i R_v}{R_v + R_2}$$

By the principle of superposition,

$$V_0 = V_{BD} = V_{BA} + V_{AD} = -V_{AB} + V_{AD}$$

Thus:

$$V_0 = -\frac{V_i R_v}{R_v + R_2} + \frac{V_i R_u}{R_u + R_3}$$

At the null point $V_0 = 0$, so:

$$\frac{R_u}{R_u + R_3} = \frac{R_v}{R_v + R_2}$$

Inverting both sides:

$$\frac{R_u + R_3}{R_u} = \frac{R_v + R_2}{R_v} \quad \text{i.e.} \quad \frac{R_3}{R_u} = \frac{R_2}{R_v} \quad \text{or } R_u = \frac{R_3 R_v}{R_2}$$

Thus, if $R_2 = R_3$, then $R_u = R_v$. As R_v is an accurately known value because it is derived from a variable decade resistance box, this means that R_u is also accurately known.

Deflection-type d.c. bridge

A deflection-type bridge with d.c. excitation is shown in Figure 7.2. This differs from the Wheatstone bridge mainly in that the variable resistance R_v is replaced by a fixed resistance R_1 of the same value as the nominal value of the unknown resistance R_u. As the resistance R_u changes, so the output voltage V_0 varies, and this relationship between V_0 and R_u must be calculated.

This relationship is simplified if we again assume that a high impedance voltage measuring instrument is used and the current drawn by it, I_m, can be approximated to zero. (The case when this assumption does not hold is covered later in this section.) The analysis is then exactly the same as for the preceding example of the Wheatstone bridge, except that R_v is replaced by R_1. Thus, from equation (7.1), we have:

$$V_0 = V_i * (R_u / R_u + R_3) - (R_1 / R_1 + R_2)$$

When R_u is at its nominal value, i.e. for R_u D R_1, it is clear that V_0 D 0 (since R_2 D R_3). For other values of R_u, V_0 has negative and positive values that vary in a non-linear way with R_u.

A.C bridges

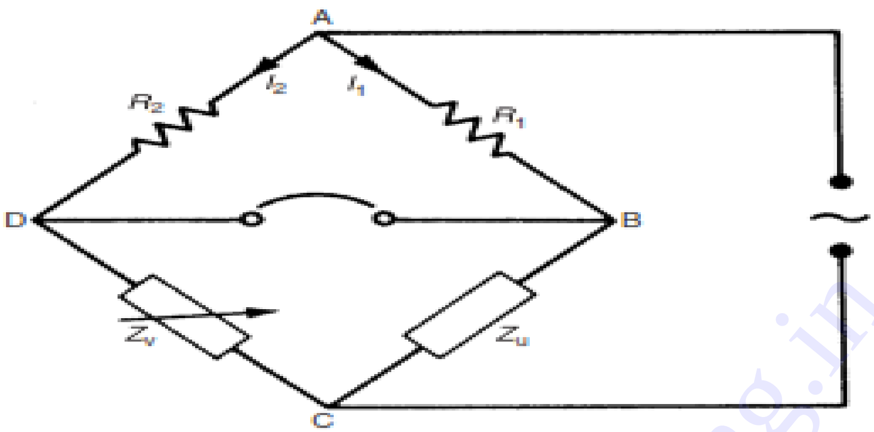
Bridges with a.c. excitation are used to measure unknown impedances. As for d.c. bridges, both null and deflection types exist, with null types being generally reserved for calibration duties.

Null-type impedance bridge

A typical null-type impedance bridge is shown in Figure 7.7. The null point can be conveniently detected by monitoring the output with a pair of headphones connected via an operational amplifier across the points BD. This is a much cheaper method of null detection than the application of an expensive galvanometer that is required for a d.c. Wheatstone bridge.

$$I_1R_1 = I_2R_2; \quad I_1Z_u = I_2Z_v$$

$$Z_u = \frac{Z_vR_1}{R_2}$$



If Z_u is capacitive, i.e. Z_u D $1/j\omega C_u$, then Z_v must consist of a variable capacitance box, which is readily available. If Z_u is inductive, then Z_u D R_u C $j\omega L_u$.

Notice that the expression for Z_u as an inductive impedance has a resistive term in it because it is impossible to realize a pure inductor. An inductor coil always has a resistive component, though this is made as small as possible by designing the coil to have a high Q factor (Q factor is the ratio inductance/resistance). Therefore, Z_v must consist of a variable-resistance box and a variable-inductance box. However, the latter are not readily available because it is difficult and hence expensive to manufacture a set of fixed value inductors to make up a variable-inductance box. For this reason, an alternative kind of null-type bridge circuit, known as the *Maxwell Bridge*, is commonly used to measure unknown inductances.

Maxwell bridge

Definition

A Maxwell bridge (in long form, a Maxwell-Wien bridge) is a type of Wheatstone bridge used to measure an unknown inductance (usually of low Q value) in terms of calibrated resistance and capacitance. It is a real product bridge.

The maxwell bridge is used to measure unknown inductance in terms of calibrated resistance and capacitance. Calibration-grade inductors are more difficult to manufacture than capacitors of similar precision, and so the use of a simple "symmetrical" inductance bridge is not always practical.

Circuit Diagram

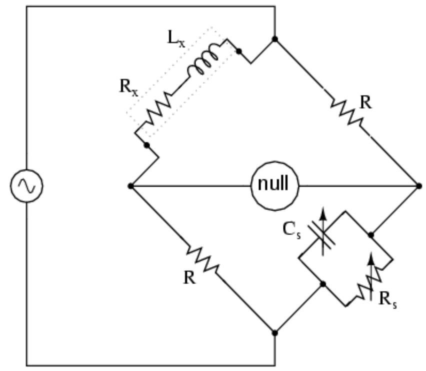


Figure 1.7.1. Maxwell Bridge

Explanation

- With reference to the picture, in a typical application R1 and R4 are known fixed entities, and R2 and C2 are known variable entities.
- R2 and C2 are adjusted until the bridge is balanced.R3 and L3 can then be calculated based on the values of the other components:
- As shown in Figure, one arm of the Maxwell bridge consists of a capacitor in parallel with a resistor (C1 and R2) and another arm consists of an inductor L1 in series with a resistor (L1 and R4). The other two arms just consist of a resistor each (R1 and R3).
- The values of R1 and R3 are known, and R2 and C1 are both adjustable. The unknown values are those of L1 and R4.
- Like other bridge circuits, the measuring ability of a Maxwell Bridge depends on 'Balancing' the circuit.
- Balancing the circuit in Figure 1 means adjusting C1 and R2 until the current through the bridge between points A and B becomes zero. This happens when the voltages at points A and B are equal.
- Mathematically,

  $Z1 = R2 + 1/(2\pi fC1)$; while $Z2 = R4 + 2\pi fL1$.

  $(R2 + 1/(2\pi fC1)) / R1 = R3 / [R4 + 2\pi fL1]$;

  or

  $R1R3 = [R2 + 1/(2\pi fC1)] [R4 + 2\pi fL1]$
- To avoid the difficulties associated with determining the precise value of a variable capacitance, sometimes a fixed-value capacitor will be installed and more than one resistor will be made variable.
- The additional complexity of using a Maxwell bridge over simpler bridge types is warranted in circumstances where either the mutual inductance between the load and the known bridge entities, or stray electromagnetic interference, distorts the measurement results.
- The capacitive reactance in the bridge will exactly oppose the inductive reactance of the load when the bridge is balanced, allowing the load's resistance and reactance to be

reliably determined.

Advantages:

- The frequency does not appear
- Wide range of inductance

Disadvantages:

- Limited measurement
- It requires variable standard capacitor

SCHERING BRIDGE

Definition

A **Schering Bridge** is a bridge circuit used for measuring an unknown electrical capacitance and its dissipation factor. The dissipation factor of a capacitor is the the ratio of its resistance to its capacitive reactance. The Schering Bridge is basically a four-arm alternating-current (AC) bridge circuit whose measurement depends on balancing the loads on its arms. Figure 1 below shows a diagram of the Schering Bridge.

Diagram

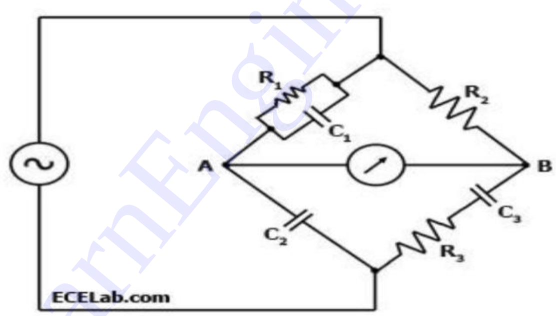


Figure 1.7.2. Schering Bridge

Explanation

- In the Schering Bridge above, the resistance values of resistors R1 and R2 are known, while the resistance value of resistor R3 is unknown.
- The capacitance values of C1 and C2 are also known, while the capacitance of C3 is the value being measured.
- To measure R3 and C3, the values of C2 and R2 are fixed, while the values of R1 and C1 are adjusted until the current through the ammeter between points A and B becomes zero.
- This happens when the voltages at points A and B are equal, in which case the bridge is

said to be 'balanced'.

- When the bridge is balanced, Z1/C2 = R2/Z3, where Z1 is the impedance of R1 in parallel with C1 and Z3 is the impedance of R3 in series with C3.
- In an AC circuit that has a capacitor, the capacitor contributes a capacitive reactance to the impedance.

$$Z1 = R1/[2\pi fC1((1/2\pi fC1) + R1)] = R1/(1 + 2\pi fC1R1)$$

$$\text{while } Z3 = 1/2\pi fC3 + R3.\ 2\pi fC2R1/(1+2\pi fC1R1) = R2/(1/2\pi fC3 + R3);\ or$$

$$2\pi fC2\ (1/2\pi fC3 + R3) = (R2/R1)\ (1+2\pi fC1R1);\ or$$

$$C2/C3 + 2\pi fC2R3 = R2/R1 + 2\pi fC1R2\cdot$$

- When the bridge is balanced, the negative and positive reactive components are equal and cancel out, so

$$2\pi fC2R3 = 2\pi fC1R2 \text{ or}$$

$$R3 = C1R2 / C2.$$

- Similarly, when the bridge is balanced, the purely resistive components are equal, so C2/C3 = R2/R1 or C3 = R1C2 / R2.
- Note that the balancing of a Schering Bridge is independent of frequency.

Advantages:

- Balance equation is independent of frequency
- Used for measuring the insulating properties of electrical cables and equipment's

HAY BRIDGE

Definition

A Hay Bridge is an AC bridge circuit used for measuring an unknown inductance by balancing the loads of its four arms, one of which contains the unknown inductance. One of the arms of a Hay Bridge has a capacitor of known characteristics, which is the principal component used for determining the unknown inductance value. Figure 1 below shows a diagram of the Hay Bridge.

Explanation

- As shown in Figure 1, one arm of the Hay bridge consists of a capacitor in series with a resistor (C1 and R2) and another arm consists of an inductor L1 in series with a resistor (L1 and R4).
- The other two arms simply contain a resistor each (R1 and R3). The values of R1and R3 are known, and R2 and C1 are both adjustable.
- The unknown values are those of L1 and R4.
- Like other bridge circuits, the measuring ability of a Hay Bridge depends on 'balancing' the circuit.
- Balancing the circuit in Figure 1 means adjusting R2 and C1 until the current through the ammeter between points A and B becomes zero. This happens when the voltages at points A and B are equal.

Diagram

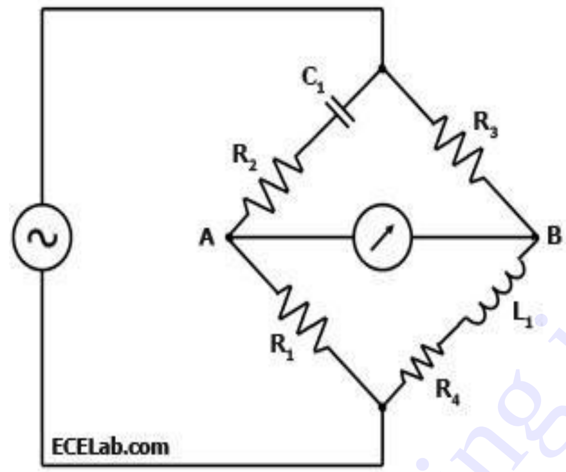


Figure 1.7.3. Hay Bridge

- When the Hay Bridge is balanced, it follows that Z1/R1 = R3/Z2 wherein Z1 is the impedance of the arm containing C1 and R2 while Z2 is the impedance of the arm containing L1 and R4.

  Thus, Z1 = R2 + 1/(2πfC) while Z2 = R4 + 2πfL1.

  [R2 + 1/(2πfC1)] / R1 = R3 / [R4 + 2πfL1]; or

  [R4 + 2πfL1] = R3R1 / [R2 + 1/(2πfC1)]; or

  R3R1 = R2R4 + 2πfL1R2 + R4/2πfC1 + L1/C1.

- When the bridge is balanced, the reactive components are equal, so
  2πfL1R2 = R4/2πfC1, or R4 = (2πf) 2L1R2C1.
- Substituting R4, one comes up with the following equation:

  R3R1 = (R2+1/2πfC1) ((2πf) 2L1R2C1) + 2πfL1R2 + L1/C1; or

  L1 = R3R1C1 / (2πf) 2R22C12 + 4πfC1R2 + 1);

  L1 = R3R1C1 / [1 + (2πfR2C1)2]

- After dropping the reactive components of the equation since the bridge is
- Thus, the equations for L1 and R4 for the Hay Bridge in Figure 1 when it is balanced are:

  L1 = R3R1C1 / [1 + (2πfR2C1)2]; and

  R4 = (2πfC1)2R2R3R1 / [1 + (2πfR2C1)2]

Advantages:

- Simple expression

Disadvantages:

- It is not suited for measurement of coil

WIEN BRIDGE:

Definition

A Wien bridge oscillator is a type of electronic oscillator that generates sine waves. It can generate a large range of frequencies. The circuit is based on an electrical network originally developed by Max Wien in 1891. Wien did not have a means of developing electronic gain so a workable oscillator could not be realized. The modern circuit is derived from William Hewlett's 1939 Stanford University master's degree thesis. Hewlett, along with David Packard co-founded Hewlett-Packard. Their first product was the HP 200A, a precision sine wave oscillator based on the Wien bridge. The 200A was one of the first instruments to produce such low distortion.

Diagram

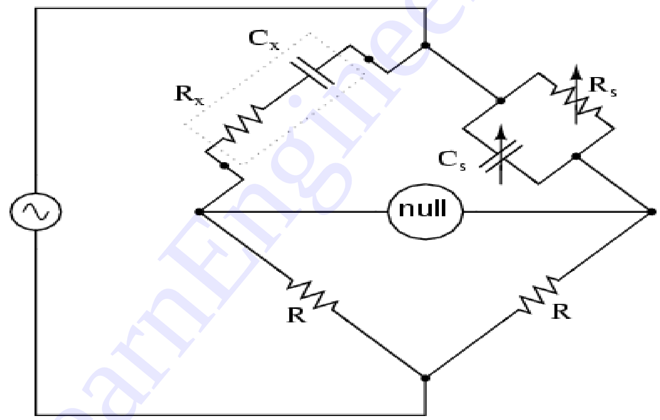


Figure 1.7.4 Wein bridge

Amplitude stabilization:

- The key to Hewlett's low distortion oscillator is effective amplitude stabilization.
- The amplitude of electronic oscillators tends to increase until clipping or other gain limitation is reached. This leads to high harmonic distortion, which is often undesirable.
- Hewlett used an incandescent bulb as a positive temperature coefficient (PTC) thermistor in the oscillator feedback path to limit the gain.
- The resistance of light bulbs and similar heating elements increases as their temperature increases.

- If the oscillation frequency is significantly higher than the thermal time constant of the heating element, the radiated power is proportional to the oscillator power.
- Since heating elements are close to black body radiators, they follow the Stefan-Boltzmann law.
- The radiated power is proportional to T4, so resistance increases at a greater rate than amplitude.
- If the gain is inversely proportional to the oscillation amplitude, the oscillator gain stage reaches a steady state and operates as a near ideal class A amplifier, achieving very low distortion at the frequency of interest.
- At lower frequencies the time period of the oscillator approaches the thermal time constant of the thermistor element and the output distortion starts to rise significantly.
- Light bulbs have their disadvantages when used as gain control elements in Wien bridge oscillators, most notably a very high sensitivity to vibration due to the bulb's micro phonic nature amplitude modulating the oscillator output, and a limitation in high frequency response due to the inductive nature of the coiled filament.
- Modern Distortion as low as 0.0008% (-100 dB) can be achieved with only modest improvements to Hewlett's original circuit.
- Wien bridge oscillators that use thermistors also exhibit "amplitude bounce" when the oscillator frequency is changed. This is due to the low damping factor and long time constant of the crude control loop, and disturbances cause the output amplitude to exhibit a decaying sinusoidal response.
- This can be used as a rough figure of merit, as the greater the amplitude bounce after a disturbance, the lower the output distortion under steady state conditions.

Analysis:

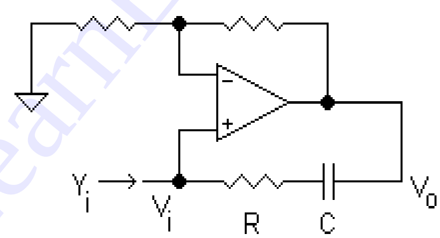


Figure 1.7.4 Input analysis

Input admittance analysis

- If a voltage source is applied directly to the input of an ideal amplifier with feedback, the input current will be:

- Where vin is the input voltage, vout is the output voltage, and Zf is the feedback impedance. If the voltage gain of the amplifier is defined as:
- And the input admittance is defined as:
- Input admittance can be rewritten as:
- If Av is greater than 1, the input admittance is a negative resistance in parallel with an inductance.
- If a resistor is placed in parallel with the amplifier input, it will cancel some of the negative resistance. If the net resistance is negative, amplitude will grow until clipping occurs.
- If a resistance is added in parallel with exactly the value of R, the net resistance will be infinite and the circuit can sustain stable oscillation at any amplitude allowed by the amplifier.

Advantages:

- Frequency sensitive
- Supply voltage is purely sinusoidal

3.3 Transformer Ratio Bridges & Self-Balancing Bridges

TRNSFORMER RATIO BRIDGES

INTRODUCTION

The product to which this manual refers should be installed, commissioned, operated and maintained under the supervision of a competent ***Electrical Engineer*** in accordance with relevant statutory requirements and good engineering practice, including Codes of Practice where applicable, and properly used within the terms of the specification.
The instructions in this manual should familiarize qualified personal with the proper procedures to keep all new unit(s) in proper operating condition. These instructions for installation, operation and maintenance of Package Compact Substation should be read carefully and used as a guide during installation and initial operation.

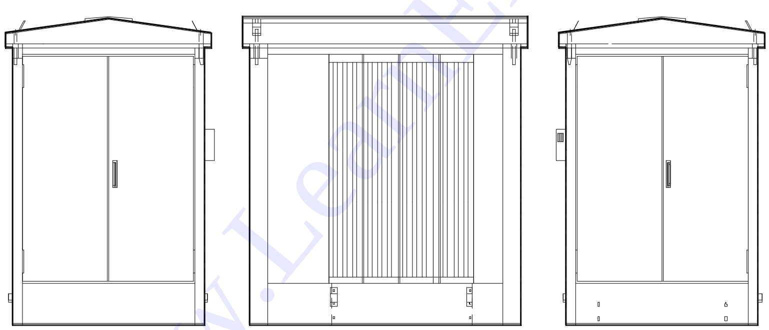
These instructions do not propose to cover all details or variations in equipment, nor to provide for every contingency to be met in connection with installation, operation, or maintenance. Should further information be desired, or particular problems arise which are not covered, please contact the nearest ABB office.
We would in particular stress the importance of care in:

- Site selection and design, embodying features that provide adequate ventilation, protection and security and which have taken account of appropriate fire, moisture and explosion hazards.
- Jointing.
- Earthing.
- Selection and setting of electrical protection in primary and secondary, against overload, overvoltage and short-circuit.
- Carrying out regular inspection and electrical and mechanical maintenance.

The Package Compact Substation(s) covered by these instructions have been repeatedly inspected and tested to meet all applicable standards of IEC, to ensure you of a first-rate quality product, which should give many years of satisfactory performance.
The specific ratings of each Package Compact Substation are shown on the drawings.

File these instructions in a readily accessible place together with drawings and descriptive data of the Package Compact Substation. These instructions will be a guide to proper maintenance of the equipment and prolong its life and usefulness

GENERAL



The Package Compact Substations are completely self-contained, mounted on an integral base, factory assembled in a totally enclosed, aesthetically and acceptable cladding, vandal-proof, vermin-proof and weather-proof housing ready for installation into position on a concrete base pad or pier. The base frame is of welded structural steel and been hot-dipped galvanized after fabrication to assure affective corrosion resistance in service.Housing of the Package Compact Substation is made of special material called ALUZINK, a sheet steel with a metallic alloy coating. The alloy consists of 55% aluminum and 43.4% zinc. This provides optimum corrosion protection.The housing has three compartments, separated with ALUZINK sheet. The transformer compartment is completely separated from the medium voltage and low voltage compartments.

RECEIVING / INSPECTION / STORAGE

The Package Compact Substation is shipped from the factory ready for installation on site. It has been submitted to all normal routine tests before being shipped, and it is not required to do any voltage testing before putting it into service, provided the substation has not sustained any damage during transportation.
Immediately upon receipt of the Package Compact Substation, examine them to determine if any damage or loss was sustained during transit. If abuse or rough handling is evident, file a damage claim with carrier and promptly notify the nearest ABB office. ABB ELECTRICAL INDUSTRIES CO. LTD. is not responsible for damage of goods after delivery to the carrier; however, we will lend assistance if notified of claims.

PERSONNEL SAFETY

The first and most important requirements are the protection against contact with live parts during normal service as well as maintenance or modifications.
This is the reason why all live parts have been metal enclosed, so that when the parts are live and the Package Compact Substation doors are open, no one can be able to touch them.
Also, it is safe in case any short-circuiting or sparking occurs at the busbars.

VENTILATION

Transformer compartment has been provided with sand trap louvers, to prevent ingress of sand and that proper air circulation should take place.

EARTHING

Proper earthing busbar has been provided.

HANDLING

Lifting lugs has been provided on top of four corners of the housing for lifting the DPS by crane and chains as a single unit, otherwise this can be done by a forklift of sufficient capacity, but the lifting fork must be positioned under the transformer portion.

INSTALLATIONS

A clean, flat surface capable of supporting the Package Compact Substation unit weight is the only requirement for a foundation. It is, however, important that adequate accessibility, ventilation and ease of inspection of the unit must be provided.
In all installation work, the safety regulations for electrical installations have to be observed.

Each Package Compact Substation must be permanently grounded or earthed by connecting an affective recognised ground or earth as prescribed by the latest applicable edition of IEC or ANSI requirements.The Package Compact Substation is designed to operate with a solidly grounded neutral system. The neutral connection should be solidly and permanently grounded.

Tap connections

All units have taps located in the High Voltage winding. The tap arrangement is shown on the nameplate of the transformer. These taps are provided to furnish rated output voltage when the input voltage differs from the rated voltage.
To change tap connections, do the following steps:

1. De-energized the unit, short-circuit both the high and low voltage connections and ground both sides.
2. Unlock the tap changer handle, and then move the taps changer handle to the desired tap, then locked the tap changer handle.
3. Remove safety shorts and ground connections from the high voltage and low voltage buses.

After ensuring that no tools or hardware was left in the enclosure, and the enclosures are closed properly, you may then re-energize the Package Compact Substation. Make sure that the tap connections are proper for the required voltage as listed on the nameplate. The transformer is normally shipped with the tap changer for the rated voltage.

Cable connections

When making outside cable connections, conductors suitable for at least 85°C should be used. All connections should be made without placing undue stress on the terminals. Conductors should be securely fastened in place and adequately supported with allowances for expansion and contraction.

FINAL INSPECTION PRIOR TO ENERGIZATION

After the Package Compact Substation has been found to be in good condition and the protective equipment is operational, the substation may be connected to the network. However, it is recommended that the transformer to be left to settle for 1 or 2 days after installation so those air bubbles in the oil have time to dissolve before connecting the voltage.
Before energizing the unit, a complete electrical inspection should be made. The following checklist should be used as a minimum requirement.

Electrical Inspection

All external connections have been made properly (phasing of connections to terminals, etc.).
All connections are tight and secure.

All accessory circuits are operational. Check the transformer protective equipment and test the function of their electrical circuits:

Thermometers (alarms, tripping)

Pressure relay (tripping)

Oil level indicator

Ensure that all fuses are inserted and in the correct position

All tap connections are properly positioned.

The neutral and ground connections have been properly made.

Mechanical Inspection

All shipping members have been removed.

There is no obstructions in or near the openings for ventilation.

No tools or other articles are left inside the enclosures.

All protective covers are in place or closed and bolted tight.

MAINTENANCE AND PERIODIC INSPECTION

In order to assure a long lifetime and correct and reliable operation of equipment delivered for this facility it is of utmost importance to perform maintenance regularly.

Following general rules should always be considered before starting maintenance activity.

1. Authority from responsible engineer shall always be obtained before starting any maintenance.
2. Follow safety procedure established in carrying out the work.

Realize that no set of safety *or maintenance instructions* will ever be written that can adequately cover all accident possibilities.

Therefore **"SAFETY"** as dictated by actual current conditions, always takes precedence over any previously prepared safety or maintenance instructions. Assume nothing. Take the precautions that you personally deem necessary in addition to those included in standard practice.

- Be familiar with the drawings and previous test records before starting activity.
- Scrutinize maintenance instructions given for the equipment to be maintained.

Maintenance information is given in the Operation and Maintenance Manual for each type of equipment.

The main dangers of such process are:

- Inaccessible lubrication points (greased for life) cannot be lubricated and may seize up.
- Areas not lubricated may be subject to corrosion.
- The high-pressure spray may damage equipment.
- Especially protective coatings may be removed.

Bolt Tightness

All connections should be tight and secure. Bolts and nuts on busbar and terminal lugs should be torqued and marked properly.

Inspection and Testing

The need for preventive maintenance will vary on operating conditions. Where heavy dust conditions exist, an accumulation of dust on the equipment may effect the operation of unit substation and its protective apparatus.
When normal maintenance inspection and cleaning of bus connections, relays, lug connections, and other part of the distribution system is being made, it is advisable to operate and check circuit breakeror switch-disconnector operation.

Routine Field Testing

Routine field testing of the electrical equipment is intended to enable maintenance personal to determine, without laboratory conditions or complicated equipment, that a particular electrical equipment is able to perform its basic circuit functions.
The following constitutes a guide to tests that might be performed during routine maintenance.

1. **Insulation Resistance Test**
   Extreme atmospheres and conditions may reduce the dielectric withstandability of any insulating material. An instrument commonly known as "megger" is used to perform this test.
   The voltage recommended for this test should be at least 50 percent greater than the circuit rating; however, a minimum of 500 volts is permissible. Tests should be made between phases of opposite polarity as well as from current carrying parts of the circuit protective device to ground. Also, a test should be made between the line-and-load terminals with the circuit protective device in the "OFF" position.
   Resistance values below one megaohm are considered unsafe and should be investigated for possible contamination on the surfaces.
   NOTE: For individual circuit protective device's resistance readings, load and line conductors should be disconnected. If not disconnected, the test measurements will also include the characteristics of the attached circuits.
   A temperature and humidity reading are recommended and recorded during the testing period.
   Insulation resistivity is markedly effected by temperature and humidity conditions. Based condition of one (1) megaohm per kV assumes a 20°C wet bulb reading. The following table shall be used to adjust readings to the 20°C constant.

2. **Connection Test**
   Connections to the circuit protective device should be inspected to determine that a proper electrical joint is present. If overheating in these connections is evident by discoloration or signs of arcing, the connections should be removed and the connecting surfaces clean before re-connections. It is essential that electrical connections be made properly to prevent and reduce overheating.

3. **Mechanical Operation**

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During routine tests, mechanical operation of the circuit protective devices or disconnects should be checked by turning it "ON" and "OFF" at least three times.

3.5 INTERFERENCE AND SCREENING

Interference is one of the most serious as well as most common problems in audio electronics. We encounter interference when it produces effects like noise, hiss, hum or cross-talk. If a radio engineer faces such problems, good theoretical knowledge as well as experience is required to overcome them.
However, it should be considered, that interference is always present. All technical remedies only aim at reducing the effect of interference to such a degree, that it is neither audible nor disturbing. This is mainly achieved by different ways of screening. This paper will explain the technical background of interference and provides some common rules and hints which may help you to reduce the problems.

TYPES OF INTERFERENCE.

Theoretically, the effects and mechanism of a single interference can well be calculated. But in practice, the complex coupling systems between pieces of equipment prevent precise prediction of interference. The following picture shows the different types of interference coupling.The different types of interference between the components of an electric system. If we consider all possible coupling paths in the diagram above we will find 10 different paths. This means a variety of 1024 different combinations. It should be noted, that not only the number of paths, but also their intensity is important.

SYMMETRICAL AND ASYMMETRICAL INTERFERENCE.

Having a closer look at the interference of cable, we find that hf-interference currents cause measurable levels on signal (audio) lines and on supply lines. A ground-free interference source would produce signals on a cable which spread along the line. These voltages and currents can be called symmetrical interference. In practice this rarely occurs.
Through interference, asymmetrical signals are produced in respect to the ground. The asymmetrical interference current flows along the two wires of the symmetrical line to the sink and via the ground back to the source. These interference signals are cancelled at the symmetrical input.

GALVANIC COUPLING OF INTERFERENCE.

Galvanic coupling of interference occurs if the source and the sink of interference are coupled by a conductive path.As can be seen from the equivalent circuit diagram, the source impedance of the interference consists of the resistance RC and the inductance LC of the conductor, which are common to the two parts of the circuit. From these elements the interference source voltage can be calculated.

CAPACITIVE COUPLING OF INTERFERENCE.

The capacitive coupling of interference occurs due to any capacitance between the source and sink of interference.

Principle of capacitive coupling of interference.

The current in the interference sink can be calculated as
The interference voltage in the sink is proportional to its impedance. Systems of high impedance are therefore more sensitive to interference than those of low impedance. The coupled interference current depends on the rate of change of the interference and on the coupling capacitance CC.

INDUCTIVE COUPLING OF INTERFERENCE.

Inductive coupling of interference occurs if the interference sink is in the magnetic field of the interference source (e.g. coils, cables, etc.)
Principle of the inductive coupling of interference.

The interference voltage induced by inductive coupling is
- increasing the distance between conductors
- mounting conductors close to conductive surfaces
- using short conductors
- avoiding parallel conductors
- screening
- using twisted cable
Note that by the same means the capacitive as well as the inductive coupling of interference will be reduced.

<u>3.5 Electrostatic And Electromagnetic Interference</u>

INTERFERENCE BY RADIATION.

Interference by electromagnetic radiation becomes important at cable lengths greater than 1/7 of the wavelength of the signals. At frequencies beyond 30Mhz, most of the interference occurs by e.m. radiation

Principle of the coupling by e.m. Interference.

INTERFERENCE BY ELECTROSTATIC CHARGE.

Charged persons and objects can store electrical charges of up to several micro- Coulombs, which means voltages of some 10kV in respect to ground. Dry air, artificial fabrics and friction favour these conditions.When touching grounded equipment, an instantaneous discharge produces arcing with short, high current pulses and associated strong changes of the e.m. field.

REDUCTION OF INTERFERENCE

There are a number of methods to prevent interference. But all of them only **reduce** the interference and never fully prevent it. This means there will never be a system which is 100% safe from interference. Because the efforts and the cost will rise with the degree of reduction of interference, a compromise has to be found between the effort and the result.
The requirement for the reduction of interference will depend on:

- The strength of the interference source
- The sensitivity of the interference sink
- The problems caused by interference

- The costs of the equipment
We will discuss ways of preventing interference, their effect, and the main aspects for the optimum efficiency of each method.

3.6 GROUNDING (OR EARTHING).

This is one of the simplest but most efficient methods to reduce interference.
Grounding can be used for three different purposes:

1. Protection Ground

Provides protection for the operators from dangerous voltages. Widely used on mains-operated equipment.

2. Function Ground

The ground is used as a conductive path for signals.

Example: in asymmetrical cables screen, which is one conductor for the signal, is connected to the ground.

3. Screening Ground

Used to provide a neutral electrical path for the interference, to prevent that the interfering voltages or currents from entering the circuit. In this chapter we will only consider the third aspect. Grounding of equipment is often required for the cases 1 or 2 anyhow, so that the screening ground is available "free of charge". Sometimes the grounding potential, provided by the mains connection, is very "polluted". This means that the ground potential itself already carries an interfering signal. This is especially likely if there are big power consumers in the neighbourhood or even in the same building. Using such a ground might do more harm than good.
The quality of the ground line can be tested by measuring it with a storage scope against some other ground connection, e.g. a metal water pipe or some metal parts of the construction.

Never use the Neutral (N) of the mains as ground.

It might contain strong interference, Because it carries the load current of all electrical consumers.The grounding can be done by single-point grounding or by multi-point grounding. Each method has advantages which depend on the frequency range of the signal frequencies. All parts to be grounded are connected to one central point. This resultsin no "ground loops" being produced. This means the groundingconductors do not form any closed conductive path in which magneticinterference could induce currents. Furthermore, conductive linesbetween the equipment are avoided, which could produce galvanic coupling of interference.Central grounding requires consistent arrangement of the groundingcircuit and requires insulation of the individual parts of the circuit. This is sometimes very difficult to achieve.*A* system using the single-point grounding.

MULTI-POINT GROUNDING:

In multi-point grounding all parts are connected to ground at as many points as possible. This requires that the ground potential itself is as widely spread as possible. In practice, all conductive parts of the chassis, the cases, the shielding, the room and the installation are included in the network.

SCREENING.

When considering the effect of electrical and magnetic fields, we have to distinguish between low and high frequencies. At high frequencies the skin effect plays an important roll for the screening. The penetration describes the depth from the surface of the conductor, where the current density has decayed to 37% compared to the surface of the conductor.

SCREENING OF CABLES.

When signal lines run close to interference sources or when the signal circuit is very sensitive to interference, screening of signal lines will give an improvement. There are different ways of connecting the cable screen:

Three different ways of connecting the cable screen.Cable screen not connected. This screen will not prevent any interference, because the charge on the screen, produced by interference, will remain and will effect the central signal line. Also, the current induced by interference in the linewill flow through the sink, effecting the signal.Cable screen grounded on one side only.This screen will only prevent interference at low frequency signals. Forelectromagnetic interference, where the wavelength is short comparedto the length of the cable, the screening efficiency is poor.Cable screen grounded on either sidet is effective for all kinds of interference. Any current induced in thescreen by magnetic interference will flow to ground. The inner of thecable is not affected. Only the voltage drop on the screen will affect thesignal in the screen. type of grounding is
- Ensure proper and careful connection of the screens.
- Use suitable plugs in connection with the cable screen.

3.7 MULTIPLE EARTH AND EARTH LOOPS

SIMPLE TWO SYNODIC PERIOD CYCLER (CASE 1)

The simple two Earth-Mars synodic period cycler. In the circular coplanar model it has a period P=l.348 years, a radius of aphelion R~ = l .15 A U and the V, at Earth is 5.6 *M s* . For the "Up" transfer, the Earth-Mars transfer is Type I or I1 and the Mars-Earth leg is Type VI. The trajectory departs the Earth with the V, inward of the Earth's velocity vector taking it through a perihelion of about 0.93 AU, crossing the Earth's orbit ahead of the Earth and outward to Mars' orbit. As seen from Figure 1 the transfer to Mars is about 225 degrees and takes a little over nine months. The trajectory continues onward making three complete orbits about the Sun without coming near either the Earth or Mars again until passing through its original starting point on the Earth's orbit for the third time, somewhat behind the Earth and finally encountering the Earth 2/7 of a revolution about the Sun (102.9 deg.) from the starting point. The cycler has made 3 2/7 complete orbits about the Sun while Earth has made 4 2/7. The Earth flyby must now rotate the incoming V, vector, which is outward, to the symmetrically inward orientation to begin the next cycle. Unfortunately, the rotation angle required is approximately 135 degrees and with a V, of 5.65 km/s the Earth can only rotate the V, vector about 82 degrees. Now in the actual Solar System, the orbit of Mars is elliptical with a semi-major axis of 1.524 AU, a perihelion of 1.381 AU and **an** aphelion of 1.666 AU. Thus the simple Case 1 cycler does not quite reach Mars' average distance from the Sun. It is thus clear that a real world version of the Case 1 cycler would require **AV** to make up for the inability of the Earth to rotate the V, vector, as well as for the fact that over the course of seven cycles, of two synodic periods each, the Case 1 cycler will not make it to Mars' orbit more than one half of the time. The real value of Case 1 is as a basis for variations that can address these deficiencies.

TWO SYNODIC PERIOD CYCLER WITH "BACKFLIP" (CASE 2)

Modifylng Case 1 by introducing another Earth flyby, approximately six months and 180 degrees after the first, changes the situation somewhat. This six month, 180 degree transfer, or "backflip" trajectory, was first introduced for lunar trajectories by U p h ~ f f . ~ The "Up" trajectory for this version leaves the Earth with a Type I or I1 short transfer to Mars and a Type V transfer back to Earth. This transfer to the first Earth encounter makes 2 11/14 revolutions about the Sun in 3 11/14 years. The Earth flyby then puts the vehicle onto a heliocentric orbit with a period of one year which re-encounters the Earth approximately six months and 180 degrees later, completing the **3** 217 revolutions in 4 2/7 years. This second Earth flyby then sends the vehicle on to the next Mars encounter, continuing the cycle. Figure 2 shows this cycler trajectory. Note that the first Earth encounter is in the lower portion of the plot. The backflip trajectory is not shown since its difference from the Earth's orbit is primarily in the z-direction. The second Earth flyby and departure point for the second cycle is indicated slightly left of straight up on the Earth's orbit. In the circular co-planar model the Earth-Mars-Earth trajectory has a period P=l.325 years, a radius of aphelion R~ z l . 4A5 U and the V, at Earth is 4.15 ***MS***F**.**or Case 2, the transfer does not reach Mars' orbit in the circular co-planar model, but in the real world does reach Mars when Mars is near its perihelion.

The lower V, for Case 2 enables the Earth to rotate the V, vector as much as about 102 degrees, thus easily enabling the first Earth flyby to rotate the incoming V, to the required near polar orientation required for the backflip trajectory outgoing V, as well as the second earth flyby to rotate the near polar incoming V, to the outgoing V, required

for the transfer to the next Mars, Thus, although Case 2 has many desirable characteristics, it cannot be used for an entire seven cycles. If fact it will reach Mars for at most two of the seven cycles without propulsive AVto augment the gravity assists.

TWO SYNODIC PERIOD CYCLER WITH "BACKFLIP" PLUS 1-YEAR LOOP (CASE 3)

Modifying Case 2 to introduce a third Earth flyby in addition to the "backflip" adds additional flexibility. This is accomplished by adding a one year Earth-Earth loop either before or after the backflip. The order of the one year loop and the "backflip" can be chosen to best

advantage in the real world. The **TJp"** trajectory for this version leaves the Earth with a Type I short transfer to Mars and a Type I11 or IV transfer back to Earth. This transfer to the first Earth encounter makes 1 11/14 revolutions about the Sun in 2
11/14 years. The Earth flyby the puts the vehicle onto a heliocentric orbit with a period of one year which re-encounters the Earth approximately six months and 180 degrees later and then re-encounters the Earth one year later, or vice versa. The final Earth flyby then sends the vehicle on to the next Mars encounter. Figure 3 shows this cycler trajectory. Again as in Case 2, the backflip trajectory is not seen. The one year Earth-Earth loop is also not shown. In the circular co-planar model the Earth-Mars-Earth trajectory has a period **P=l.484** years, a radius of aphelion R~=l .65A U and the V, at Earth is **5.4** km/s.
In this case the transfer reaches an aphelion approximately equal to Mars' aphelion and will thus always cross Mars orbit in the real world. Analysis of Case 3 with the actual ephemerides of Earth and Mars is considered in more detail below.

1-YEAR LOOP (CASE 3)

TWO SYNODIC PERIOD CYCLER WITH ONE OR TWO 1-YEAR LOOPS
Modifying Case 1 to introduce one or two one year Earth-Earth loops or even a two year

Earth-Earth loop without a backflip is also possible, it leads however, to much higher

V,'s less desirable characteristics that any of Cases 1,2 or 3, or the Aldrin Cycler for that matter.

DETAILED ANALYSIS OF CASE 3

A detailed analysis of Case 3 was performed using the actual ephemerides of the Earth and Mars. The trajectories were modeled as Sun-centered point-to-point conics connecting the Earth and Mars flybys. The flybys were modeled as instantaneous V m rotations. This – V m -matching‖ model gives excellent insight into both the heliocentric and planetocentric trajectories and sufficient accuracy for developing long term trajectory scenarios that can be closely reproduced with fully numerically integrated trajectory models. The Table shows data for a full cycle of seven two-synodic period cyclers (30 years). This should approximately repeat since the Earth and Mars are very nearly at the same inertial positions every 15 years.The choice of one year loop or backflip and whether the backflip is –north‖ or –south‖ needs to be made in each case to make best use of the arrival and departure V,'s to minimize the required bending by the Earth and potential required **AV.** The Mars flybys (given to the nearest 1000 km) are all at reasonably high altitudes. Whereas in the circular co-planar analysis the Mars flybys are arbitrarily high, in the real world the Mars gravity assist must control the inclination of the heliocentric orbit as well as adjust the energy slightly to properly phase for the next encounter. The Mars V,'s vary between about 3 km/s and **8** km/s which compares to the value of 5.3 km/s in the circular coplanar case. The Earth V,'s vary between about **4** km/s and 7.5 km/s which compares to 5.4 km/s.

UNIT IV STORAGE AND DISPLAY DEVICES

4.1 Recorders

A recorder is a measuring instrument which records time varying quantity, even after the quantity or variable to be measured has stopped. The electrical quantities such as voltage & current are measured directly. The non- electrical quantities are recorded using indirect methods. The non- electrical quantities are first converted to their equivalent voltages or currents, using various transducers.

Electronic recorders may be classified as:

1. Analog recorders
2. Digital recorders

Analog recorders dealing with analog systems can be classified as

1. Graphic recorders
2. Oscillographic recorders
3. Magnetic Tape recorders

Digital recorders dealing with digital output can be classified as

1. Incremental digital recorders
2. Synchronous digital recorders

4.2 Magnetic Disk And Tape

MagneticTapeRecorder

- Ø The magnetic tape recorders are used for high frequency signal recording.
- Ø In these recorders, the data is recorded in a way that it can be reproduced in electrical form any time.
- Ø Also main advantage of these recorders is that the recorded data can be replayed for almost infinite times.
- Ø Because of good higher frequency response, these are used in Instrumentation systems extensively.

Basic Components of Tape Recorder

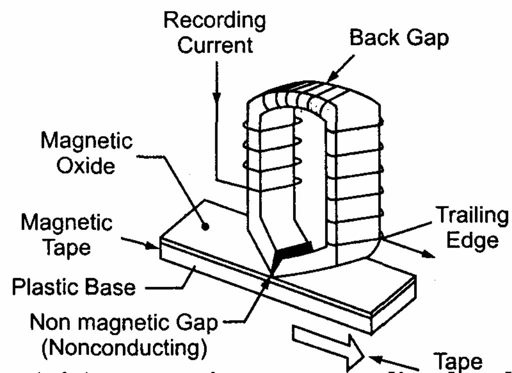
Following are the basic components of magnetic tape recorder

1. Recording Head
2. Magnetic Tape
3. Reproducing Head
4. Tape Transport Mechanism
5. Conditioning Devices

Recording Head

- Ø The construction of the magnetic recording head is very much similar to the construction of a Transformer having a toroidal core with coil.

Ø There is a uniform fine air gap of 5µ m to 15µ m between the head and the magnetic tape.



(Fig) Magnetic tape recording head

Ø When the current used for recording is passed through coil wound around magnetic core, it produces magnetic flux.

Ø The magnetic tape is having iron oxide particles.

Ø When th e tape is passing the head, the flux pr oduced due to recording current gets linked with iron oxide part ices on th e magnetic tape and these particles get magnetized.

Ø This magnetization particle remain as it is, e vent Hough the magnetic tape leaves the gap.

Ø The actual recording takes place at the trailing edge of the air gap.

Ø Any signal is recorded in the form of the patterns.

Ø These magnetic patterns are dispersed anyw here along the length of mag netictape in accordance with the variation in recording current with respect to time.

Magnetic Tape

Ø The magnetic tape is made of thin sheet of tough and dimensionally stable plastic ribbon.

Ø One side of this plastic ribbon is coated by powdered iron oxide particles (Fe2O3) thick.

Ø The magnetic tape is wound around a reel.

Ø This tape is transferred from one reel to another.

Ø When the tape passes across air gap magnetic pattern is created in accordance with variation of recording current.

Ø To reproduce this pattern, the same tape with some recorded pattern is passed across another magnetic head in which voltage is induced.

Ø This voltage induced is in accordance with the magnetic pattern.

Reproducing Head

Ø The use of the reproducing head is to get the recorded data played back.

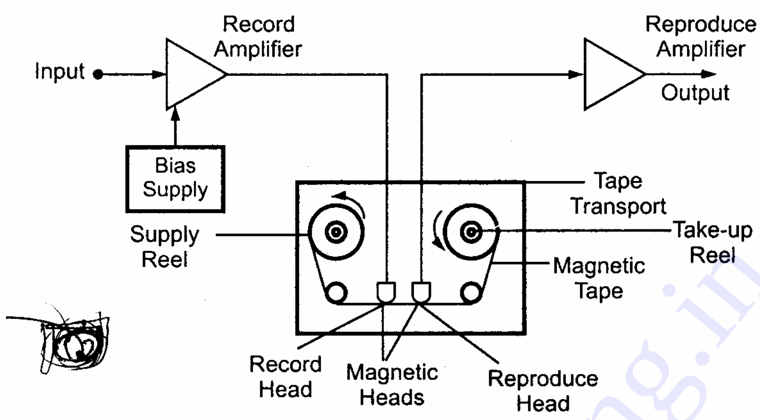
Ø The working of the reproducing head is exactly opposite to that of the recording head.

Ø The reproducing head detects the magnetic pattern recorded on the tape.

Ø The head converts the magnetic pattern back to the original electrical signal.

Ø In appearance, both recording and reproducing heads are very much similar.

Tape Transport Mechanism



(Fig) Basic tape transport mechanism

- The tape transport mechanism moves the magnetic tape along the recording head or reproducing head with a constant speed
- The tape transport mechanism must perform following tasks.
  - It must handle the tape without straining and wearing it.
  - It must guide the tape across magnetic heads with great precision.
  - It must maintain proper tension of magnetic tape.
  - It must maintain uniform and sufficient gap between the tape and heads.
- The magnetic tape is wound on reel.
- There are two reels; one is called as supply & other is called as take-up reel.
- Both the reels rotate in same direction.
- The transportation of the tape is done by using supply reel and take-up reel.
- The fast winding of the tape or the reversing of the tape is done by using special arrangements.
- The rollers are used to drive and guide the tape.

Conditioning Devices

- These devices consist of amplifiers and fitters to modify signal to be recorded.
- The conditioning devices allow the signals to be recorded on the magnetic tape with proper format.
- Amplifiers allow amplification of signal to be recorded and filters removes unwanted ripple quantities.

Principle of Tape Recorders

- When a magnetic tape is passed through a recording head, the signal to be recorded appears as some magnetic pattern on the tape.
- This magnetic pattern is in accordance with the variations of original recording current.
- The recorded signal can be reproduced back by passing the same tape through a reproducing head where the voltage is induced corresponding to the magnetic pattern on the tape.

- Ø When the tape is passed through the reproducing head, the head detects the changes in the magnetic pattern i.e. magnetization.
- Ø The change in magnetization of particles produces change in the reluctance of the magnetic circuit of the reproducing head, inducing a voltage in its winding.
- Ø The induced voltage depends on the direction of magnetisation and its magnitude on the tape.
- Ø The emf, thus induced is proportional to the rate of change of magnitude of magnetisation i.e. e N (dΦ / dt)

  Where N = number of turns of the winding on reproducing head

  Æ = magnetic flux produced.

  Suppose the signal to be recorded is Vm sin Ût. Thus, the current in the recording head and flux induced will be proportional to this voltage.
- Ø It is given by e= k 1. Vm sin wt, where k1 = constant.
- Ø Above pattern of flux is recorded on the tape. Now, when this tape is passed through the reproducing head, above pattern is regenerated by inducing voltage in the reproducing head winding.
- Ø It is given by e= k2 ŬVm cos wt
- Ø Thus the reproducing signal is equal to derivative of input signal & it is proportional to flux recorded & frequency of recorded signal.

Methods of Recording

The methods used for magnetic tape recording used for instrumentation purposes are as follows:

i) Direct Recording
ii) Frequency Modulation Recording
iii) Pulse Duration Modulation Recording

For instrumentation purposes mostly frequency modulation recording is used. The pulse duration modulation recording is generally used in the systems for special applications where large number of slowly changing variables has to be recorded simultaneously.

4.3 Digital Plotters And Printers

PRINTERS

- Ø Printers can be classified according to their printing methodology **Impact printers** and **Non-impact printers**.
- Ø Impact printers press formed character faces against an inked ribbon onto the paper.
- Ø A line printer and dot matrix printer are the examples of an impact printer.
- Ø Non impact printer and plotters use laser techniques, inkjet sprays, xerographic processes, electrostatic methods and e1ectrothermal methods to get images onto the paper.
- Ø A ink-jet printer and laser printer are the examples of non- impact printers.

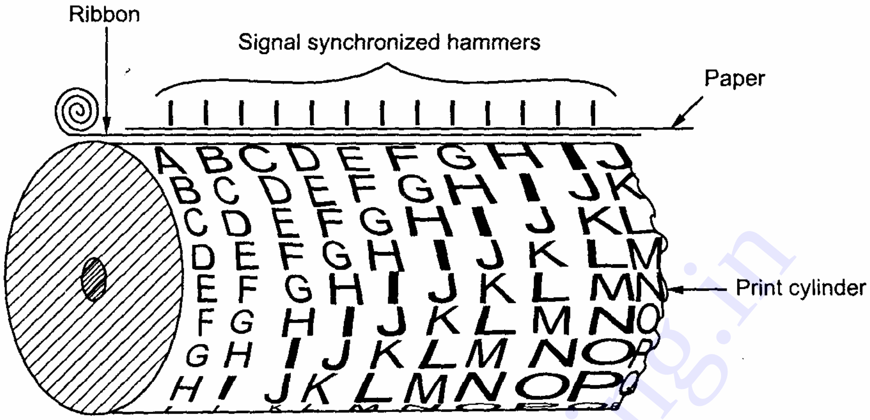
Line Printers

A line printer prints a complete line at a time. The printing speed of line printer varies from 150 lines to

2500 lines per minute with 96 to 100 characters on one line. The line printers are divided into two categories Drum printers and chain printer.

Drum Printers

Drum printer consists of a cylindrical drum. One complete set of characters is embossed on all the print positions on a line, as shown in the Fig. The character to be printed is adjusted by rotating drum.

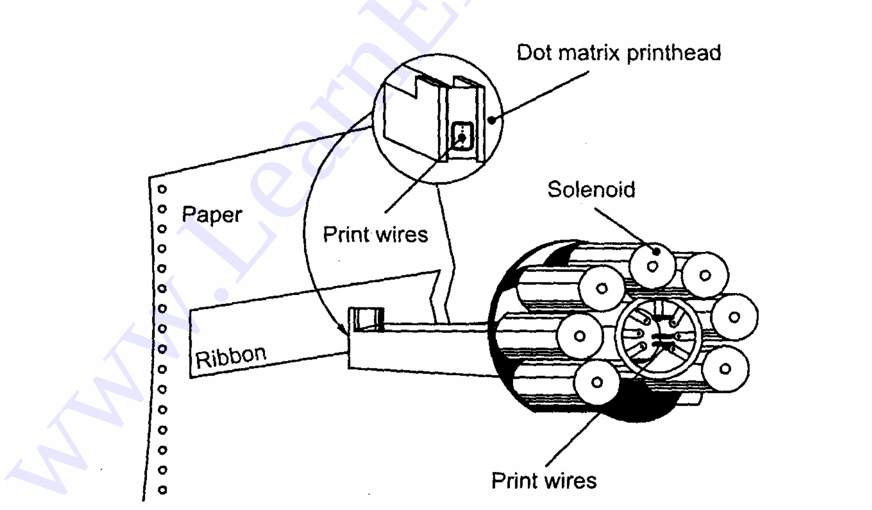


Chain Printers

In these printers chain with embossed character set is used, instead of drum. Here, the character to be printed is adjusted by rotating chain.

Dot Matrix Printers

Dot matrix printers are also called serial printers as they print one character at a time, with printing head moving across a line.

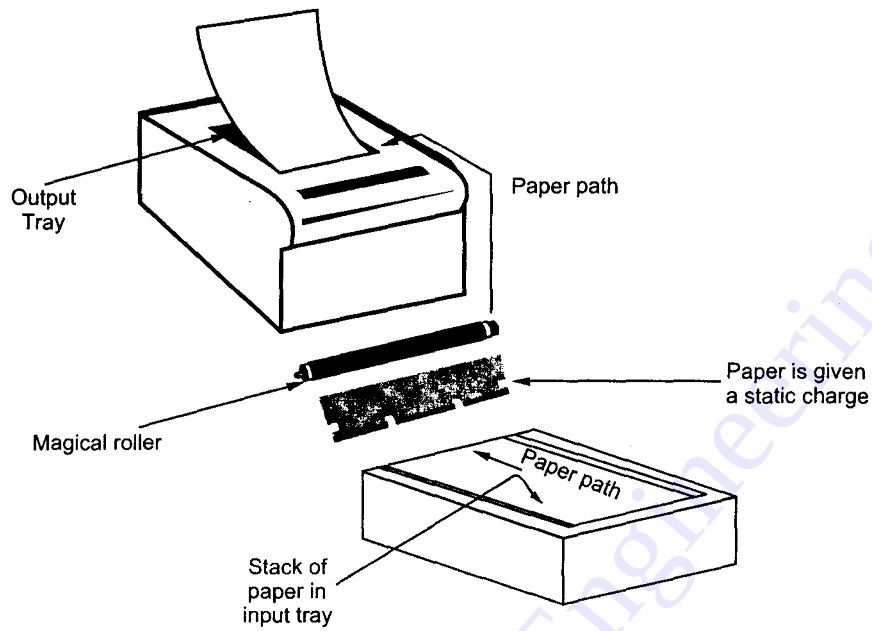


Laser Printer

- Ø The li ne, do t matrix, and ink jet printers need a head movement on a ribbon to print characters.
- Ø This mechanical movement is relatively slow due to the high inertia of mechanical elements.
- Ø In laser printers these mechanical movements are avoided.

- Ø In these printers, an electronically controlled laser beam traces out the desired character to be printed on a photoconductive drum.
- Ø The exposed areas of the drum gets charged, which attracts an oppositely charged ink from the ink toner on to the exposed areas.
- Ø This image is then transferred to the paper which comes in contact with the drum with pressure and heat.

- Ø The charge on the drum decides the darkness of the print.
- Ø When charge is more, more ink is attracted and we get a dark print.



- Ø A colour laser printer works like a single colour laser printer, except that the process is repeated four times with four different ink colours: Cyan, magenta, yellow and black.
- Ø Laser printers have high resolution from 600 dots per inch upto 1200 per inch.
- Ø These printers print 4 to 16 page of text per minute.
- Ø The high quality and speed of laser printers make them ideal for office environment.

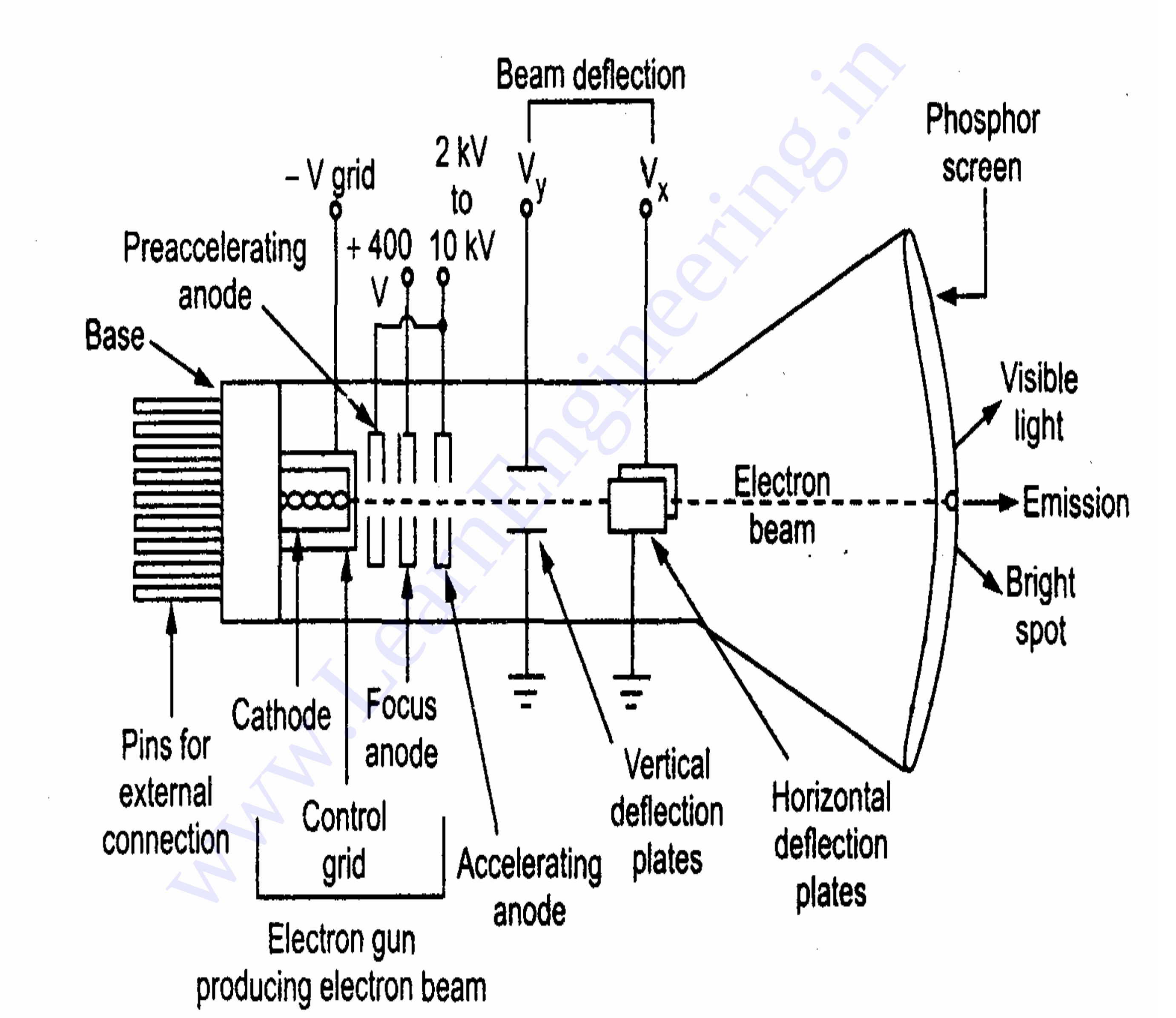
Advantages of Laser printer

- Ø The main advantages of laser printers are speed, precision and economy.
- Ø A laser can move very quickly, so it can "write" with much greater speed than an inket.
- Ø Because the laser beam has an unvarying diameter, it can draw more precisely, without spilling any excess ink.
- Ø Laser printers tend to be more expensive than ink-jet printers, but it doesn't cost as much to keep them running.
- Ø Its toner power is cheap and lasts for longer time.

4.4 CRT Display

The device which allows, the amplitude of such signals, to be displayed primarily as a function of time, is called cathode ray oscilloscope. The cathode ray tube (CRT) is the heart of the C.R.O. The CRT generates the electron beam, accelerates the beam, deflects the beam and also has a screen where beam becomes visible as a spot. The main parts of the CRT are

i) Electron gun
ii) Deflection system
iii) Fluorescent screen
iv) Glass tube or envelope
v) Base



Electron gun

- Ø The electron gun section of the cathode ray tube provides a sharply focused, electron beam directed towards the fluorescent-coated screen.
- Ø This section starts from thermally heated cathode, emitting the electrons.
- Ø The control grid is given negative potential with respect to cathode.
- Ø This grid controls the number of electrons in t beam, going to the screen.
- Ø The momentum of the electrons (their number x their speed) determines the intensity, or brightness, of the light emitted from the fluorescent screen due to the electron bombardment.
- Ø The light emitted is usually of the green colour.

Deflection System

Ø When the electron beam is accelerated it passes through the deflection system, with which beam can be positioned anywhere on the screen.

Fluorescent Screen

- Ø The light produced by the screen does not disappear immediately when bombardment by electrons ceases, i.e., when the signal becomes zero.
- Ø The time period for which the trace remains on the screen after the signal becomes zero is known as "persistence or fluorescence".
- Ø The persistence may be as short as a few microsecond, or as long as tens of seconds or even minutes.
- Ø Medium persistence traces are mostly used for general purpose applications.
  - Ø Long persistence traces are used in the study of transients.
- Ø Long persistence helps in the study of transients since the trace is still seen on the screen after the transient has disappeared.

Glass Tube

- Ø All the components of a CRT are enclosed in an evacuated glass tube called envelope.
- Ø This allows the emitted electrons to move about freely from one end of the tube to the other end.

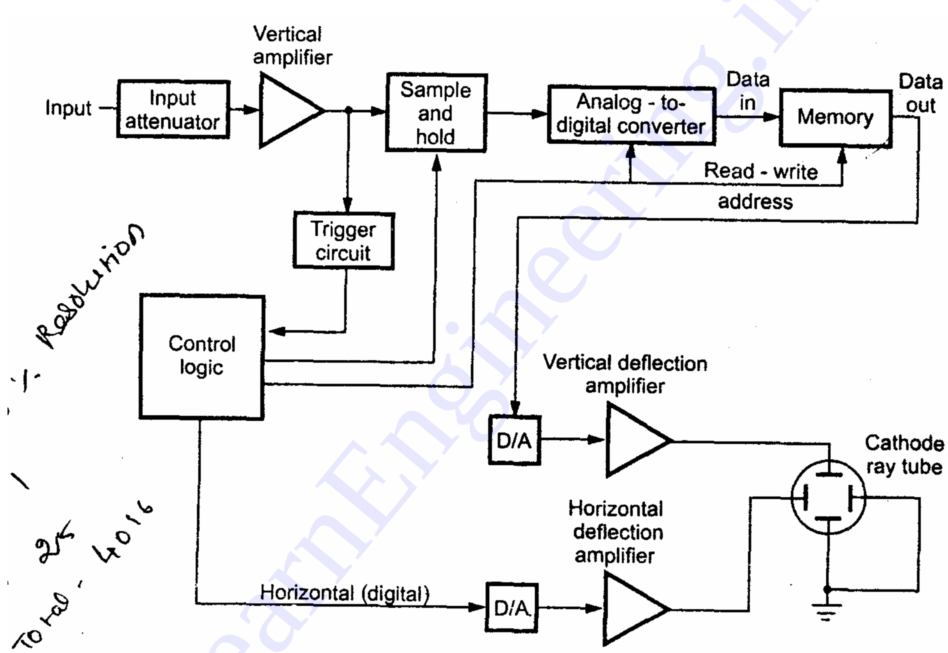
Base

Ø The base is provided to the CRT through which the connections are made to the various parts.

Digital Storage Oscilloscope

Block Diagram

The block diagram of digital storage oscilloscope is shown in the Fig.



- Ø The input signal is applied to the amplifier and attenuator section.
- Ø The oscilloscope uses same type of amplifier and attenuator circuitry as used in the conventional oscilloscopes.
- Ø The attenuated signal is then applied to the vertical amplifier.
- Ø To digitize the analog signal, analog to digital (A/D) converter is used.
- Ø The output of the vertical amplifier is applied to the A/D converter section.
- Ø The successive approximation type of A/D converter is most oftenly used in the digital storage oscilloscopes.
- Ø The sampling rate and memory size are selected depending upon the duration & the waveform to be recorded.
- Ø Once the input signal is sampled, the A/D converter digitizes it.
- Ø The signal is then captured in the memory.

- Once it is stored in the memory, many manipulations are possible as memory can be readout without being erased.
- The digital storage oscilloscope has three modes:

1. Roll mode
2. Store mode
3. Hold or save mode.

Advantages

i) It is easier to operate and has more capability. ii) The storage time is infinite.

iii) The display flexibility is available. The number of traces that can be stored and recalled depends on the size of the memory.

iv) The cursor measurement is possible.

v) The characters can be displayed on screen along with the waveform which can indicate waveform information such as minimum, maximum, frequency, amplitude etc.

vi) The X-Y plots, B-H curve, P-V diagrams can be displayed.

vii) The pretrigger viewing feature allows to display the waveform before trigger pulse.

viii) Keeping the records is possible by transmitting the data to computer system where the further processing is possible

ix) Signal processing is possible which includes translating the raw data into finished information e.g. computing parameters of a captured signal like r.m.s. value, energy stored etc.

4.6 DATA LOGGER

Definition

Data logger is an electronic device that records data over time or in relation to location either with a built in instrument or sensor.

Components

- Pulse inputs
  - Counts circuit closing
- Control ports
  - Digital in and out
  - Most commonly used to turn things on and off
  - Can be programmed as a digital input
- Excitation outputs

Though they can be deployed while connected to a host PC over an Ethernet or serial port a data logger is more typically deployed as standalone devices. The term data logger (also sometimes referred to as a data recorder) is commonly used to describe a self-contained, standalone data acquisition system or device. These products are comprised of a number of analog and digital inputs that are monitored, and the results or conditions of these inputs is then stored on some type of local memory (e.g. SD Card, Hard Drive).

Examples

Examples of where these devices are used abound. A few of these examples are shown below:

Ø monitoring temperature, pressure, strain and other physical phenomena in aircraft flight tests (even including logging info from Arinc 429 or other serial communications buses)

Ø Monitoring temperature, pressure, strain and other physical phenomena in automotive and in-vehicle tests including monitoring traffic and data transmitted on the vehicles CAN bus.

Ø Environmental monitoring for quality control in food processing, food storage, pharmaceutical manufacturing, and even monitoring the environment during various stages of contract assembly or semiconductor fabrication

Ø Monitoring stress and strain in large mechanical structures such as bridges, steel framed buildings, towers, launch pads etc.

Ø Monitoring environmental parameters in temperature and environmental chambers and test facilities.

Ø A data logger is a self-contained unit that does not require a host to operate.

Ø It can be installed in almost any location, and left to operate unattended.
Ø This data can be immediately analyzed for trends, or stored for historical archive purposes.
Ø Data loggers can also monitor for alarm conditions, while recording a minimum number of samples, for economy.
Ø If the recording is of a steady-state nature, without rapid changes, the user may go through rolls of paper, without seeing a single change in the input.
Ø A data logger can record at very long intervals, saving paper, and can note when an alarm condition is occurring. When this happens, the event will be recorded and any outputs will be activated, even if the event occurs in between sample times.
Ø A record of all significant conditions and events is generated using a minimum of recording hardcopy
Ø The differences between various data loggers are based on the way that data is recorded and stored.
Ø The basic difference between the two data logger types is that one type allows the data to be stored in a memory, to be retrieved at a later time, while the other type automatically records the data on paper, for immediate viewing and analysis.
Ø Many data loggers combine these two functions, usually unequally, with the emphasis on either the ability to transfer the data or to provide a printout of it

Advantages

- Ø A data logger is an attractive alternative to either a recorder or data acquisition system in many applications. When compared to a recorder, data loggers have the ability to accept a greater number of input channels, with better resolution and accuracy.

- Ø Also, data loggers usually have some form of on-board intelligence, which provides the user with diverse capabilities.

- Ø For example, raw data can be analyzed to give flow rates, differential temperatures, and other interpreted data that otherwise would require manual analysis by the operator the operator has a permanent recording on paper,

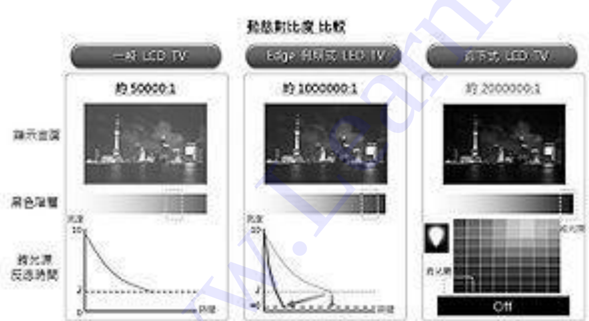
- Ø No other external or peripheral equipment is required for operation, and

- Ø Many data loggers of this type also have the ability to record data trends, in addition to simple digital data recording

Applications

Ø Temperature sensor
Ø Pressure sensor

4.7 LED-BACKLIT LCD TELEVISION



Comparison of LCD, edge lit LED and LED TV

LED-backlight LCD television (incorrectly called LED TV by (CCFLs) used in traditional LCD televisions. This has a dramatic impact resulting in a thinner panel and less power consumption, brighter display with better contrast levels. It also generates less heat than regular LCD TVs. The LEDs can come in three forms: dynamic RGB LEDs which are positioned behind the panel, white Edge-LEDs positioned around the rim of the screen which use a special diffusion panel to spread the light evenly behind the screen (the most common) and full-array which are arranged behind the screen but they are incapable of dimming or brightening individually

LED backlighting techniques

RGB dynamic LEDs

This method of backlighting allows dimming to occur in locally specific areas of darkness on the screen. This can show truer blacks, whites and PRs[clarification needed] at much higher dynamic contrast ratios, at the cost of less detail in small bright objects on a dark background, such as star fields

Edge-LEDs

This method of backlighting allows for LED-backlit TVs to become extremely thin. The light is diffused across the screen by a special panel which produces a uniform color range across the screen.

Full Array LEDs

Sharp, and now other brands, also have LED backlighting technology that aligns the LEDs on back of the TV like the RGB Dynamic LED backlight, but it lacks the local dimming of other sets.[6] The main benefit of its LED backlight is simply reduced energy consumption and may not improve quality over non-LED LCD TVs.[7]

Differences between LED-backlit and CCFL-backlit LCD displays

An LED backlight offers several general benefits over regular CCFL backlight TVs, typically higher brightness. Compared to regular CCFL backlighting, there may also be benefits to color gamut. However advancements in CCFL technology mean wide color gamuts and lower power consumption are also possible. The principal barrier to wide use of LED backlighting on LCD televisions is cost.

The variations of LED backlighting do offer different benefits. The first commercial LED backlit LCD TV was the Sony Qualia 005 (introduced in 2004). This featured RGB LED arrays to offer a color gamut around twice that of a conventional CCFL LCD television (the combined light output from red, green and blue LEDs produces a more pure white light than is possible with a single white light LED). RGB LED technology continues to be used on selected Sony BRAVIA LCD models, with the addition of 'local dimming' which enables excellent on-screen contrast through selectively turning off the LEDs behind dark parts of a picture frame.

Edge LED lighting was also first introduced by Sony (September 2008) on the 40 inch BRAVIA KLV-40ZX1M (referred to as the ZX1 in Europe). The principal benefit of Edge-LED lighting for LCD televisions is the ability to build thinner housings (the BRAVIA KLV-40ZX1M is as thin as 9.9mm). Samsung has also introduced a range of Edge-LED lit LCD televisions with extremely thin housings.

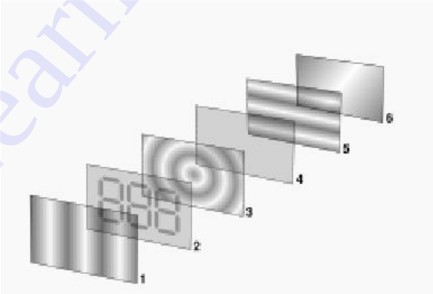
LED-backlit LCD TVs are considered a more sustainable choice, with a longer life and better energy efficiency than plasmas and conventional LCD TVs.[10] Unlike CCFL backlights, LEDs also use nomercury in their manufacture. However, other elements such as gallium and arsenic are used in the manufacture of the LED emitters themselves, meaning there is some debate over whether they are a significantly better long term solution to the problem of TV disposal.

Because LEDs are able to be switched on and off more quickly than CCFL displays and can offer a higher light output, it is theoretically possible to offer very high contrast ratios. They can produce deep blacks (LEDs off) and a high brightness (LEDs on), however care should be taken with measurements made from pure black and pure white outputs, as technologies like Edge-LED lighting do not allow these outputs to be reproduced simultaneously on-screen.

In September 2009 Nanoco Group announced that it has signed a joint development agreement with a major Japanese electronics company under which it will design and develop quantum dots for LED Backlights in LCD televisions.[11] Quantum dots are valued for displays, because they emit light in very specific gaussian distributions. This can result in a display that more accurately renders the colors than the human eye can perceive. Quantum dots also require very little power since they are not color filtered. In September 2010, LG Electronics revealed their new product which claimed as the world's slimmest full LED 3D TV at the IFA consumer electronics trade show in Berlin

4.8 LCD & Dot Matrix Display

LIQUID CRYSTAL DISPLAY



Reflective twisted nematic liquid crystal display.

1. Polarizing filter film with a vertical axis to polarize light as it enters.
2. Glass substrate with ITO electrodes. The shapes of these electrodes will determine the shapes that will appear when the LCD is turned ON. Vertical ridges etched on the surface are smooth.
3. Twisted nematic liquid crystal.

4. Glass substrate with common electrode film (ITO) with horizontal ridges to line up with the horizontal filter.
5. Polarizing filter film with a horizontal axis to block/pass light.
6. Reflective surface to send light back to viewer. (In a backlit LCD, this layer is replaced with a light source.)

A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). LCs do not emit light directly.
They are used in a wide range of applications including: computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. LCDs have displaced cathode ray tube (CRT) displays in most applications. They are usually more compact, lightweight, portable, less expensive, more reliable, and easier on the eyes.They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they cannot suffer image burn-in. LCDs are more energy efficient and offer safer disposal than CRTs.

Overview

LCD alarm clock

Each pixel of an LCD typically consists of a layer of molecules aligned between two transparent electrodes, and two polarizing filters, the axes of transmission of which are (in most of the cases) perpendicular to each other. With no actual liquid crystal between the polarizing filters, light passing through the first filter would be blocked by the second (crossed) polarizer. In most of the cases the liquid crystal has double refraction.

The surface of the electrodes that are in contact with the liquid crystal material are treated so as to align the liquid crystal molecules in a particular direction. This treatment typically consists of a thin polymer layer that is unidirectionally rubbed using, for example, a cloth. The direction of the liquid crystal alignment is then defined by the direction of rubbing. Electrodes are made of a transparent conductor called Indium Tin Oxide (ITO).

Before applying an electric field, the orientation of the liquid crystal molecules is determined by the alignment at the surfaces of electrodes. In a twisted nematic device (still the most common liquid crystal device), the surface alignment directions at the two electrodes are perpendicular to each other, and so the molecules arrange themselves in a helical structure, or twist. This reduces the rotation of the polarization of the incident light, and the device appears grey. If the applied voltage is large enough, the liquid crystal molecules in the center of the layer are almost completely untwisted and the polarization of the incident light is not rotated as it passes through the liquid crystal layer. This light will then be mainly polarized perpendicular to the second filter, and thus be blocked and the pixel will appear black. By controlling the voltage applied across the liquid crystal layer in each pixel, light can be allowed to pass through in varying amounts thus constituting different levels of gray. This electric field also controls (reduces) the double refraction properties of the liquid crystal.

LCD with top polarizer removed from device and placed on top, such that the top and bottom polarizers are parallel.

The optical effect of a twisted nematic device in the voltage-on state is far less dependent on variations in the device thickness than that in the voltage-off state. Because of this, these devices are usually operated between crossed polarizers such that they appear bright with no voltage (the eye is much more sensitive to variations in the dark state than the bright state). These devices can also be operated between parallel polarizers, in which case the bright and dark states are reversed. The voltage-off dark state in this configuration appears blotchy, however, because of small variations of thickness across the device.

Both the liquid crystal material and the alignment layer material contain ionic compounds. If an electric field of one particular polarity is applied for a long period of time, this ionic material is attracted to the surfaces and degrades the device performance. This is avoided either by applying an alternating current or by reversing the polarity of the electric field as the device is addressed (the response of the liquid crystal layer is identical, regardless of the polarity of the applied field).

When a large number of pixels are needed in a display, it is not technically possible to drive each directly since then each pixel would require independent electrodes. Instead, the display is multiplexed. In a multiplexed display, electrodes on one side of the display are grouped and wired together (typically in columns), and each group gets its own voltage source. On the other side, the electrodes are also grouped (typically in rows), with each group getting a voltage sink. The groups are designed so each pixel has a unique, unshared combination of source and sink. The electronics, or the software driving the electronics then turns on sinks in sequence, and drives sources for the pixels of each sink.

ILLUMINATION

LCD panels produce no light of their own, they require an external lighting mechanism to be easily visible. On most displays, this consists of a cold cathode fluorescent lamp that is situated behind the LCD panel. Passive-matrix displays are usually not backlit, but active-matrix displays almost always are, with a few exceptions such as the display in the original Gameboy Advance. Recently, two types of LED backlit LCD displays have appeared in some televisions as an alternative to conventional backlit LCDs. In one scheme, the LEDs are used to backlight the entire LCD panel. In another scheme, a set of green red and blue LEDs is used to illuminate a small cluster of pixels, which can improve contrast and black level in some situations. For example, the LEDs in one section of the screen can be dimmed to produce a dark section of the image while the LEDs in another section are kept bright. Both schemes also allows for a slimmer panel than on conventional displays.

Passive-matrix and active-matrix addressed LCDs

A general purpose alphanumeric LCD, with two lines of 16 characters. LCDs with a small number of segments, such as those used in digital watches and pocket calculators, have individual electrical contacts for each segment. A external dedicated circuit supplies an electric charge to control each segment. This display structure is unwieldy for more than a few display elements.

Small monochrome displays such as those found in personal organizers, electronic weighing scales, older laptop screens, and the originalGameboy have a passive-matrix structure employing super-twisted nematic (STN) or double-layer STN (DSTN) technology (the latter of which addresses a colour-shifting problem with the former), and colour-STN (CSTN) in which colour is added by using an internal filter. Each row or column of the display has a single electrical circuit. The pixels are addressed one at a time by row and column addresses. This type of display is called passive-matrix addressed because the pixel must retain its state between refreshes without the benefit of a steady electrical charge. As the number of pixels (and, correspondingly, columns and rows) increases, this type of display becomes less feasible. Very slow response times and poor contrast are typical of passive-matrix addressed LCDs.
Monochrome passive-matrix LCDs were standard in most early laptops (although a few used plasma displays). The commercially unsuccessful Macintosh Portable (released in 1989) was one of the first to use an active-matrix display (though still monochrome), but passive-matrix was the norm until the mid-1990s, when colour active-matrix became standard on all laptops.

High-resolution colour displays such as modern LCD computer monitors and televisions use an active matrix structure. A matrix of thin-film transistors (TFTs) is added to the polarizing and colour filters. Each pixel has its own dedicated transistor, allowing each column line to access one pixel. When a row line is activated, all of the column lines are connected to a row of pixels and the correct voltage is driven onto all of the column lines. The row line is then deactivated and the next row line is activated. All of the row lines are activated in sequence during a refresh operation. Active-matrix addressed displays look "brighter" and "sharper" than passive-matrix addressed displays of the same size, and generally have quicker response times, producing much better images.

ACTIVE MATRIX TECHNOLOGIES

A Casio 1.8 in colour TFT liquid crystal display which equips the SonyCyber-shot DSC-P93A

Twisted nematic (TN)

Twisted nematic displays contain liquid crystal elements which twist and untwist at varying degrees to allow light to pass through. When no voltage is applied to a TN liquid crystal cell, the light is polarized to pass through the cell. In proportion to the voltage applied, the LC cells twist up to 90 degrees changing the polarization and blocking the light's path. By properly adjusting the level of the voltage almost any grey level or transmission can be achieved.

In-plane switching (IPS)

In-plane switching is an LCD technology which aligns the liquid crystal cells in a horizontal direction. In this method, the electrical field is applied through each end of the crystal, but this requires two transistors for each pixel instead of the single transistor needed for a standard thin-film transistor (TFT) display. Before LGEnhanced IPS was introduced in 2009, the additional transistors resulted in blocking more transmission area, thus requiring a brighter backlight, which consumed more power, and made this type of display less desirable for notebook computers. This newer, lower power technology can be found in the AppleiMac, iPad, and iPhone 4, as well as the Hewlett-Packard EliteBook 8740w. Currently Panasonic is using an enhanced version eIPS for their large size LCD-TV products.Advanced fringe field switching (AFFS)
Known as fringe field switching (FFS) until 2003, advanced fringe field switching is a technology similar to IPS or S-IPS offering superior performance and colour gamut with high

luminosity. AFFS is developed by HYDIS TECHNOLOGIES CO.,LTD, Korea (formally Hyundai Electronics, LCD Task Force). AFFS-applied notebook applications minimize colour

In 2004, HYDIS TECHNOLOGIES CO.,LTD licenses AFFS patent to Japan's Hitachi Displays. Hitachi is using AFFS to manufacture high end panels in their product line. In 2006, HYDIS also licenses AFFS to Sanyo Epson Imaging Devices Corporation.
HYDIS introduced AFFS+ which improved outdoor readability in 2007.

Vertical alignment (VA)

Vertical alignment displays are a form of LCDs in which the liquid crystal material naturally exists in a vertical state removing the need for extra transistors (as in IPS). When no voltage is applied, the liquid crystal cell remains perpendicular to the substrate creating a black display. When voltage is applied, the liquid crystal cells shift to a horizontal position, parallel to the substrate, allowing light to pass through and create a white display. VA liquid crystal displays provide some of the same advantages as IPS panels, particularly an improved viewing angle and improved black level

Blue Phase mode

Blue phase LCDs do not require a liquid crystal top layer. Blue phase LCDs are relatively new to the market, and very expensive because of the low volume of production. They provide a higher refresh rate than normal LCDs, but normal LCDs are still cheaper to make and actually provide better colours and a sharper image

Military use of LCD monitors

LCD monitors have been adopted by the United States of America military instead of CRT displays because they are smaller, lighter and more efficient, although monochrome plasma displays are also used, notably for their M1 Abrams tanks. For use with night vision imaging systems a US military LCD monitor must be compliant with MIL-L-3009 (formerly MIL-L-85762A). These LCD monitors go through extensive certification so that they pass the standards for the military. These include MIL-STD-901D - High Shock (Sea Vessels), MIL-STD-167B - Vibration (Sea Vessels), MIL-STD-810F – Field Environmental Conditions (Ground Vehicles and Systems),MIL-STD-461E/F –EMI/RFI(Electromagnetic nterference/Radio Frequency Interference), MIL-STD-740B – Airborne/Structureborne Noise, and TEMPEST - Telecommunications Electronics Material Protected from Emanating Spurious Transmissions

Quality control

Some LCD panels have defective transistors, causing permanently lit or unlit pixels which are commonly referred to as stuck pixels or dead pixels respectively. Unlike integrated circuits (ICs), LCD panels with a few defective transistors are usually still usable. It is claimed that it is economically prohibitive to discard a panel with just a few defective pixels because LCD panels are much larger than ICs, but this has never been proven. Manufacturers' policies for the acceptable number of defective pixels vary greatly. At one point, Samsung held a zero-tolerance policy for LCD monitors sold in Korea. Currently, though, Samsung adheres to the less restrictive ISO 13406-2 standard. Other companies have been known to tolerate as many as 11 dead pixels in their policies. Dead pixel policies are often hotly debated between manufacturers and customers. To regulate the acceptability of defects and to protect the end user, ISO released the ISO 13406-2 standard. However, not every LCD manufacturer conforms to the ISO standard and the ISO standard is quite often interpreted in different ways. LCD panels are more likely to have defects than most ICs due to their larger size. For example, a 300 mm SVGA LCD has 8 defects and a 150 mm wafer has only 3 defects. However, 134 of the 137 dies on the wafer will be acceptable, whereas rejection of the LCD panel would be a 0% yield. Due to competition between manufacturers quality control has been improved. An SVGA LCD panel with 4 defective pixels is usually considered defective and customers can request an exchange for a new one. Some manufacturers, notably in South Korea where some of the largest LCD panel manufacturers, such as LG, are located, now have "zero defective pixel guarantee", which is an extra screening process which can then determine "A" and "B" grade panels. Many manufacturers would replace a product even with one defective pixel. Even where such guarantees do not exist, the location of defective pixels is important. A display with only a few defective pixels may be unacceptable if the defective pixels are near each other. Manufacturers may also relax their replacement criteria when defective pixels are in the center of the viewing area. LCD panels also have defects known as *clouding* (or less commonly *mura*), which describes the uneven patches of changes in luminance. It is most visible in dark or black areas of displayed scenes

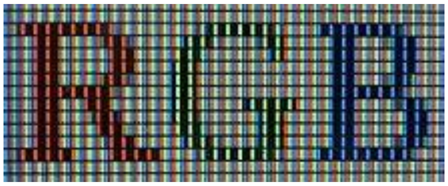
ZERO-POWER (BISTABLE) DISPLAYS

The zenithal bistable device (ZBD), developed by QinetiQ (formerly DERA), can retain an image without power. The crystals may exist in one of two stable orientations ("Black" and "White") and power is only required to change the image. ZBD Displays is a spin-off company from QinetiQ who manufacture both grayscale and colour ZBD devices. A French company, Nemoptic, has developed the BiNem zero-power, paper-like LCD technology which has been mass-produced in partnership with Seiko since 2007.

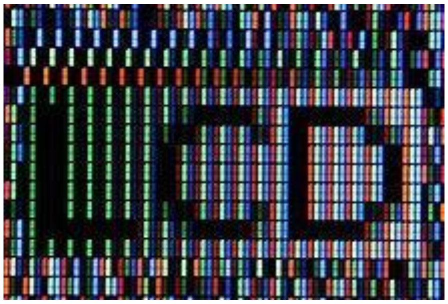
This technology is intended for use in applications such as Electronic Shelf Labels, E-books, E-documents, E-newspapers, E-dictionaries, Industrial sensors, Ultra-Mobile PCs, etc.

Kent Displays has also developed a "no power" display that uses Polymer Stabilized Cholesteric Liquid Crystals (ChLCD). A major drawback of ChLCD screens are their slow refresh rate, especially at low temperatures. Kent has recently demonstrated the use of a ChLCD to cover the entire surface of a mobile phone, allowing it to change colours, and keep that colour even when power is cut off. In 2004 researchers at the University of Oxford demonstrated two new types of zero-power bistable LCDs based on Zenithal bistable techniques. Several bistable technologies, like the 360° BTN and the bistable cholesteric, depend mainly on the bulk properties of the liquid crystal (LC) and use standard strong anchoring, with alignment films and LC mixtures similar to the traditional monostable materials. Other bistable technologies (i.e. Binem Technology) are based mainly on the surface properties and need specific weak anchoring materials. distortion while maintaining its superior wide viewing angle for a professional display. Colour shift and deviation caused by light leakage is corrected by optimizing the white gamut which also enhances white/grey reproduction.

Comparison of the OLPC XO-1 display (left) with a typical colour LCD. The images show 1×1 mm of each screen. A typical LCD addresses groups of 3 locations as pixels. The XO-1 display addresses each location as a separate pixel.



Example of how the colours are generated (R-red, G-green and B-blue)



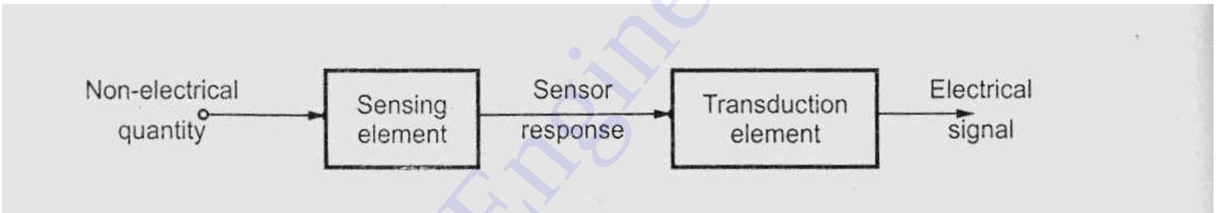
In colour LCDs each individual pixel is divided into three cells, or subpixels, which are coloured red, green, and blue, respectively, by additional filters (pigment filters, dye filters and metal oxide filters). Each subpixel can be controlled independently to yield thousands or millions of possible colours for each pixel. CRT monitors employ a similar 'subpixel' structures *via* phosphors, although the electron beam employed in CRTs do not hit exact subpixels. The figure at the left shows the twisted nematic (TN) type of LCD.

UNIT-V

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS

TRANSDUCERS

- Ø The input quantity for most instrumentation systems is nonelectrical. In order to use electrical methods and techniques for measurement, the nonelectrical quantity is converted into a proportional electrical signal by a device called transducer.
- Ø Another definition states that transducer is a device which when actuated by energy in one system, supplies energy in the same form or in another form to a second system.
- Ø When transducer gives output in electrical form it is known as electrical transducer. Actually, electrical transducer consists of two parts which are very closely related to Each other.
- Ø These two parts are sensing or detecting element and transduction element. The sensing or detecting element is commonly known as sensor.
- Ø Definition states that sensor is a device that produces a measurable response to a Change in a physical condition.
- Ø The transduction element transforms the output of the sensor to an electrical output, as shown in the Fig.



(Fig)Transducer elements in cascade

5.1 Classification of Electrical Transducers

Transducers may be classified according to their structure, method of energy conversion and application. Thus we can say that transducers are classified

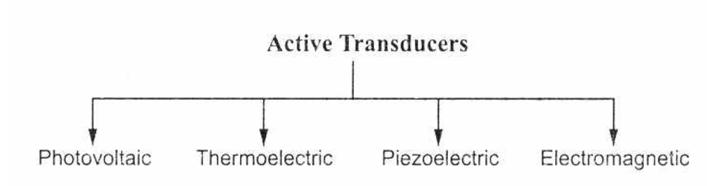
- As active and passive transducer
- According to transduction principle
- As analog and digital transducer
- As primary and secondary transducer
- As transducer and inverse transducer

Active and Passive Transducer

Active Transducers

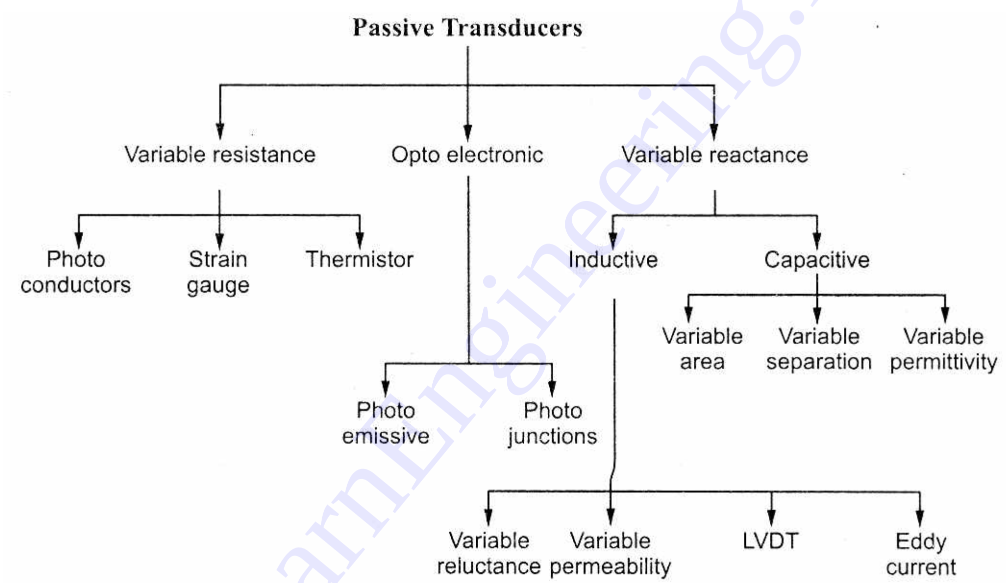
- Ø Active transducers are self-generating type of transducers.
- Ø These transducers develop an electrical parameter (i.e. voltage or current) which is proportional to the quantity under measurement.
- Ø These transducers do not require any external source or power for their operation.

- They can be subdivided into the following commonly used types



Passive Transducers

- Passive transducers do not generate any electrical signal by themselves.
  - To obtain an electrical signal from such transducers, an external source of power is essential.
- Passive transducers depend upon the change in an electrical parameter (R, L, or C).
- They are also known as externally power driven transducers.
- They can be subdivided into the following commonly used types.



According to Transduction Principle

The transducers can be classified according to principle used in transduction.

- Capacitive transduction
- Electromagnetic transduction
- Inductive transduction
- Piezoelectric transduction
- Photovoltaic transduction
- Photoconductive transduction

Analog and Digital Transducers

The transducers can be classified on the basis of the output which may be a continuous function of time or the output may be in discrete steps.

Analog Transducers

- These transducers convert the input quantity into an analog output which is a continuous function of time.
- A strain gauge, LVDT, thermocouples or thermistors are called analog transducers as they produce an outpu

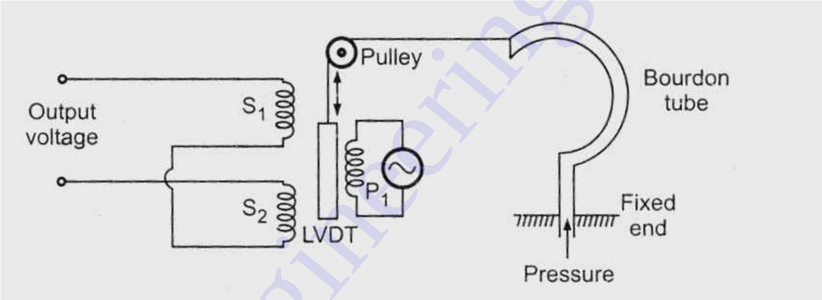
which is a continuous function of time.

Digital Transducers

- Digital transducers produce an electrical output in the form of pulses which forms an unique code.
- Unique code is generated for each discrete value sensed.

Primary or Secondary

- Some transducers consist of mechanical device along with the electrical device.
  - In such transducers mechanical device acts as a primary transducer and converts physical quantity into mechanical signal.
- The electrical device then converts mechanical signal produced by primary transducer into an electrical signal.
- Therefore, electrical device acts as a secondary transducer.
- For an example, in pressure measurement Bourdons tube acts as a primary transducer which converts a pressure into displacement and LVDT acts as a secondary transducer which converts this displacement into an equivalent electrical signal.



(Fig) pressure Measurement

Transducer and Inverse Transducer

- Transducers convert non-electrical quantity into electrical quantity whereas inverse transducer converts electrical quantity into non-electrical quantity.
- For example, microphone is a transducer which converts sound signal into an electrical signal whereas loudspeaker is an inverse transducer which converts electrical signal into sound signal.

Advantages of Electrical Transducers

1. Electrical signal obtained from electrical transducer can be easily processed (mainly amplified) and brought to a level suitable for output device which may be an indicator or recorder.
2. The electrical systems can be controlled with a very small level of power
3. The electrical output can be easily used, transmitted, and processed for the purpose of measurement.
4. With the advent of IC technology, the electronic systems have become extremely small in size, requiring small space for their operation.
5. No moving mechanical parts are involved in the electrical systems. Therefore there is no question of mechanical wear and tear and no possibility of mechanical failure.

Electrical transducer is almost a must in this modem world. Apart from the merits described above, some disadvantages do exist in electrical sensors.

Disadvantages of Electrical Transducers

- Ø The electrical transducer is sometimes less reliable than mechanical type because of the ageing and drift of the active components.
- Ø Also, the sensing elements and the associated signal processing circuitry are comparatively expensive.
- Ø With the use of better materials, improved technology and circuitry, the range of accuracy and stability have been increased for electrical transducers.
- Ø Using negative feedback technique, the accuracy of measurement and the stability of the system are improved, but all at the expense of increased circuit complexity, more space, and obviously, more cost.

Characteristics of Transducer

1. **Accuracy**: It is defined as the closeness with which the reading approaches an accepted standard value or ideal value or true value, of the variable being measured.
2. **Ruggedness**: The transducer should be mechanically rugged to withstand overloads. It should have overload protection.
3. **Linearity**: The output of the transducer should be linearly proportional to the input quantity under measurement. It should have linear input - output characteristic. -
4. **Repeatability:** The output of the transducer must be exactly the same, under same environmental conditions, when the same quantity is applied at the input repeatedly.
5. **High output**: The transducer should give reasonably high output signal so that it can be easily processed and measured. The output must be much larger than noise. Now-a-days, digital output is preferred in many applications;
6. **High Stability and Reliability:** The output of the transducer should be highly stable and reliable so that there will be minimum error in measurement. The output must remain unaffected by environmental conditions such as change in temperature, pressure, etc.
7. **Sensitivity**: The sensitivity of the electrical transducer is defined as the electrical output obtained per unit change in the physical parameter of the input quantity. For example, for a transducer used for temperature measurement, sensitivity will be expressed in mV/' C. A high sensitivity is always desirable for a given transducer.
8. **Dynamic Range:** For a transducer, the operating range should be wide, so that it can be used over a wide range of measurement conditions.
9. **Size:** The transducer should have smallest possible size and shape with minimal weight and volume. This will make the measurement system very compact.
10. **Speed of Response:** It is the rapidity with which the transducer responds to changes in the measured quantity. The speed of response of the transducer should be as high as practicable.

5.2 Transducer Selection Factors

1. Nature of measurement
2. Loading effect
3. Environmental considerations
4. Measuring system
5. Cost & Availability

5.3 Resistance Transducers

Temperature Sensors

Temperature is one of the fundamental parameters indicating the physical condition of matter, i.e. expressing its degree of hotness or coldness. Whenever a body is heat' various effects are observed. They include

- Change in the physical or chemical state, (freezing, melting, boiling etc.)
- Change in physical dimensions,
- Changes in electrical properties, mainly the change in resistance,
- Generation of an emf at the junction of two dissimilar metals.

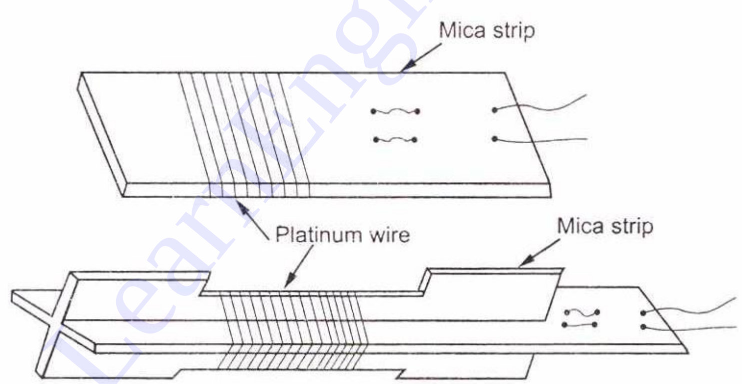
One of these effects can be employed for temperature measurement purposes. Electrical methods are the most convenient and accurate methods of temperature measurement. These methods are based on change in resistance with temperature and generation of thermal e.m.f. The change in resistance with temperature may be positive or negative. According to that there are two types

- Resistance Thermometers —Positive temperature coefficient
- Thermistors —Negative temperature coefficient

Construction of Resistance Thermometers

Ø The wire resistance thermometer usually consists of a coil wound on a mica or ceramic former, as shown in the Fig.

Ø The coil is wound in bifilar form so as to make it no inductive. Such coils are available in different sizes and with different resistance values ranging from 10 ohms to 25,000 ohms.



(Fig) Resistance Thermometer

Advantages of Resistance Thermometers

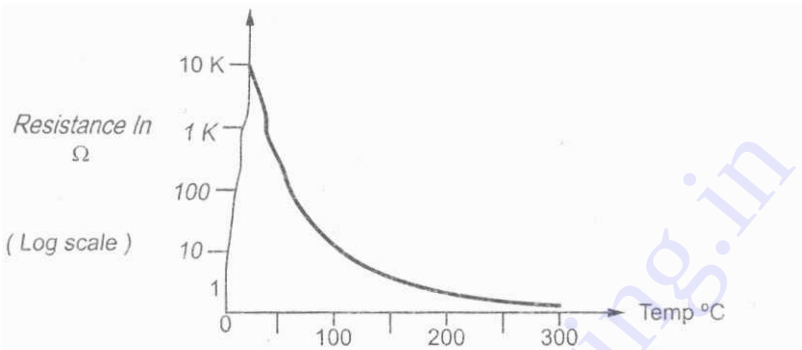
1. The measurement is accurate.
2. Indicators, recorders can be directly operated.
3. The temperature sensor can be easily installed and replaced.
4. Measurement of differential temperature is possible.
5. Resistance thermometers can work over a wide range of temperature from -20' C to + 650° C.
6. They are suitable for remote indication.
7. They are smaller in size
8. They have stability over long periods of time.

Limitations of Resistance Thermometers

1. A bridge circuit with external power source is necessary for their operation.
2. They are comparatively costly.

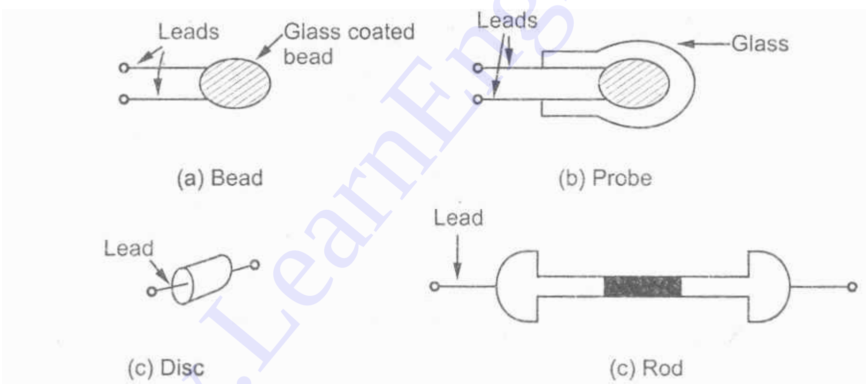
Thermistors

- Thermistor is a contraction of a term ' thermal-resistors' .
- Thermistors are semiconductor device which behave as thermal resistors having negative temperature coefficient [i.e. their resistance decreases as temperature increases.
- The below Fig. shows this characteristic.



Construction of Thermistor

- Thermistors are composed of a sintered mixture of metallic oxides, manganese, nickel, cobalt, copper, iron, and uranium.
- Their resistances at temperature may range from 100 to 100k .
- Thermistors are available in variety of shapes and sizes as shown in the Fig.



- Smallest in size are the beads with a diameter of 0.15 mm to 1.25 mm.
- Beads may be sealed in the tips of solid glass rods to form probes.
- Disks and washers are made by pressing thermistor material under high pressure into flat cylindrical shapes.
- Washers can be placed in series or in parallel to increase power dissipation rating.
- Thermistors are well suited for precision temperature measurement, temperature control, and temperature compensation, because of their very large change in resistance with temperature.
- They are widely used for measurements in the temperature range -100 C to +100 C

Advantages of Thermistor

1. Small size and low cost.

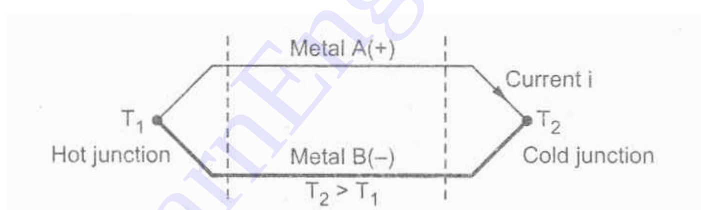
2. Comparatively large change in resistance for a given change in temperature
3. Fast response over a narrow temperature range.

Limitations of Thermistor
1. The resistance versus temperature characteristic is highly non-linear.
2. Not suitable over a wide temperature range.
3. Because of high resistance of thermistor, shielded cables have to be used to minimize interference.

Applications of Thermistor
1. The thermistors relatively large resistance change per degree change in temperature [known as sensitivity] makes it useful as temperature transducer.
2. The high sensitivity, together with the relatively high thermistor resistance that may be selected [e.g. 100k .], makes the thermistor ideal for remote measurement or control. Thermistor control systems are inherently sensitive, stable, and fast acting, and they require relatively simple circuitry.
3. Because thermistors have a negative temperature coefficient of resistance, thermistors are widely used to compensate for the effects of temperature on circuit performance.
4. Measurement of conductivity.

Temperature Transducers
They are also called thermo-electric transducers. Two commonly used temperature transducers are
• Resistance Temperature Detectors
• Thermocouples.

Thermocouples



(Fig) Basic circuit

Ø The thermocouple is one of the simplest and most commonly used methods of measuring process temperatures.

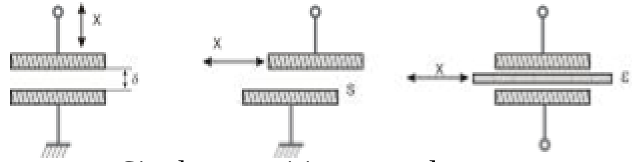
5.4 Capacitive Transducers

Capacitive transducers are capacitors that change their capacity under the influence of the input magnitude, which can be linear or angular movement. The capacity of a flat capacitor, composed of two electrodes with sizes **a´b**, with area of overlapping **s**, located at a distance **δ** from each other (in **d** << **a**/10 and **d** << **b**/10) is defined by the formula

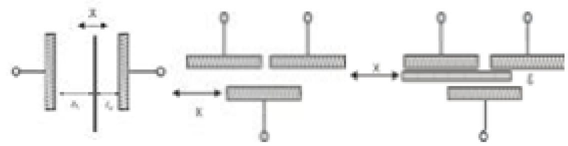
$$C=\varepsilon_0 \varepsilon s/d$$

where: ε_0=8,854.10^{-12} F/m is the dielectric permittivity of vacuum;
ε - permittivity of the area between the electrodes (for air **e**= 1,0005);
S=a.b – overlapping cross-sectional area of the electrodes. The capacity can be influenced by changing the air gap **d**, the active area of overlapping of the electrodes **s** and the dielectric properties of

the environment



Single capacitive transducers



Differential capacitive transducers

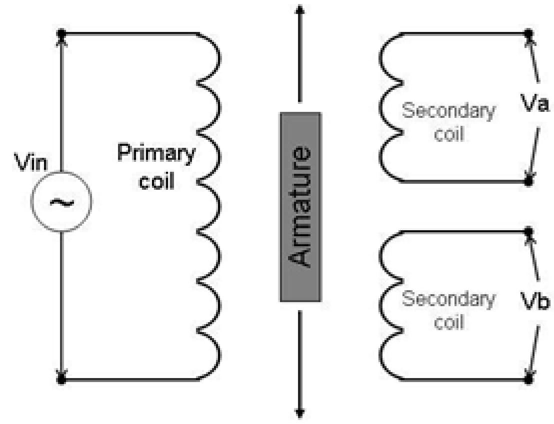
Application of capacitive transducers

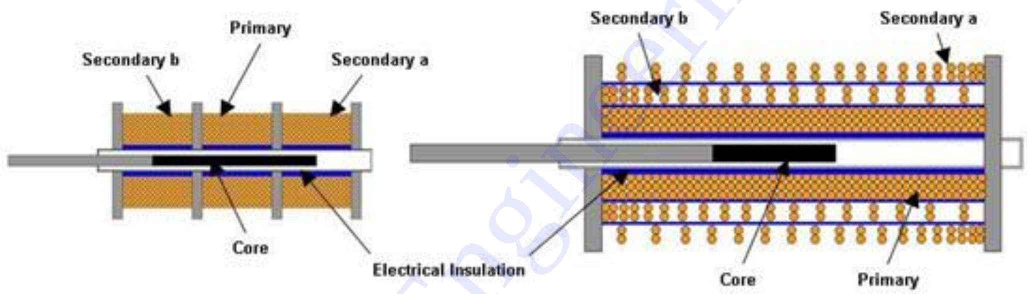
Capacitive sensors have found wide application in automated systems that require precise determination of the placement of theobjects, processes in microelectronics, assembly of precise equipment associated with spindles for high speed drilling machines, ultrasonic welding machines and inequipment for vibration measurement. They can be used not only to measure displacements (large and small), but also the level of fluids, fuel bulk materials, humidity environment, concentration of substances and others Capacitive sensors are often used for non-contact measurement of the thickness of various materials, such as silicon wafers, brake discs and plates of hard discs. Among the possibilities of the capacitive sensors is the measurement of density, thickness and location of dielectrics.

5.5 Inductive Transducers

An LVDT, or Linear Variable Differential Transformer, is a transducer that converts a linear displacement or position from a mechanical reference (or zero) into a proportional electrical signal containing phase (for direction) and amplitude information (for distance). The LVDT operation does not require electrical contact between the moving part (probe or core rod assembly) and the transformer, but rather relies on electromagnetic coupling; this and the fact that they operate without any built-in electronic circuitry are the primary reasons why LVDTs have been widely used in applications where long life and high reliability under severe environments are a required, such Military/Aerospace applications.

The LVDT consists of a primary coil (of magnet wire) wound over the whole length of a non-ferromagnetic bore liner (or spool tube) or a cylindrical coil form. Two secondary coils are wound on top of the primary coil for “long stroke” LVDTs (i.e. for actuator main RAM) or each side of the primary coil for “Short stroke” LVDTs (i.e. for electro-hydraulic servo-valve or EHSV). The two secondary windings are typically connected in “opposite series” (or wound in opposite rotational directions). A ferromagnetic core, which length is a fraction of the bore liner length, magnetically couples the primary to the secondary winding turns that are located above the length of the core.





The LVDT: construction and principle of operation

When the primary coil is excited with a sine wave voltage (Vin), it generate a variable magnetic field which, concentrated by the core, induces the secondary voltages (also sine waves). While the secondary windings are designed so that the differential output voltage (Va-Vb) is proportional to the core position from null, the phase angle (close to 0 degree or close to 180 degrees depending of direction) determines the direction away from the mechanical zero. The zero is defined as the core position where the phase angle of the (Va-Vb) differential output is 90 degrees.

The differential output between the two secondary outputs (Va-Vb) when the core is at the mechanical zero (or "Null Position") is called the Null Voltage; as the phase angle at null position is 90 degrees, the Null Voltage is a "quadrature" voltage. This residual voltage is due to the complex nature of the LVDT electrical model, which includes the parasitic capacitances of the windings.

5.6 Digital Transducers

A transducer measures physical quantities and transmits the information as coded digital signals rather than as continuously varying currents or voltages. Any transducer that presents information as discrete samples and that does not introduce a quantization error when the reading is represented in the digital form may be classified as a digital transducer. Most transducers used in digital systems are primarily analogue in nature and incorporate some form of conversion to provide the digital output. Many special techniques have been developed to avoid the necessity to use a conventional analogue- to-digital conversion technique to produce the digital signal. This article describes some of the direct methods which are in current use of producing digital outputs from transducers.

Some of the techniques used in transducers which are particularly adaptable for use in digital systems are introduced. The uses of encoder discs for absolute and incremental position measurement and to provide measurement of angul ar speed are outlined. The application of linear gratings for measurement of translational displacement is compared with the use of Moire fringe techniques used for similar purposes. Synchro devices are briefly explained and the various techniques used to produce a digital output from synchro resolvers are described. Brief descriptions of devices which develop a digital output from the natural frequency of vibration of some part of the transducer are presented. Digital techniques including vortex flowmeters and instruments using laser beams are also briefly dealt with. Some of them are as follows:

1. Shaft Encoders
2. Digital Resolvers
3. Digital Tachometers
4. Hall Effect Sensors
5. Limit Switches

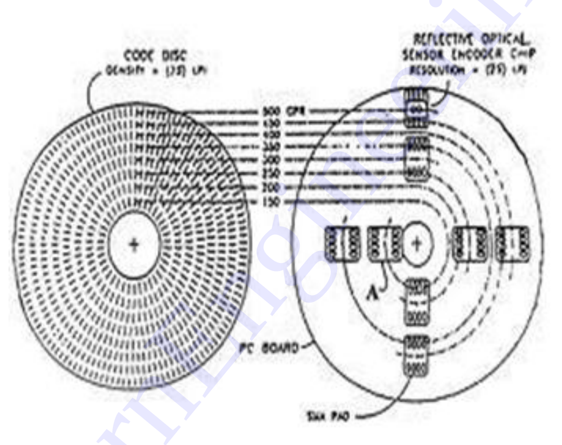
Shaft Encoders:

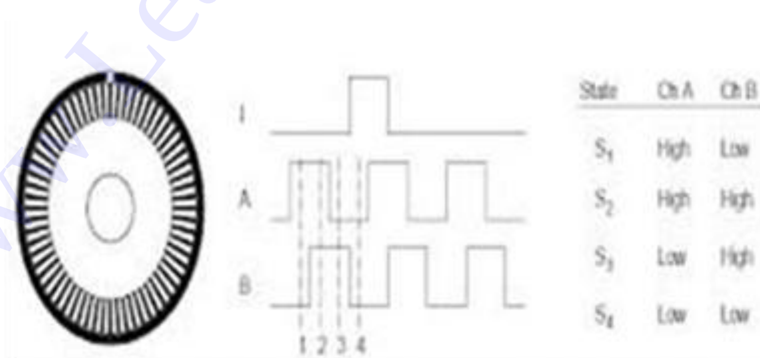
An encoder is a device that provides a coded reading of a measurement. A Shaft encoders can be one of the encoder that provide digital output measurements of angular position and velocity. This shaft encoders are excessively applicable in robotics, machine tools, mirror positioning systems, rotating machinery controls (fluid and electric), etc. Shaft encoders are basically of two types-Absolute and Incremental encoders.

An "absolute" encoder maintains position information when power is removed from the system. The position of the encoder is available immediately on applying power. The relationship between the encoder value and the physical position of the controlled machinery is set at assembly; the system does not need to return to a calibration point to maintain position accuracy. An "incremental" encoder accurately records changes in position, but does not power up with a fixed relation between encoder state and physical position. Devices controlled by incremental encoders may have to "go home" to a fixed reference point to initialize the position measurement. A multi-turn absolute rotary encoder includes additional code wheels and gears. A high-resolution wheel measures the fractional rotation, and lower-resolution geared code wheels record the number of whole revolutions of the shaft.

An absolute encoder has multiple code rings with various binary weightings which provide a data word representing the absolute position of the encoder within one revolution. This type of encoder is often referred to as a parallel absolute encoder.

An incremental encoder works differently by providing an A and a B pulse output that provide no usable count information in their own right. Rather, the counting is done in the external electronics. The point where the counting begins depends on the counter in the external electronics and not on the position of the encoder. To provide useful position information, the encoder position must be referenced to the device to which it is attached, generally using an index pulse. The distinguishing feature of the incremental encoder is that it reports an incremental change in position of the encoder to the counting electronics.





5.7 Piezoelectric Transducers

Piezoelectric transducers produce an output voltage when a force is applied to them. They are frequently used as ultrasonic receivers and also as displacement transducers, particularly as part of devices measuring acceleration, force and pressure. In ultra- sonic receivers, the sinusoidal amplitude variations in the ultrasound wave received are translated into sinusoidal changes in the amplitude of the force applied to the piezoelectric transducer. In a similar way, the translational movement in a displacement transducer is caused by mechanical means to apply a force to the piezoelectric transducer. Piezoelectric transducers are made from piezoelectric materials. These have an asymmetrical lattice of molecules that distorts when a mechanical force is applied to it. This distortion causes a reorientation of electric charges within the material, resulting in a relative displacement of positive and negative charges. The charge displacement induces surface charges on the material of opposite polarity between the two sides. By implanting electrodes into the surface of the material, these surface charges can be measured as an output voltage. For a rectangular block of material, the induced voltage is given by:

$$V = \frac{kFd}{A}$$

Where **F** is the applied force in g, A is the area of the material in mm, d is the thickness of the material and k is the piezoelectric constant. The polarity of the induced voltage depends on whether the material is compressed or stretched.

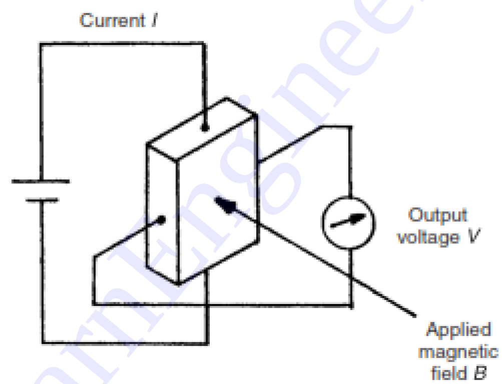
Where **F** is the applied force in g, A is the area of the material in mm, d is the thickness of the material and k is the piezoelectric constant. The polarity of the induced voltage depends on whether the material is compressed or stretched.

Materials exhibiting piezoelectric behaviour include natural ones such as quartz, synthetic ones such as lithiumsulphate andferroelectric ceramics such as barium titanate. The piezoelectric constant varies widely between different materials. Typical values of k are 2.3 for quartz and 140 for barium titanate. Applying equation (13.1) for a force of 1 g applied to a crystal of area 100 mm^2 and thickness 1 mm gives an output of 23 μV for quartz and 1.4 mV for barium titanate.

The piezoelectric principle is invertible, and therefore distortion in a piezoelectric material can be caused by applying a voltage to it. This is commonly used in ultrasonic transmitters, where the application of a sinusoidal voltage at a frequency in the ultra- sound range causes a sinusoidal variation in the thickness of the material and results in a sound wave being emitted at the chosen frequency. This is considered further in the section below on ultrasonic transducers.

5.8 Hall-effect transducers

Basically, a Hall-effect sensor is a device that is used to measure the magnitude of a magnetic field. It consists of a conductor carrying a current that is aligned orthogonally with the magnetic field, as shown in Figure 13.4. This produces a transverse voltage difference across the device that is directly proportional to the magnetic field strength. For an excitation current I and magnetic field strength B, the output voltage is given by V D KIB, where K is known as the Hall constant



The conductor in Hall-effect sensors is usually made from a semiconductor material as opposed to a metal, because a larger voltage output is produced for a magnetic field of a given size. In one common use of the device as a proximity sensor, the magnetic field is provided by a permanent magnet that is built into the device. The magnitude of this field changes when the device becomes close to any ferrous metal object or boundary. The Hall Effect is also commonly used in keyboard pushbuttons, in which a magnet is attached underneath the button. When the button is depressed, the magnet moves past a Hall-effect sensor. The induced voltage is then converted by a trigger circuit into a digital output. Such pushbutton switches can operate at high frequencies without contact bounce.

5.9 DATA ACQUISITION SYSTEMS

Definition

Data acquisition is the process of real world physical conditions and conversion of the resulting samples into digital numeric values that can be manipulated by a computer. Data acquisition and data acquisition systems (abbreviated with the acronym **DAS**) typically involves the conversion of analog waveforms into digital values for processing.

The components of data acquisition systems include:

i) Sensors that convert physical parameters to electrical signals.
ii) Signal conditioning circuitry to convert sensor signals into a form that can be converted to digital values.
iii) Analog-to-digital converters, which convert conditioned sensor signals to digital values.

Diagram

Fundamental elements of data acquisition system

Explanation

- Data acquisition is the process of extracting, transforming, and transporting data from the source systems and external data sources to the data processing system to be displayed, analyzed, and stored.
- A data acquisition system (DAQ) typically consist of transducers for asserting and measuring electrical signals, signal conditioning logic to perform amplification, isolation, and filtering, and other hardware for receiving analog signals and providing them to a processing system, such as a personal computer.
- Data acquisition systems are used to perform a variety of functions, including laboratory research, process monitoring and control, data logging, analytical chemistry, tests and analysis of physical phenomena, and control of mechanical or electrical machinery.
- Data recorders are used in a wide variety of applications for imprinting various types of forms, and documents.
- Data collection systems or data loggers generally include memory chips or strip charts for electronic recording, probes or sensors which measure product environmental parameters and are connected to the data logger.
- Hand-held portable data collection systems permit in field data collection for up-to-date information processing.

Source

- Data acquisition begins with the physical phenomenon or physical property to be measured.
- Examples of this include temperature, light intensity, gas pressure, fluid flow, and force. Regardless of the type of physical property to be measured, the physical state that is to be measured must first be transformed into a unified form that can be sampled by a data acquisition system.
- The task of performing such transformations falls on devices called sensors.
- A sensor, which is a type of transducer, is a device that converts a physical property into a corresponding electrical signal (e.g., a voltage or current) or, in many cases, into

a corresponding electrical characteristic (e.g., resistance or capacitance) that can easily be converted to electrical signal.

- The ability of a data acquisition system to measure differing properties depends on having sensors that are suited to detect the various properties to be measured. There are specific sensors for many different applications.
- DAQ systems also employ various signal conditioning techniques to adequately modify various different electrical signals into voltage that can then be digitized using an Analog-to-digital converter (ADC).

Signals

- Signals may be digital (also called logic signals sometimes) or analog depending on the transducer used. Signal conditioning may be necessary if the signal from the transducer is not suitable for the DAQ hardware being used.
- The signal may need to be amplified, filtered or demodulated.
- Various other examples of signal conditioning might be bridge completion, providing current or voltage excitation to the sensor, isolation, and linearization. For transmission purposes, single ended analog signals, which are more susceptible to noise can be converted to differential signals. Once digitized, the signal can be encoded to reduce and correct transmission errors.

DAQ hardware

- DAQ hardware is what usually interfaces between the signal and a PC. It could be in the form of modules that can be connected to the computer's ports (parallel, serial, USB, etc.) or cards connected to slots (S-100 bus, Apple Bus, ISA, MCA, PCI, PCI-E, etc.) in the mother board.
- Usually the space on the back of a PCI card is too small for all the connections needed, so an external breakout box is required. The cable between this box and the PC can be expensive due to the many wires, and the required shielding
- DAQ cards often contain multiple components (multiplexer, ADC, DAC, TTL-IO, high speed timers, RAM). These are accessible via a bus by a microcontroller, which can run small programs.
- A controller is more flexible than a hard wired logic, yet cheaper than a CPU so that it is alright to block it with simple polling loops.
- The fixed connection with the PC allows for comfortable compilation and debugging. Using an external housing a modular design with slots in a bus can grow with the needs of the user.
- Not all DAQ hardware has to run permanently connected to a PC, for example intelligent stand-alone loggers and oscilloscopes, which can be operated from a PC, yet they can operate completely independent of the PC.

DAQ software

- DAQ software is needed in order for the DAQ hardware to work with a PC. The device driver performs low-level register writes and reads on the hardware, while exposing a standard API for developing user applications.

A standard API such as COMEDI allows the same user applications to run on

- different operating systems, e.g. a user application that runs on Windows will also run on Linux and BSD.

Advantages

- Reduced data redundancy
- Reduced updating errors and increased consistency
- Greater data integrity and independence from applications programs
- Improved data access to users through use of host and query languages
- Improved data security
- Reduced data entry, storage, and retrieval costs
- Facilitated development of new applications program

Disadvantages

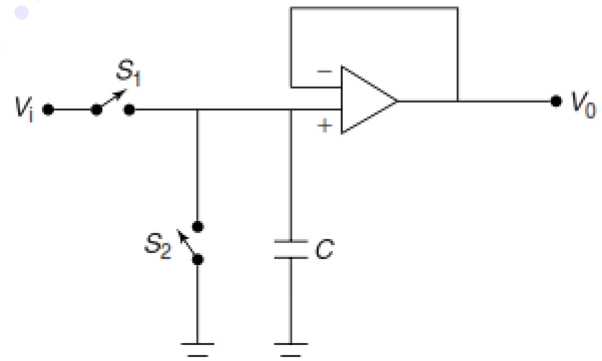
- Database systems are complex, difficult, and time-consuming to design
- Substantial hardware and software start-up costs
- Damage to database affects virtually all applications programs
- Extensive conversion costs in moving form a file-based system to a database system
- Initial training required for all programmers and users

Applications

- Temperature measurement
- Recommended application software packages and necessary toolkit
- Prewritten Lab VIEW example code, available for download
- Sensor recommendations
- Video tutorials for hardware setup and software programming

5.10 Analogue-To-Digital Converters

Important factors in the design of an analogue-to-digital converter are the speed of conversion and the number of digital bits used to represent the analogue signal level. The minimum number of bits used in analogue-to-digital converters is eight.

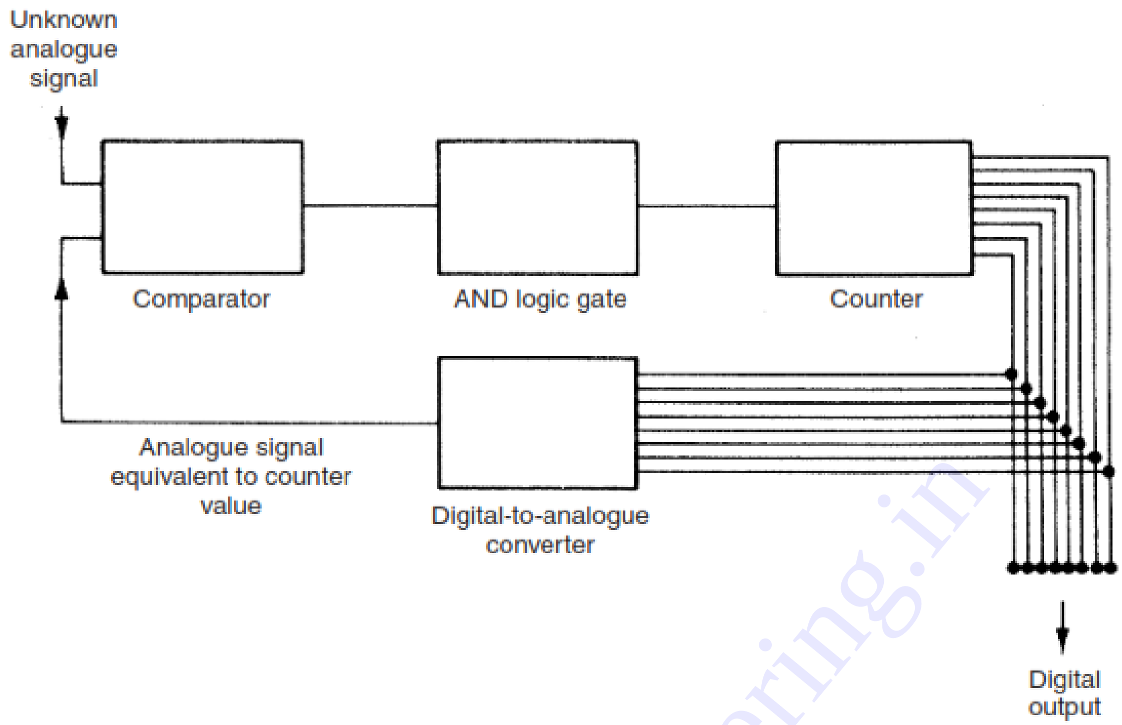


Operational amplifier connected as 'sample and hold' circuit

The use of eight bits means that the analogue signal can be represented to a resolution of 1 part in 256 if the input signal is carefully scaled to make full use of the converter range. However, it is more common to use either 10 bit or 12 bit analogue-to-digital converters, which give resolutions respectively of 1 part in 1024 and 1 part in 4096. Several types of analogue-to-digital converter exist. These differ in the technique used to effect signal conversion, in operational speed, and in cost.

The simplest type of analogue-to-digital converter is the *counter analogue-to-digital converter*, as shown in Figure 5.23. This, like most types of analogue-to-digital converter, does not convert continuously, but in a stop-start mode triggered by special signals on the computer's control bus. At the start of each conversion cycle, the counter is set to zero. The digital counter value is converted to an analogue signal by a digital- to-analogue converter (a discussion of digital-to-analogue converters follows in the next section), and a comparator then compares this analogue counter value with the unknown analogue signal. The output of the comparator forms one of the inputs to an AND logic gate. The other input to the AND gate is a sequence of clock pulses. The comparator acts as a switch that can turn on and off the passage of pulses from the clock through the AND gate. The output of the AND gate is connected to the input of the digital counter. Following reset of the counter at the start of the conversion cycle, clock pulses are applied continuously to the counter through the AND gate, and the analogue signal at the output of the digital-to-analogue converter gradually increases in magnitude. At some point in time, this analogue signal becomes equal in magnitude to the unknown signal at the input to the comparator. The output of the comparator changes state in consequence, closing the AND gate and stopping further increments of the counter. At this point, the value held in the counter is a digital representation of the level of the unknown analogue signal.

output



Counter analogue – digital converter circuit.

5.11 Digital-To-Analogue (D/A) Conversion

Digital-to-analogue conversion is much simpler to achieve than analogue-to-digital conversion and the cost of building the necessary hardware circuit is considerably less. It is required wherever a digitally processed signal has to be presented to an analogue control actuator or an analogue signal display device. A common form of digital-to-analogue converter is illustrated in Figure 5.24. This is shown with 8 bits for simplicity of explanation, although in practice 10 and 12 bit D/A converters are used more frequently. This form of D/A converter consists of a resistor-ladder network on the input to an operational amplifier

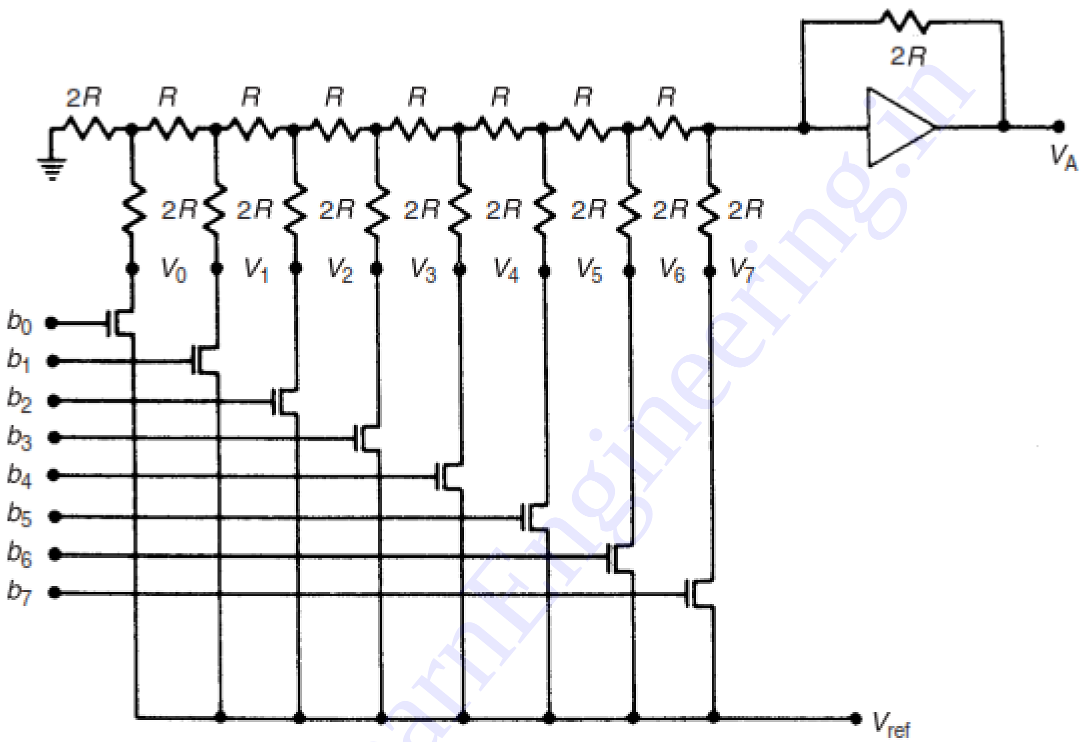
$$V_A = V_7 + \frac{V_6}{2} + \frac{V_5}{4} + \frac{V_4}{8} + \frac{V_3}{16} + \frac{V_2}{32} + \frac{V_1}{64} + \frac{V_0}{128}$$

V_0 to V_7 are set at either the reference voltage level V_{ref} or at zero volts according to whether an associated switch is open or closed. Each switch is controlled by the logic level of one of the bits 0–7 of the 8 bit binary signal being converted. A particular switch is open if the relevant binary bit has a value of 0 and closed if the value is 1. Consider for example a digital signal with binary value of 11010100. The values of V_7 to V_0 are therefore:

$$V_7 = V_6 = V_4 = V_2 = V_{ref}; \quad V_5 = V_3 = V_1 = V_0 = 0$$

The analogue output from the converter is then given by:

$$V_A = V_{ref} + \frac{V_{ref}}{2} + \frac{V_{ref}}{8} + \frac{V_{ref}}{32}$$



Common form of digital – analogue converter

5.12 Smart Sensors

A smart sensor is a sensor with local processing power that enables it to react to local conditions without having to refer back to a central controller. Smart sensors are usually at least twice as accurate as non-smart devices, have reduced maintenance costs and require less wiring to the site where they are used. In addition, long-term stability is improved, reducing the required calibration frequency.

The functions possessed by smart sensors vary widely, but consist of at least some of the following:

Remote calibration capability Self-diagnosis of faults Automatic calculation of measurement accuracy and compensation for random errors Adjustment for measurement of non-linearity's to produce a linear output Compensation for the loading effect of the measuring process on the measured system.

Calibration capability

Self-calibration is very simple in some cases. Sensors with an electrical output can use a known reference voltage level to carry out self-calibration. Also, load-cell types of sensor, which are used in weighing systems, can adjust the output reading to zero when there is no applied mass. In the case of other sensors, two methods of self-calibration are possible, use of a look-up table and an interpolation technique. Unfortunately, a *look-up table* requires a large memory capacity to store correction points. Also, a large amount of data has to be gathered from the sensor during calibration. In consequence, the interpolation calibration technique is preferable. This uses an interpolation method to calculate the correction required to any particular measurement and only requires a small matrix of calibration points (van der Horn, 1996).

Self-diagnosis of faults

Smart sensors perform self-diagnosis by monitoring internal signals for evidence of faults. Whilst it is difficult to achieve a sensor that can carry out self-diagnosis of all possible faults that might arise, it is often possible to make simple checks that detect many of the more common faults. One example of self-diagnosis in a sensor is measuring the sheath capacitance and resistance in insulated thermocouples to detect breakdown of the insulation. Usually, a specific code is generated to indicate each type of possible fault (e.g. a failing of insulation in a device).

One difficulty that often arises in self-diagnosis is in differentiating between normal measurement deviations and sensor faults. Some smart sensors overcome this by storing multiple measured values around a set-point, calculating minimum and maximum expected values for the measured quantity.

Uncertainty techniques can be applied to measure the impact of a sensor fault on measurement quality. This makes it possible in certain circumstances to continue to use a sensor after it has developed a fault. A scheme for generating a validity index has been proposed that indicates the validity and quality of a measurement from a sensor (Henry, 1995).

Automatic calculation of measurement accuracy and compensation for random errors

Many smart sensors can calculate measurement accuracy on-line by computing the Mean over a number of measurements and analyzing all factors affecting accuracy. This averaging process also serves to greatly reduce the magnitude of random measurement errors.

Adjustment for measurement non-linearities

In the case of sensors that have a non-linear relationship between the measured quantity and the sensor output, digital processing can convert the output to a linear form, providing that the nature of the non-linearity is known so that an equation describing it can be programmed into the sensor.

5.13 Optical Transducer

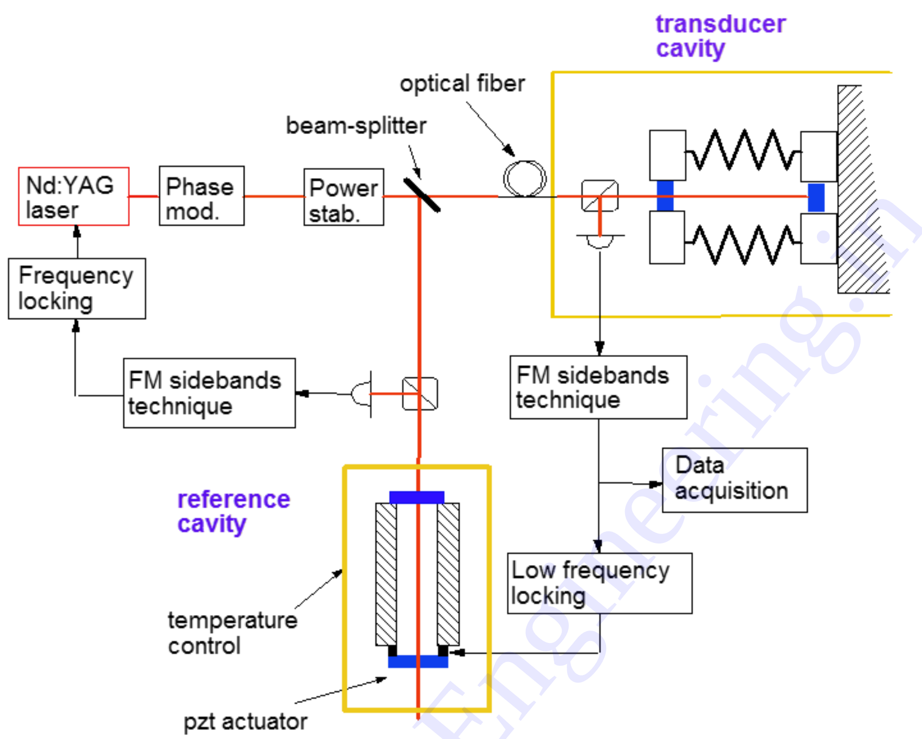
Transducer cavity:

A Fabry-Perot cavity between the bar and the resonant plate

Reference cavity:

A stable Fabry-Perot cavity acting as length reference

Laser source frequency locked to the reference cavity



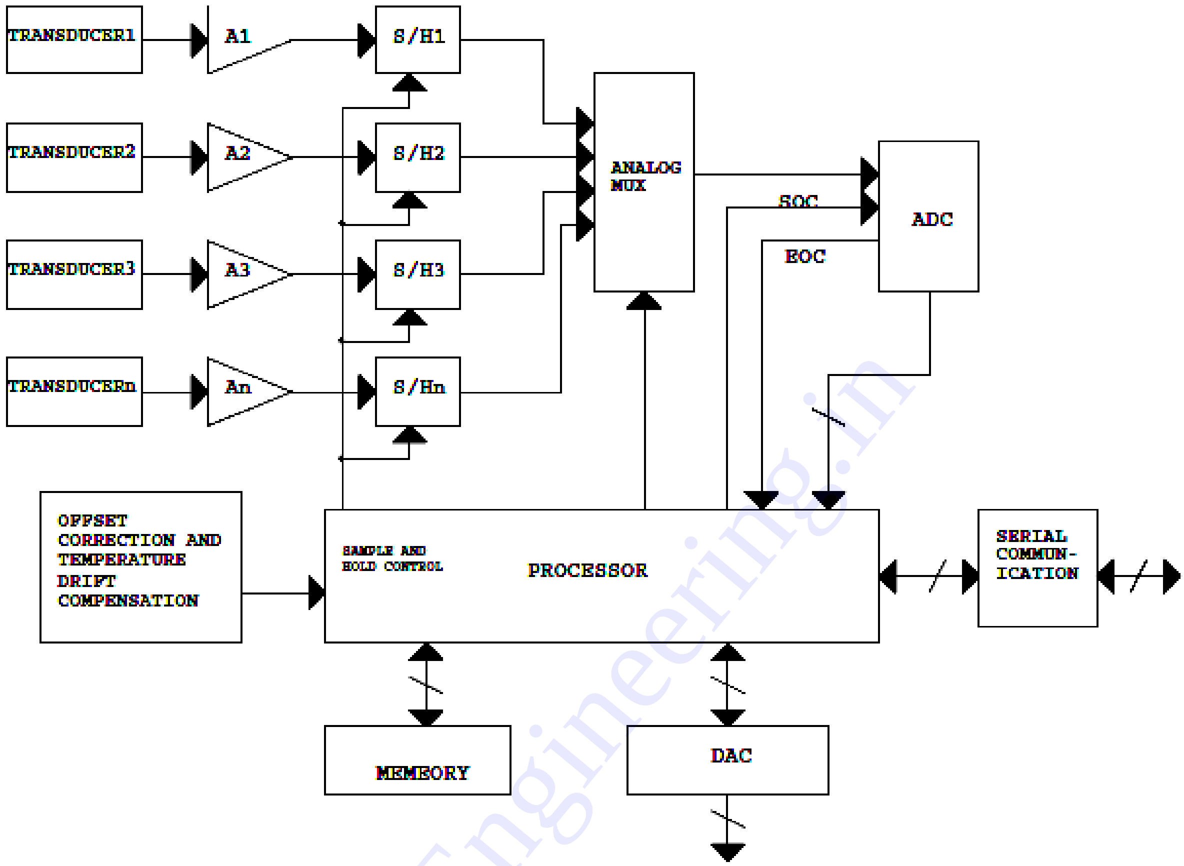
General Architecture of smart sensor:

One can easily propose a general architecture of smart sensor from its definition, functions. From the definition of smart sensor it seems that it is similar to a data acquisition system, the only difference being the presence of complete system on a single silicon chip. In addition to this it has on–chip offset and temperature compensation. A general architecture of smart sensor consists of following important components:

- Sensing element/transduction element,
- Amplifier,
- Sample and hold,
- Analog multiplexer,
- Analog to digital converter (ADC),
- Offset and temperature compensation,
- Digital to analog converter (DAC),
- Memory,
- Serial communication and

- Processor

The generalized architecture of smart sensor is shown below:



GENERAL ARCHITECTURE OF SMART SENSOR

Architecture of smart sensor is shown. In the architecture shown A1, A2…An and S/H1, S/H2…S/Hn are the amplifiers and sample and hold circuit corresponding to different sensing element respectively. So as to get a digital form of an analog signal the analog signal is periodically sampled (its instantaneous value is acquired by circuit), and that constant value is held and is converted into a digital words. Any type of ADC must contain or proceeded by, a circuit that holds the voltage at the input to the ADC converter constant during the entire conversion time. Conversion times vary widely, from nanoseconds (for flash ADCs) to microseconds (successive approximation ADC) to hundreds of microseconds (for dual slope integrator ADCs). ADC starts conversion when it receives start of conversion signal (SOC) from the processor and after conversion is over it gives end of conversion signal to the processor. Outputs of all the sample and hold circuits are multiplexed together so that we can use a single ADC, which will reduce the cost of the chip. Offset compensation and correction comprises of an ADC for measuring a reference voltage and other for the zero. Dedicating two channels of the multiplexer and using only one ADC for whole system can avoid the addition of ADC for this. This is helpful in offset correction and zero compensation of gain due to temperature drifts of acquisition chain. In addition to this smart sensor also include internal memory so that we can store the data and program required.

1 Kilo bits are equal to

- 1000 bits
- 1024 bits
- 1012 bits
- 1008 bits

Ans : b

A Nibble is equal to _________ bit(s)

- 1
- 2
- 4
- 8

Ans : c

Transfer of data from one register to another register is known as _________ register operation.

- Inter
- Intra
- Inside
- In between

Ans: a

1. 8085 microprocessor is an 8-bit microprocessor designed by?

A. IBM
B. Dell
C. Intel
D. VAX

View Answer
Ans : C

Explanation: 8085 is pronounced as "eighty-eighty-five" microprocessor. It is an 8-bit microprocessor designed by Intel in 1977.

2. In 8085, 16-bit address bus, which can address upto?

A. 16KB
B. 32KB
C. 64KB
D. 128KB

View Answer
Ans : C

Explanation: In 8085, 16-bit address bus, which can address upto 64KB.

3. There are _______ general purpose registers in 8085 processor

A. 5
B. 6
C. 7
D. 8

View Answer
Ans : B

Explanation: There are 6 general purpose registers in 8085 processor, i.e. B, C, D, E, H & L. Each register can hold 8-bit data.

4. It is also a 16-bit register works like stack, which is always incremented/decremented by 2 during push & pop operations.

A. Stack pointer
B. Temporary register
C. Flag register
D. Program counter

View Answer
Ans : A

Explanation: Stack pointer : It is also a 16-bit register works like stack, which is always incremented/decremented by 2 during push & pop operations.

5. Flag register is an 8-bit register having __________ 1-bit flip-flops.

A. 3
B. 4
C. 5
D. 6

View Answer
Ans : C

Explanation: These are the set of 5 flip-flops : Sign (S), Zero (Z), Auxiliary Carry (AC), Parity (P) and Carry (C)

6. What is true about Program counter?

A. It is an 8-bit register, which holds the temporary data of arithmetic and logical operations.
B. When an instruction is fetched from memory then it is stored in the program counter
C. It provides timing and control signal to the microprocessor
D. It is a 16-bit register used to store the memory address location of the next instruction to be executed.

View Answer
Ans : D

Explanation: Program counter : It is a 16-bit register used to store the memory address location of the next instruction to be executed.

7. This signal indicates that another master is requesting the use of the address and data buses.

A. READY
B. HOLD
C. HLDA
D. INTA

View Answer
Ans : B

Explanation: HOLD : This signal indicates that another master is requesting the use of the address and data buses.

8. This signal is used as the system clock for devices connected with the microprocessor.

A. X1, X2
B. CLK OUT
C. CLK IN
D. IO/M

View Answer
Ans : B

Explanation: CLK OUT : This signal is used as the system clock for devices connected with the microprocessor.

9. Which of the following is true about Control and status signals?

A. These signals are used to identify the nature of operation.
B. There are 3 control signal and 3 status signals.
C. Three status signals are IO/M, S0 & S1.
D. All of the above

View Answer
Ans : D

Explanation: All of the above are correct about Control and status signals.

10. MVI K, 20F is an example of?

A. Immediate addressing mode
B. Register addressing mode
C. Direct addressing mode
D. Indirect addressing mode

View Answer
Ans : A

Explanation: Immediate addressing mode : In this mode, the 8/16-bit data is specified in the instruction itself as one of its operand. For example: MVI K, 20F: means 20F is copied into register K.

1. How many types of Interfacing?

A. 2
B. 3
C. 4
D. 5

View Answer
Ans : A

Explanation: Interface is the path for communication between two components. Interfacing is of two types, memory interfacing and I/O interfacing.

2. In which type of communication, the interface gets a single byte of data from the microprocessor and sends it bit by bit to the other system serially and vice-a-versa?

A. Parallel Communication Interface
B. Serial Communication Interface
C. Both A and B
D. None of the above

View Answer
Ans : B

Explanation: Serial Communication Interface : In this type of communication, the interface gets a single byte of data from the microprocessor and sends it bit by bit to the other system serially and vice-a-versa.

3. Which of the following are known as Higher Address Bus?

A. A15 - A8
B. AD7 - AD0
C. READY
D. WR

View Answer
Ans : A

Explanation: A15 - A8 (Higher Address Bus)

4. In which mode, the CPU periodically reads an internal flag of 8279 to check whether any key is pressed or not with key pressure?

A. Interrupt mode
B. Polled mode
C. Decoded Mode
D. Encoded Mode

View Answer
Ans : B

Explanation: In the Polled mode, the CPU periodically reads an internal flag of 8279 to check whether any key is pressed or not with key pressure.

5. What is true about Encoded Mode?

A. the unit contains registers to store the keyboard, display modes
B. the counter internally decodes the least significant 2 bits and provides a decoded 1 out of 4 scan on SL0-SL3.
C. the processor is requested service only if any key is pressed, otherwise the CPU will continue with its main task.
D. the counter provides the binary count that is to be externally decoded to provide the scan lines for the keyboard and display.

View Answer
Ans : D

Explanation: In the encoded mode, the counter provides the binary count that is to be externally decoded to provide the scan lines for the keyboard and display.

6. Which pin is used to blank the display during digit switching?

A. WR
B. IR
C. BD
D. DB

View Answer
Ans : C

Explanation: BD : It stands for blank display. It is used to blank the display during digit switching.

7. Which mode allows 8/16 character multiplexed displays to be organized as dual 4-bit/single 8-bit display units?

A. Display Entry
B. Display Scan
C. Strobed Input
D. Scanned Keyboard Mode

View Answer
Ans : B

Explanation: Display Scan : This mode allows 8/16 character multiplexed displays to be organized as dual 4-bit/single 8-bit display units.

8. DMA stands for?

A. Display Memory Access
B. Directly Memory Access
C. Device Memory Access
D. Direct Memory Access

View Answer
Ans : D

Explanation: DMA stands for Direct Memory Access

9. Which of the following is not true features of 8257?

A. It has three channels which can be used over three I/O devices.
B. Each channel has 16-bit address and 14-bit counter.

C. Each channel can transfer data up to 64kb.
D. Each channel can be programmed independently.

View Answer

Ans : A

Explanation: It has four channels which can be used over four I/O devices is true.

10. What is correct range of frequency for 8257?

A. 500Hz to 3MHz.
B. 250Hz to 2MHz.
C. 250Hz to 3MHz.
D. 500Hz to 2MHz.

View Answer

Ans : C

Explanation: Its frequency ranges from 250Hz to 3MHz.

1. What is true about microcontroller?

A. A microcontroller is a small and low-cost microcomputer
B. It is designed to perform the specific tasks of embedded systems
C. microcontroller consists of the processor, the memory, Serial ports, peripherals.
D. All of the above

View Answer

Ans : D

Explanation: All of the above statement are true.

2. Which is false about microcontroller?

A. Microcontrollers are used to execute a single task within an application.
B. It consists of CPU, RAM, ROM, I/O ports.
C. Its power consumption is high because it has to control the entire system.
D. It is built with CMOS technology

View Answer

Ans : C

Explanation: It is built with CMOS technology, which requires less power to operate.

3. This type of microcontroller is generally used in automatically controlled appliances like automatic operational machines.

A. 8-bit microcontroller
B. 16-bit microcontroller
C. 32-bit microcontroller
D. 64-bit microcontroller

View Answer
Ans : C

Explanation: 32-bit microcontroller : This type of microcontroller is generally used in automatically controlled appliances like automatic operational machines.

4. This type of microcontroller is designed in such a way that they do not have a program memory on the chip.

A. External memory microcontroller
B. Embedded memory microcontroller
C. CISC
D. RISC

View Answer
Ans : A

Explanation: External memory microcontroller : This type of microcontroller is designed in such a way that they do not have a program memory on the chip. Hence, it is named as external memory microcontroller.

5. Which of the following is an example of Embedded memory microcontroller?

A. Intel 8031 microcontroller
B. Intel 8051 microcontroller.
C. Intel 8081 microcontroller.
D. Intel 8085 microcontroller.

View Answer
Ans : B

Explanation: Intel 8051 microcontroller is an example of Embedded memory microcontroller.

6. 8051 microcontroller is designed by Intel in?

A. 1980
B. 1981
C. 1982
D. 1983

View Answer

Ans : B

Explanation: 8051 microcontroller is designed by Intel in 1981. It is an 8-bit microcontroller

7. At what PIN number, there is a RESET pin, which is used to reset the microcontroller to its initial values?

A. PIN 9
B. PIN 20
C. PIN 30
D. PIN 35

View Answer
Ans : A

Explanation: Pin 9 : It is a RESET pin, which is used to reset the microcontroller to its initial values.

8. At what PIN number, there is EA pin which stands for External Access input?

A. PIN 28
B. PIN 29
C. PIN 30
D. PIN 31

View Answer
Ans : C

Explanation: Pin 30 : This is EA pin which stands for External Access input. It is used to enable/disable the external memory interfacing.

9. When pins are configured as an output (i.e. logic 0), then the single port pins can receive a current of?

A. 5mA
B. 8mA
C. 15mA
D. 10mA

View Answer
Ans : D

Explanation: When pins are configured as an output (i.e. logic 0), then the single port pins can receive a current of 10mA.

10. Which IO Port can be used for higher address byte with addresses A8-A15?

A. PORT1
B. PORT0
C. PORT3
D. PORT2

View Answer
Ans : D

Explanation: PORT2 : This port can be used for higher address byte with addresses A8-A15. When no memory is added then this port can be used as a general input/output port similar to Port 1.

1. The ______ is a general purpose programmable I/O device designed to transfer the data from I/O to interrupt I/O.

A. 8285A
B. 8241A
C. 8255A
D. 8251A

View Answer
Ans : C

Explanation: The 8255A is a general purpose programmable I/O device designed to transfer the data from I/O to interrupt I/O

2. How many ports 8255A has?

A. 2
B. 3
C. 4
D. 5

View Answer
Ans : B

Explanation: 8255A has three ports, i.e., PORT A, PORT B, and PORT C.

3. Which port can be split into two parts?

A. PORT A
B. PORT B

C. PORT C
D. PORT D

View Answer

Ans : C

Explanation: Port C can be split into two parts, i.e. PORT C lower (PC0-PC3) and PORT C upper (PC7-PC4) by the control word.

4. Which of the following are Features of 8255A?

A. It consists of 3 8-bit IO ports i.e. PA, PB, and PC.
B. Address/data bus must be externally demux'd.
C. It is TTL compatible.
D. All of the above

View Answer

Ans : D

Explanation: All of the above are Features of 8255A.

5. Which of the following is responsible for controlling the internal/external transfer of data/control/status word?

A. Data Bus Buffer
B. Read/Write Control Logic
C. CS
D. WR

View Answer

Ans : B

Explanation: Read/Write Control Logic : This block is responsible for controlling the internal/external transfer of data/control/status word.

6. Which of the following uses N-MOS technology?

A. 8253
B. 8254
C. 8255
D. 8256

View Answer

Ans : A

Explanation: 8253 : It uses N-MOS technology.

7. It is a tri-state, bi-directional, 8-bit buffer, which is used to interface the 8253/54 to the system data bus.

A. Read/Write Logic
B. Data Bus Buffer
C. system data bus
D. System Buffer

View Answer
Ans : B

Explanation: Data Bus Buffer : It is a tri-state, bi-directional, 8-bit buffer, which is used to interface the 8253/54 to the system data bus.

8. 8253/54 can be operated in _________ Modes?

A. 3
B. 4
C. 5
D. 6

View Answer
Ans : D

Explanation: 8253/54 can be operated in 6 different modes

9. Which mode can be used as a mono stable multi-vibrator?

A. Mode 0
B. Mode 1
C. Mode 2
D. Mode 3

View Answer
Ans : B

Explanation: Mode 1 : Programmable One Shot can be used as a mono stable multi-vibrator.

10. Which mode generates a strobe in response to an externally generated signal?

A. Mode 3
B. Mode 4
C. Mode 5
D. Mode 6

View Answer
Ans : C

Explanation: Mode 5 : Hardware Triggered Mode generates a strobe in response to an externally generated signal.

1.	Which of the following is an 8-bit register?
a.	PSW(Program Status Word)
b.	TCON(Timer Control Register)
c.	Accumulator
d.	all of the mentioned

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Answer: (d).all of the mentioned

2.	Which of the following is not an instruction of 8051?
a.	arithmetic instructions
b.	boolean instructions
c.	logical instructions
d.	none of the above

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Answer: (d).none of the above

3.	The operations performed by data transfer instructions are on
a.	bit data
b.	byte data
c.	16-bit data
d.	all of the mentioned

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Answer: (d).all of the mentioned

4.	Which of the following is true while executing data transfer instructions?
a.	program counter is not accessible
b.	restricted bit-transfer operations are allowed
c.	both operands can be direct/indirect register operands
d.	all of the mentioned

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Answer: (c).both operands can be direct/indirect register operands

5.	The logical instruction that affect the carry flag during its execution is
a.	XRL A;
b.	ANL A;
c.	ORL A;
d.	RLC A;

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Answer: (d).RLC A;

6.	The instruction that is used to complement or invert the bit of a bit addressable SFR is
a.	CLR C
b.	CPL C
c.	CPL Bit
d.	ANL Bit

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Answer: (c).CPL Bit

7.	The instructions that change the sequence of execution are
a.	conditional instructions
b.	logical instructions
c.	control transfer instructions
d.	data transfer instructions

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Answer: (c).control transfer instructions

8.	The control transfer instructions are divided into
a.	explicit and implicit control transfer instructions
b.	conditional and unconditional control transfer instructions
c.	auto control and self control transfer instructions
d.	all of the mentioned

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Answer: (b).conditional and unconditional control transfer instructions

9.	The conditional control transfer instructions check a bit condition which includes any bit of
a.	bit addressable RAM
b.	bit addressable SFRs
c.	content of accumulator
d.	all of the mentioned

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Answer: (d).all of the mentioned

10.	All conditional jumps are
a.	absolute jumps

b.	long jumps
c.	short jumps
d.	none of the above

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Answer: (c).short jumps

11.	The first byte of a short jump instruction represents
a.	opcode byte
b.	relative address
c.	opcode field
d.	none of the above

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Answer: (a).opcode byte

12.	Which of the following is not an addressing mode of 8051?
a.	register instructions
b.	register specific instructions
c.	indexed addressing
d.	none of the above

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Answer: (d).none of the above

13.	The symbol, 'addr 16' represents the 16-bit address which is used by the instructions to specify the
a.	destination address of CALL
b.	source address of JUMP
c.	destination address of call or jump

d.	source address of call or jump

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Answer: (c).destination address of call or jump

14.	The external interrupts of 8051 can be enabled by
a.	4 LSBs of TCON register
b.	Interrupt enable
c.	priority register
d.	all of the mentioned

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Answer: (d).all of the mentioned

15.	The bits that control the external interrupts are
a.	ET0 and ET1
b.	ET1 and ET2
c.	EX0 and EX1
d.	EX1 and EX2

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Answer: (c).EX0 and EX1

16.	EA bit is used to
a.	enable or disable external interrupts
b.	enable or disable internal interrupts
c.	enable or disable all the interrupts
d.	none of the mentioned

View Answer Report Discuss Too Difficult! Search Google

Answer: (c).enable or disable all the interrupts

17.	The number of priority levels that each interrupt of 8051 have is
a.	1
b.	2
c.	3
d.	4

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Answer: (b).2

18.	The priority level of interrupt of 8051 for which SI(serial interrupt) interrupt is programmed is
a.	level 0
b.	level 1
c.	level 0 or level 1
d.	none of the above

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Answer: (b).level 1

19.	The interrupt bit that when set works at level 1, and otherwise at level 0 is
a.	PT1
b.	PT0
c.	PX1
d.	all of the mentioned

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Answer: (d).all of the mentioned

20.	All the interrupts at level 1 are polled in the second clock cycle of the
a.	forth T state
b.	fifth T state
c.	third T state
d.	none of the above

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Answer: (b).fifth T state

21.	The 8259-A is a _________.
a.	piority Interrupt Controller
b.	priority Resolver
c.	interrupt Request Registry
d.	control logic

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Answer: (a).piority Interrupt Controller

22.	______ is used to transfer data between microprocess
a.	8255A
b.	8279
c.	8254A
d.	8237A

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Answer: (a).8255A

1.	Consider the following registers: 1. Accumulator and flag register 2. B and C register 3. D and E register 4. H and L register Which of these 8-bit registers of 8085 microprocessor c make a 16-bit register?
a.	1 ,3 and 4
b.	2 ,3 and 4

c.	1, 2 and 3
d.	1, 2 and 4

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Answer: (b).2 ,3 and 4

2.	In 8085 microprocessor system with memory mapped I/O, which of the following is true?
a.	Devices have 8-bit address line
b.	Devices are accessed using IN and OUT instructions
c.	There can be maximum of 256 input devices and 256 output devices
d.	Arithmetic and logic operations can be directly performed with the I/O data

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Answer: (d).Arithmetic and logic operations can be directly performed with the I/O data

3.	In an intel 8085A microprocessor, why is READY signal used?
a.	To indicate to user that the microprocessor is working and is ready for use.
b.	To provide proper WAIT states when the microprocessor is communicating with a slow peripheral device.
c.	To slow down a fast peripheral device so as to communicate at the microprocessor's device.
d.	None of the above.

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Answer: (b).To provide proper WAIT states when the microprocessor is communicating with a slow peripheral de

4.	consider the following I) Sign flag II) Trap flag III) Parity flag IV) Auxiliary carry flag Which one of the above flags is/are present in 8085 microprocessor?
a.	(I) only
b.	(I) & (II)
c.	(II) & (III)

d.	(I) ,(III) & (IV)

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Answer: (d).(I) ,(III) & (IV)

5.	Consider the following statements: In 8085 microprocessor, data-bus and address bus are multiplexed in order to I)Increase the speed of microprocessor. II)Reduce the number of pins. III)Connect more peripheral chips. Which of these statements is/are correct?
a.	(I) only
b.	(II) only
c.	(II) & (III)
d.	(I), (II) & (III)

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Answer: (b).(II) only

6.	ALU (Arithmetic and Logic Unit) of 8085 microprocessor consists of
a.	Accumulator, temporary register, arithmetic and logic circuits
b.	Accumulator, arithmetic, logic circuits and five flags
c.	Accumulator, arithmetic and logic circuits
d.	Accumulator, temporary register, arithmetic, logic circuits and five flags

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Answer: (d).Accumulator, temporary register, arithmetic, logic circuits and five flags

7.	In intel 8085A microprocessor ALE signal is made high to
a.	Enable the data bus to be used as low order address bus
b.	To latch data D0-D7 from data bus

c.	To disable data bus
d.	To achieve all the functions listed above

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Answer: (a).Enable the data bus to be used as low order address bus

8.	Which of the following statements for Intel 8085 is correct?
a.	Program Counter (PC) specifies the address of the instruction last executed
b.	PC specifies the address of the instruction being executed
c.	PC specifies the address of the instruction to be executed
d.	PC specifies the number of instructions executed so far

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Answer: (c).PC specifies the address of the instruction to be executed

9.	Processor status word of 8085 microprocessor has five flags. They are
a.	S, Z, AC, P, CY
b.	S, OV, AC, P, CY
c.	S, Z, OV, P, CY
d.	S, Z, AC, P, OV

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Answer: (a).S, Z, AC, P, CY

10.	The cycle required to fetch and execute an instruction in a 8085 microprocessor is which one of the follow
a.	Clock cycle
b.	Memory cycle
c.	Machine cycle
d.	Instruction cycle

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Answer: (d).Instruction cycle

11.	In an Intel 8085A, which is the first machine cycle of ar
a.	An op-code fetch cycle
b.	A memory read cycle
c.	A memory write cycle
d.	An I/O read cycle

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Answer: (a).An op-code fetch cycle

12.	The number of output pins in 8085 microprocessors are
a.	40
b.	27
c.	21
d.	19

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Answer: (a).40

13.	In 8085 name of the 16 bit registers is
a.	stack pointer
b.	program counter
c.	both A and B
d.	none of these

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Answer: (c).both A and B

14.	Which of the following instruction is not possible in 8085?
a.	POP PSW
b.	POP B
c.	POP D
d.	POP 30 H

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Answer: (d).POP 30 H

15.	How many T-states are required for execution of OUT 80H instruction?
a.	10
b.	13
c.	16
d.	7

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Answer: (a).10

16.	Which instruction is required to rotate the content of accumulator one bit right along with carry?
a.	RLC
b.	RAL
c.	RRC
d.	RAR

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Answer: (d).RAR

17.	The frequency of the driving network connected between pins 1 and 2 of 8085 microprocessor is
a.	twice the desired frequency

b.	equal to the desired frequency
c.	four times the desired frequency
d.	none of the above

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Answer: (a).twice the desired frequency

18.	READY signal in 8085 is useful when the CPU communicates with
a.	a slow peripheral device
b.	a fast peripheral device
c.	a DMA chip
d.	a PPI

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Answer: (a).a slow peripheral device

19.	Temporary registers in 8085 are
a.	B and C
b.	D and E
c.	H and L
d.	W and Z

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Answer: (d).W and Z

20.	Register pair used to indicate memory
a.	B and C
b.	D and E
c.	H and L

d.	W and Z

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Answer: (c).H and L

21.	A sequence of two registers that multiplies the content stores the result in HL register pair (in 8085 assembly l
a.	XCHG & DAD B
b.	XTHL & DAD H
c.	PCHL & DAD D
d.	XCHG & DAD H

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Answer: (d).XCHG & DAD H

22.	The Intel 8086 microprocessor is a _______ processor.
a.	8 bit
b.	16 bit
c.	32 bit
d.	4 bit

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Answer: (b).16 bit

23.	The 16 bit flag of 8086 microprocessor is responsible to indicate ___________.
a.	the condition of result of ALU operation
b.	the condition of memory
c.	the result of addition
d.	the result of subtraction

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Answer: (a).the condition of result of ALU operation

24.	The register AX is formed by grouping ________.
a.	AH & AL
b.	BH & BL
c.	CH & CL
d.	DH & DL

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Answer: (a).AH & AL

25.	In which year, 8086 microprocessor was introduced?
a.	1978
b.	1979
c.	1977
d.	1981

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Answer: (a).1978

26.	In which year, 8088 microprocessor was announced?
a.	1979
b.	1988
c.	1999
d.	2000

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Answer: (a).1979

27.	Which interrupt has the highest priority?
a.	INTR
b.	TRAP
c.	RST6.5
d.	RST6.6

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Answer: (c).RST6.5

28.	What is the RST for the TRAP?
a.	RST5.5
b.	RST4.5
c.	RST4
d.	RST3

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Answer: (b).RST4.5

29.	What are level Triggering interrupts?
a.	INTR & TRAP
b.	RST6.5 & RST5.5
c.	RST7.5 & RST6.5
d.	RST2.5 & RST6.2

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Answer: (b).RST6.5 & RST5.5

30.	Which interrupt is not level sensitive in 8085?
a.	RST 6.5

b.	RST 7.5
c.	RST 5.5
d.	RST 4.5

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Answer: (b).RST 7.5

31.	What are software interrupts?
a.	RST 0-7
b.	RST 5.5 - 7.5
c.	INTR, TRAP
d.	RST 4.4 - 6.4

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Answer: (a).RST 0-7

32.	Which stack is used in 8085 ?
a.	FIFO
b.	LIFO
c.	FILO
d.	LILO

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Answer: (b).LIFO

33.	Why 8085 processor is called an 8 bit processor?
a.	because 8085 processor has 8 bit ALU
b.	because 8085 processor has 8 bit data bus
c.	because 8085 processor has 16 bit data bus
d.	because 8085 processor has 16 bit address bus

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Answer: (a).because 8085 processor has 8 bit ALU

34.	What is SIM in context of microprocessor ?
a.	Select Interrupt Mask
b.	Sorting Interrupt Mask
c.	Set Interrupt Mask
d.	Set Integer Mask

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Answer: (c).Set Interrupt Mask

35.	What is meant by maskable interrupts?
a.	an interrupt which can never be turned off
b.	an interrupt that can be turned off by the programmer
c.	an interrupt which can never be turned on
d.	an interrupt which can never be turned on or off

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Answer: (b).an interrupt that can be turned off by the programmer

36.	In 8086, Example for Non maskable interrupts are ________.
a.	trap
b.	rst6.5
c.	intr
d.	rst6.6

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Answer: (a).trap

37.	In 8085 microprocessor address line for RST3 is ?
a.	0020H
b.	0028H
c.	0018H
d.	0019H

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Answer: (c).0018H

38.	In 8086 the overflow flag is set when _____________.
a.	the sum is more than 16 bits
b.	signed numbers go out of their range after an arithmetic operation
c.	carry and sign flags are set
d.	subtraction

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Answer: (b).signed numbers go out of their range after an arithmetic operation

39.	In 8086 microprocessor the following has the highest priority among all type interrupts?
a.	NMI
b.	DIV 0
c.	TYPE 255
d.	OVER FLOW

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Answer: (a).NMI

41.	8088 microprocessor differs with 8086 microprocessor
a.	data width on the output

b.	address capability
c.	support of coprocessor
d.	support of MAX / MIN mode

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Answer: (a).data width on the output

42.	Address line for TRAP is ?
a.	0023H
b.	0024H
c.	0033H
d.	0099H

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Answer: (b).0024H

43.	8085 microprocessor was introduced in __________.
a.	1971
b.	1976
c.	1972
d.	1978

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Answer: (b).1976

44.	The address / data bus in 8085 is __________.
a.	multiplexed
b.	demultiplexed
c.	decoded

d.	encoded

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Answer: (a).multiplexed

45.	In 8085 name the 16 bit registers?
a.	Stack pointer
b.	Program counter
c.	Both a and b
d.	None of these

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Answer: (c).Both a and b

46.	Which stack is used in 8085?
a.	FIFO
b.	LIFO
c.	FILO
d.	None of these

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Answer: (b).LIFO

47.	RIM is used to check whether, _______
a.	The write operation is done or not
b.	The interrupt is Masked or not
c.	a & b
d.	None of these

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Answer: (b).The interrupt is Masked or not

48.	8088 microprocessor has
a.	16 bit data bus
b.	4 byte pre-fetch queue
c.	6 byte pre-fetch queue
d.	16 bit address bus

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Answer: (d).16 bit address bus

49.	By what factor does the 8284A clock generator divide the crystal oscillator's output frequency?
a.	One
b.	Two
c.	Three
d.	Four

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Answer: (c).Three

1. A machine language instruction format consists of -

- Operation code field
- Operation code field & operand field
- Operand field
- none of the mentioned

View Answer

A machine language instruction format consists of Operation code field & operand field.

2. The instruction, MOV AX, 1234H is an example of -

- register addressing mode
- immediate addressing mode
- based indexed addressing mode
- direct addressing mode

View Answer

The instruction, MOV AX, 1234H is an example of immediate addressing mode.

3. The full form of FPGA is -

- Forward Programmable Gate Array
- Forward Parallel Gate Array
- Field Programmable Gate Array
- Field Parallel Gate Array

View Answer
The full form of FPGA is Field Programmable Gate Array

4. Which language could be used for programming an FPGA.

- VHDL
- Verilog
- Both A and B
- None

View Answer
Both A and B

5. 8085 microprocessor has how many pins -

- 41.
- 39.

- ◌ 40.
- ◌ 30.

[View Answer]
8085 microprocessor has 40 pins .

6. What is SIM?

- ◌ Set interrupt mask.
- ◌ Sorting interrupt mask.
- ◌ Select interrupt mask.
- ◌ None of these

[View Answer]
SIM stands for Set interrupt mask.

7. The ROM programmed during manufacturing process itself is called -

- ◌ EPROM
- ◌ PROM
- ◌ EEPROM
- ◌ MROM

[View Answer]
The ROM programmed during manufacturing process itself is called MROM

8. The ROM programmed during manufacturing process itself is called -

- ◌ EPROM
- ◌ PROM
- ◌ EEPROM
- ◌ MROM

[View Answer]
The ROM programmed during manufacturing process itself is called MROM

9. Output of the assembler in machine codes is referred to as -

- Source program
- Macroinstruction
- Object program
- Symbolic addressing

View Answer
Output of the assembler in machine codes is referred to as Object program.

10. The software used to drive microprocessor-based systems is called-

- firmware
- machine language code
- BASIC interpreter instructions
- assembly language

View Answer
The software used to drive microprocessor-based systems is called assembly language

11. How many buses are connected as part of the 8085A microprocessor?

- 8
- 5
- 3
- 2

View Answer
3 buses are connected as part of the 8085A microprocessor.

12. The items that you can physically touch in a computer system are called:-

- firmware
- hardware
- software

- none of the above

View Answer
The items that you can physically touch in a computer system are called hardware.

13. ALU (Arithmetic and Logic Unit) of 8085 microprocessor consists of-

- Accumulator, arithmetic, logic circuits and five flags
- Accumulator, arithmetic and logic circuits
- Accumulator, temporary register, arithmetic, logic circuits and five flags
- Accumulator, temporary register, arithmetic and logic circuits

View Answer
ALU (Arithmetic and Logic Unit) of 8085 microprocessor consists of Accumulator, temporary register, arithmetic, logic circuits and five flags.

14. Register pair used to indicate memory-

- B and C
- D and E
- H and L
- W and Z

View Answer
Register pair used to indicate memory H and L.

15. The Intel 8086 microprocessor is a _______ processor.

- 16 bit
- 32 bit
- 8 bit
- 4 bit

View Answer
The Intel 8086 microprocessor is a 16 bit processor.

16. In which year, 8086 microprocessor was introduced?

- 1978
- 1979
- 1977
- 1981

View Answer
In 1978 8086 microprocessor was introduced .

17. In 8086, Example for Non maskable interrupts are ________.

- rst6.5
- intr
- rst6.6
- trap

View Answer
In 8086, Example for Non maskable interrupts are trap.

18. RIM is used to check whether, _____

- The interrupt is Masked or not
- The write operation is done or not
- both 1 & 2
- None of these

View Answer
RIM is used to check whether the interrupt is Masked or not.

19. The first digital computer build with IC chips was known as -

- Apple -1
- IBM 7090
- IBM system / 360

- VAX - 10

View Answer
The first digital computer build with IC chips was known as IBM system / 360.

20. Which of the following is used for manufacturing chips?

- Control bus
- Control unit
- Parity unit
- Semiconductor

View Answer
Semiconductor is used for manufacturing chips.

21. Which of following instruction subtract memory and carry from a,b

- AB[a,x,y]
- SBC[a,b]
- SUB[a,b,d]
- tst[a,b]

View Answer
SBC[a,b] instruction subtract memory and carry from a,b.

22. Which of following load the stack pointer

- bgt
- LDS
- bhs
- RTS

View Answer
LDS load the stack pointer

1. In the I/O mode, the 8255 ports work as
a) reset pins
b) set pins

c) programmable I/O ports
d) only output ports
View Answer
Answer: c
Explanation: In the I/O mode, the 8255 ports work as programmable I/O ports.

2. In BSR mode, only port C can be used to
a) set individual ports
b) reset individual ports
c) set and reset individual ports
d) programmable I/O ports
View Answer
Answer: c
Explanation: In BSR (Bit Set-Reset) Mode, port C can be used to set and reset its individual port bits.

3. The feature of mode 0 is
a) any port can be used as input or output
b) output ports are latched
c) maximum of 4 ports are available
d) all of the mentioned
View Answer
Answer: d
Explanation: In mode 0, any port can be used as input or output and output ports are latched.

4. The strobed input/output mode is another name of
a) mode 0
b) mode 1
c) mode 2
d) none
View Answer
Answer: b
Explanation: In this mode, the handshaking signals control the input or output action of the specified port.

5. If the value of the pin STB (Strobe Input) falls to low level, then
a) input port is loaded into input latches
b) input port is loaded into output latches
c) output port is loaded into input latches
d) output port is loaded into output latches
View Answer
Answer: a
Explanation: If the value of the pin STB (Strobe Input) falls to low level, the input port is loaded into input latches.

6. The signal, SLCT in the direction of signal flow, OUT, indicates the selection of
a) Control word register
b) CPU
c) Printer
d) Ports
View Answer
Answer: c
Explanation: This signal indicates that the printer is selected.

7. The pulse width of the signal INIT at the receiving terminal must be more than
a) 10 microseconds
b) 20 microseconds
c) 40 microseconds
d) 50 microseconds
View Answer
Answer: d
Explanation: The pulse width of the signal must be more than 50microseconds at the receiving terminal.

8. The level of the signal ERROR(active low) becomes 'low' when the printer is in
a) Paper end state
b) Offline state
c) Error state
d) All of the mentioned
View Answer
Answer: d
Explanation: The level of the signal ERROR(active low) becomes 'low' when the printer is in the Paper end state, Offline state and Error state.

9. The signals that are provided to maintain proper data flow and synchronization between the data transmitter and receiver are
a) handshaking signals
b) control signals
c) input signals
d) none
View Answer
Answer: a
Explanation: Handshaking signals maintain proper data flow and synchronization.

10. The feature of mode 2 of 8255 is
a) single 8-bit port is available
b) both inputs and outputs are latched
c) port C is used for generating handshake signals
d) all of the mentioned
View Answer
Answer: d
Explanation: In mode 2 of 8255, a single 8-bit port is available i.e group A.

1. The time taken by the ADC from the active edge of SOC(start of conversion) pulse till the active edge of EOC(end of conversion) signal is called
a) edge time
b) conversion time
c) conversion delay
d) time delay
View Answer
Answer: c
Explanation: Broadly speaking, the time taken by the converter to calculate the equivalent digital data output from the moment of the start of conversion is called conversion delay.

2. The popular technique that is used in the integration of ADC chips is
a) successive approximation
b) dual slope integration

c) successive approximation and dual slope integration
d) none
View Answer
Answer: c
Explanation: Successive approximation and dual slope integration are the most popular techniques that are used in the integrated ADC chips.

3. The procedure of algorithm for interfacing ADC contain
a) ensuring stability of analog input
b) issuing start of conversion pulse to ADC
c) reading digital data output of ADC as equivalent digital output
d) all of the mentioned
View Answer
Answer: d
Explanation: The general algorithm for interfacing ADC contains ensuring the stability of analog input, issuing start of conversion pulse to ADC, reading end of conversion signal to mark the end of a conversion process, reading digital data output of ADC as equivalent digital output.

4. Which is the ADC among the following?
a) AD 7523
b) 74373
c) 74245
d) ICL7109
View Answer
Answer: d
Explanation: AD 7523 is a DAC(Digital to analog converter), 74373 is a latch, 74245 is transceiver and ICL7109 is an ADC.

5. The conversion delay in a successive approximation of an ADC 0808/0809 is
a) 100 milliseconds
b) 100 microseconds
c) 50 milliseconds
d) 50 milliseconds
View Answer
Answer: b
Explanation: The conversion delay is 100microseconds which is low as compared to other converters.

6. The number of inputs that can be connected at a time to an ADC that is integrated with successive approximation is
a) 4
b) 2
c) 8
d) 16
View Answer
Answer: c
Explanation: As these converters internally have 3:8 analog multiplexer, at a time 8 different analog inputs can be connected to the chip.

7. ADC 7109 integrated by Dual slope integration technique is used for
a) low cost option
b) slow practical applications
c) low complexity

d) all of the mentioned
View Answer
Answer: d
Explanation: Compared to other 12-bit ADCs, it is of very low cost and useful for slow practical applications.

8. Which of the following is not one of the phases of the total conversion cycle?
a) autozero phase
b) conversion phase
c) signal integrate phase
d) disintegrate phase
View Answer
Answer: b
Explanation: Autozero phase, signal integrate phase and disintegrate phase are the three phases of total conversion cycle.

9. Which of the following phase contain feedback loop in it?
a) autozero phase
b) signal integrate phase
c) disintegrate phase
d) none
View Answer
Answer: a
Explanation: A feedback loop is closed around the system to charge the autozero capacitor to compensate for the offset voltages in the buffer amplifier, integrator and comparator.

10. In the signal integrate phase, the differential input voltage between IN LO(input low) and IN HI(input high) pins is integrated by the internal integrator for a fixed period of
a) 256 clock cycles
b) 1024 clock cycles
c) 2048 clock cycles
d) 4096 clock cycles
View Answer
Answer: c
Explanation: The internal integrator needs 2048 clock cycles to integrate voltage difference between input low and input high.

1. DAC (Digital to Analog Converter) finds application in
a) digitally controlled gains
b) motor speed controls
c) programmable gain amplifiers
d) all of the mentioned
View Answer
Answer: d
Explanation: DAC is used in digitally controlled gains, motor speed controls and programmable gain amplifiers.

2. To save the DAC from negative transients the device connected between OUT1 and OUT2 of AD 7523 is
a) p-n junction diode
b) Zener

c) FET
d) BJT (Bipolar Junction transistor)
View Answer
Answer: b
Explanation: Zener is connected between OUT1 and OUT2 pins of AD7523 to save from negative transients.

3. An operational amplifier connected to the output of AD 7523 is used
a) to convert current output to output voltage
b) to provide additional driving capability
c) as current-to-voltage converter
d) all of the mentioned
View Answer
Answer: d
Explanation: An operational amplifier is used as a current-to-voltage converter to convert the current output to output voltage and also provides additional driving capability to the DAC.

4. The DAC 0800 has a settling time of
a) 100 milliseconds
b) 100 microseconds
c) 50 milliseconds
d) 50 microseconds
View Answer
Answer: a
Explanation: DAC 0800 has a settling time of 100 milliseconds.

5. The device that is used to obtain an accurate position control of rotating shafts in terms of steps is
a) DC motor
b) AC motor
c) Stepper motor
d) Servo motor
View Answer
Answer: c
Explanation: Stepper motor employs rotation of its shaft in terms of steps, rather than continuous rotation as in case of AC or DC motors.

6. The internal schematic of a typical stepper motor has
a) 1 winding
b) 2 windings
c) 3 windings
d) 4 windings
View Answer
Answer: d
Explanation: The internal schematic of a typical stepper motor has 4 windings.

7. The number of pulses required for one complete rotation of the shaft of the stepper motor is equal to the
a) number of internal teeth on a rotor
b) number of internal teeth on a stator
c) number of internal teeth on a rotor and stator
d) number of external teeth on a stator
View Answer

Answer: a
Explanation: The number of pulses required for one complete rotation of the shaft of the stepper motor is equal to the number of internal teeth on its rotor.

8. A simple scheme for rotating the shaft of a stepper motor is called
a) rotating scheme
b) shaft scheme
c) wave scheme
d) none
View Answer
Answer: c
Explanation: In this scheme, the windings are applied with the required voltage pulses, in a cyclic fashion.

9. The firing angles of thyristors are controlled by
a) pulse generating circuits
b) relaxation oscillators
c) microprocessor
d) all of the mentioned
View Answer
Answer: d
Explanation: In early days, the firing angles were controlled by a pulse generating circuits like relaxation oscillators and now, they are accurately fired using a microprocessor.

10. The Isolation transformers are generally used for
a) protecting low power circuit
b) isolation
c) protecting low power circuit and isolation
d) none
View Answer
Answer: c
Explanation: Any switching component of a high power circuit may be sufficient to damage the microprocessor system. So, to protect the low power circuit isolation transformers are used. They are also used if isolation is necessary.

1. The number of counters that are present in the programmable timer device 8254 is
a) 1
b) 2
c) 3
d) 4
View Answer
Answer: c
Explanation: There are three counters that can be used as either counters or delay generators.

2. The operation that can be performed on control word register is
a) read operation
b) write operation
c) read and write operations
d) none
View Answer

Answer: b
Explanation: The control word register can only be written and cannot be read.

3. The mode that is used to interrupt the processor by setting a suitable terminal count is
a) mode 0
b) mode 1
c) mode 2
d) mode 3
View Answer
Answer: a
Explanation: Mode 0 is also called as an interrupt on the terminal count.

4. In mode 2, if N is loaded as the count value, then after (N-1) cycles, the output becomes low for
a) 1 clockcycle
b) 2 clockcycles
c) 3 clockcycles
d) 4 clockcycles
View Answer
Answer: a
Explanation: After (N-1) cycles, the output becomes low for only 1 clockcycle. If the count N is reloaded and again the output becomes high and remains so for (N-1) clock pulses.

5. The generation of a square wave is possible in the mode
a) mode 1
b) mode 2
c) mode 3
d) mode 4
View Answer
Answer: c
Explanation: When the count N loaded is even, then for half of the count, the output remains high and for the remaining half it remains low. If the count loaded is odd, the first clock pulse decrements it by 1 resulting in an even count value.

6. In control word register, if SC1=0 and SC0=1, then the counter selected is
a) counter 0
b) counter 1
c) counter 2
d) none
View Answer
Answer: b
Explanation: SC denotes select counter.

7. In control word format, if RL1=1, RL0=1 then the operation performed is
a) read/load least significant byte only
b) read/load most significant byte only
c) read/load LSB first and then MSB
d) read/load MSB first and then LSB
View Answer
Answer: c
Explanation: To access 16 bit, first LSB is loaded first, and then MSB.

8. If BCD=0, then the operation is
a) decimal count
b) hexadecimal count
c) binary count
d) octal count
View Answer
Answer: b
Explanation: If BCD=0 then hexadecimal count. If BCD=1, then the operation is BCD count.

9. The counter starts counting only if
a) GATE signal is low
b) GATE signal is high
c) CLK signal is low
d) CLK signal is high
View Answer
Answer: b
Explanation: If the GATE signal is enabled, then the counter starts counting.

10. The control word register contents are used for
a) initializing the operating modes
b) selection of counters
c) choosing binary/BCD counters
d) all of the mentioned
View Answer
Answer: d
Explanation: The control word register contents are used for
i) initializing the operating modes (mode 0-mode 4)
ii) selection of counters (counter0-counter2)
iii) choosing binary or BCD counters
iv) loading of the counter registers.

1. The number of hardware interrupts that the processor 8085 consists of is
a) 1
b) 3
c) 5
d) 7
View Answer
Answer: c
Explanation: The processor 8085 has five hardware interrupt pins. Out of these five, four pins were alloted fixed vector addresses but the pin INTR was not alloted by vector address, rather an external device was supposed to hand over the type of the interrupt to the microprocessor.

2. The register that stores all the interrupt requests in it in order to serve them one by one on a priority basis is
a) Interrupt Request Register
b) In-Service Register
c) Priority resolver
d) Interrupt Mask Register
View Answer

Answer: a
Explanation: The interrupts at IRQ input lines are handled by Interrupt Request Register internally.

3. The register that stores the bits required to mask the interrupt inputs is
a) In-service register
b) Priority resolver
c) Interrupt Mask register
d) None
View Answer
Answer: c
Explanation: Also, Interrupt Mask Register operates on IRR(Interrupt Request Register) at the direction of the Priority Resolver.

4. The interrupt control logic
a) manages interrupts
b) manages interrupt acknowledge signals
c) accepts interrupt acknowledge signal
d) all of the mentioned
View Answer
Answer: d
Explanation: The interrupt control logic performs all the operations that are involved within the interrupts like accepting and managing interrupt acknowledge signals, interrupts.

5. In a cascaded mode, the number of vectored interrupts provided by 8259A is
a) 4
b) 8
c) 16
d) 64
View Answer
Answer: d
Explanation: A single 8259A provides 8 vectored interrupts. In cascade mode, 64 vectored interrupts can be provided.

6. When the PS(active low)/EN(active low) pin of 8259A used in buffered mode, then it can be used as a
a) input to designate chip is master or slave
b) buffer enable
c) buffer disable
d) none
View Answer
Answer: b
Explanation: When the pin is used in buffered mode, then it can be used as a buffer enable to control buffer transreceivers. If it is not used in buffered mode, then the pin is used as input to designate whether the chip is used as a master or a slave.

7. Once the ICW1 is loaded, then the initialization procedure involves
a) edge sense circuit is reset
b) IMR is cleared
c) slave mode address is set to 7
d) all of the mentioned
View Answer

Answer: d
Explanation: The initialization procedure involves
i) edge sense circuit is reset.
ii) IMR is cleared.
iii) IR7 input is assigned the lowest priority.
iv) slave mode address is set to 7
v) special mask mode is cleared and the status read is set to IRR.

8. When non-specific EOI command is issued to 8259A it will automatically
a) set the ISR
b) reset the ISR
c) set the INTR
d) reset the INTR
View Answer
Answer: b
Explanation: When non-specific EOI command is issued to 8259A it will automatically reset the highest ISR.

9. In the application where all the interrupting devices are of equal priority, the mode used is
a) Automatic rotation
b) Automatic EOI mode
c) Specific rotation
d) EOI
View Answer
Answer: a
Explanation: The automatic rotation is used in the applications where all the interrupting devices are of equal priority.

1. The registers that store the keyboard and display modes and operations programmed by CPU are
a) I/O control and data buffers
b) Control and timing registers
c) Return buffers
d) Display address registers
View Answer
Answer: b
Explanation: The control and timing register to store the keyboard and display modes and other operations programmed by CPU.

2. The sensor RAM acts as 8-byte first-in-first-out RAM in
a) keyboard mode
b) strobed input mode
c) keyboard and strobed input mode
d) scanned sensor matrix mode
View Answer
Answer: c
Explanation: In this mode, each key code of the pressed key is entered in the order of the entry, and in the meantime, read by the CPU, till the RAM becomes empty.

3. The registers that hold the address of the word currently being written by the CPU from the display RAM are
a) control and timing register
b) control and timing register and timing control

c) display RAM
d) display address registers
View Answer
Answer: d
Explanation: The display address registers holds the address of the word currently being written or read by the CPU to or from the display RAM.

4. When a key is pressed, a debounce logic comes into operation in
a) scanned keyboard special error mode
b) scanned keyboard with N-key rollover
c) scanned keyboard mode with 2 key lockout
d) sensor matrix mode
View Answer
Answer: c
Explanation: In scanned keyboard mode with 2 key lockout mode of operation, when a key is pressed, a debounce logic comes into operation. During the next two scans, other keys are checked for closure and if no other key is pressed then the first pressed key is identified.

5. The mode that is programmed using “end interrupt/error mode set command” is
a) scanned keyboard special error mode
b) scanned keyboard with N-key rollover
c) scanned keyboard mode with 2 key lockout
d) sensor matrix mode
View Answer
Answer: a
Explanation: The scanned keyboard special error mode is programmed using end interrupt/error mode set command. This mode is valid only under the N-key rollover mode.

6. When a key is pressed, the debounce circuit waits for 2 keyboard scans and then checks whether the key is still depressed in
a) scanned keyboard special error mode
b) scanned keyboard with N-key rollover
c) scanned keyboard mode with 2 key lockout
d) sensor matrix mode
View Answer
Answer: b
Explanation: In this mode, When a key is pressed, the debounce circuit waits for 2 keyboard scans and then checks whether the key is still depressed. If it is still depressed, the code is entered in FIFO RAM.

7. The data that is entered from the left side of the display unit is of
a) left entry mode
b) right entry mode
c) left and right entry modes
d) none
View Answer
Answer: a
Explanation: The data that is entered from the left side of the display unit is of left entry mode, as in a type-writer the first character typed appears at the left-most position, while the subsequent characters appear successively to the right of the first one.

8. The FIFO status word is used to indicate the error in
a) keyboard mode
b) strobed input mode
c) keyboard and strobed input mode
d) scanned sensor matrix mode
View Answer
Answer: c
Explanation: Overrun error occurs when an already full FIFO has attempted an entry. Underrun error occurs when an empty FIFO read is attempted.

9. The flag that increments automatically after each read or write operation to the display RAM is
a) IF
b) RF
c) AI
d) WF
View Answer
Answer: c
Explanation: AI refers to auto increment flag.

10. If any change in sensor value is detected at the end of a sensor matrix scan, then the IRQ line
a) goes low
b) goes high
c) remains unchanged
d) none
View Answer
Answer: b
Explanation: In sensor matrix mode, the IRQ line goes high, if any change in sensor value is detected at the end of a sensor matrix scan or the sensor RAM has a previous entry to be read by the CPU.

1. Which of the following is not a mode of data transmission?
a) simplex
b) duplex
c) semi duplex
d) half duplex
View Answer
Answer: c
Explanation: Basically, there are three modes of data transmission. simplex, duplex and half duplex.

2. If the data is transmitted only in one direction over a single communication channel, then it is of
a) simplex mode
b) duplex mode
c) semi duplex mode
d) half duplex mode
View Answer
Answer: a
Explanation: In simplex mode, the data transmission is unidirectional. For example, a CPU may transmit data for a CRT display unit in this mode.

3. If the data transmission takes place in either direction, but at a time data may be transmitted only in one direction then, it is of
a) simplex mode
b) duplex mode
c) semi duplex mode
d) half duplex mode
View Answer
Answer: d
Explanation: In half duplex mode, data transmission is bidirectional but not at a time. For example, Walkie-Talkie.

4. In 8251A, the pin that controls the rate at which the character is to be transmitted is
a) TXC(active low)
b) TXC(active high)
c) TXD(active low)
d) RXC(active low)
View Answer
Answer: a
Explanation: Transmitter Clock Input (TXC(active low)) is a pin that controls the rate at which the character is to be transmitted.

5. TXD(Transmitted Data Output) pin carries serial stream of the transmitted data bits along with
a) start bit
b) stop bit
c) parity bit
d) all of the mentioned
View Answer
Answer: d
Explanation: Transmitted Data Output pin carries a serial stream of the transmitted data bits along with other information like start bits, stop bits and parity bits etc.

6. The signal that may be used either to interrupt the CPU or polled by the CPU is
a) TXRDY(Transmitter ready)
b) RXRDY(Receiver ready output)
c) DSR(active low)
d) DTR(active low)
View Answer
Answer: b
Explanation: RXRDY(Receiver ready output) may be used either to interrupt the CPU or polled by the CPU.

7. The disadvantage of RS-232C is
a) limited speed of communication
b) high-voltage level signaling
c) big-size communication adapters
d) all of the mentioned
View Answer
Answer: d
Explanation: RS232C has been used for long and has a few disadvantages like limited speed of communication, high-voltage level signaling and big-size communication adapters.

8. The USB supports the signaling rate of
a) full-speed USB 1.0 at rate of 12 Mbps
b) high-speed USB 2.0 at rate of 480 Mbps
c) super-speed USB 3.0 at rate of 596 Mbps
d) all of the mentioned
View Answer
Answer: d
Explanation: The USB standards support the signaling rates. Also, USB signaling is implemented in a differential in low- and full-speed options.

9. The bit packet that commands the device either to receive data or transmit data in transmission of USB asynchronous communication is
a) Handshake packet
b) Token packet
c) PRE packet
d) Data packet
View Answer
Answer: b
Explanation: The token packet is the second type of packet which commands the device either to receive data or transmit data.

10. High speed USB devices neglect
a) Handshake packet
b) Token packet
c) PRE packet
d) Data packet
View Answer
Answer: c
Explanation: PRE packets are only of importance to low-speed USB devices.

SHORT QUESTIONS AND ANSWERS

UNIT-I - INTRODUCTION

1. What is load curve?

The curve drawn between the variations of load on the power station with reference to time is known as load curve. There are three types, Daily load curve, Monthly load curve, Yearly load curve

2. What is daily load curve?

The curve drawn between the variations of load with reference to varioustime period of day is known as daily load curve.

3. What is monthly load curve?

It is obtained from daily load curve. Average value of the power at a month for a different time periods are calculated and plotted in the graph which is known as monthly load curve.

4. What is yearly load curve?

It is obtained from monthly load curve which is used to find annual load factor.

5. What is connected load?

It is the sum of continuous ratings of all the equipments connected to supply systems.

6. What is Maximum demand?

It is the greatest demand of load on the power station during a given period.

7. What is Demand factor?

It is the ratio of maximum demand to connected load.
Demand factor= (max demand)/ (connected load)

8. What is Average demand?

The average of loads occurring on the power station in a given period (day or month or year) is known as average demand.

Daily avg demand = (no of units generated per day)/ (24 hours)
Monthly avg demand = (no of units generated in month)/ (no of hours in a month)
Yearly avg demand = (no of units generated in a year)/ (no of hours in a year)

9. What is Load factor?

The ratio of average load to the maximum demand during a given period is known as load factor.

Load factor = (average load)/ (maximum demand)

10. What is Diversity factor?

The ratio of the sum of individual maximum demand on power station is known as diversity factor.
Diversity factor = (sum of individual maximum demand)/(maximum demand).

11. What is Capacity factor?

This is the ratio of actual energy produced to the maximum possible energy that could have been produced during a given period.
Capacity factor= (actual energy produced)/ (maximum energy that have been produced)

12. What is Plant use factor?

It is the ratio of units generated to the product of plant capacity and the number of hours for which the plant was in operation.
Units generated per annum= average load * hours in a year

13. What is Load duration curve?

When the load elements of a load curve are arranged in the order of descending magnitudes the curve then obtained is called load duration curve.

UNIT-II – REAL POWER FREQUENCY CONTROL

1. What is the major control loops used in large generators?

The major control loops used in large generators are
1. Automatic voltage regulator (AVR)
2. Automatic load frequency control (ALFC).

2. What is the use of secondary loop?

A slower secondary loop maintains the fine adjustment of the frequency, and also by reset action maintains proper MW interchange with other pool members. This loop is insensitive to rapid load and frequency changes but focuses instead on drift like changes which take place over periods of minutes.

3. What is the adv of AVR loop over ALFC?

AVR loop is much faster than the ALFC loop and therefore there is a tendency, for the VR dynamics to settle down before they can make themselves felt in the slower load frequency control channel.

4. What is the diff. between large and small signal analysis?

Large signal analysis is used where voltage and power may undergo sudden changes of magnitude that may approach 100 percent of operating values. Usually this type of analysis leads to differential equations of non-linear type. Small signal anaysis is used when variable excursions are relatively small, typically at most a few percent of normal operating values.

5. What is the exciter?

The exciter is the main component in AVR loop. It delivers the DC power to the generator field. It must have adequate power capacity and sufficient speed of response (rise time less than 0.1 sec).

6. What is the function of AVR?

The basic role of the AVR is to provide constancy of the generator terminal voltage during normal, small and slow changes in the load.

7. Explain about static AVR loop?

In a static AVR loop, the execution power is obtained directly from the generator terminals or from the station service bus. The AC power is rectified by thyristor bridges and fed into the main generator field via slip rings. Static exciters are very fast and contribute to proved transient stability.

8. Write the static performance of AVR loop?

The AVR loop must regulate the terminal |V| to within required static accuracy limit. Have sufficient speed of response. Be stable.

9. What is the dis.adv of high loop gain? How is to be eliminated?

High loop gain is needed for static accuracy but this causes undesirable dynamic response, possibly instability. By adding series AND/OR feedback stability compensation to the AVR loop, this conflicting situation can be resolved.

10. What are the effects of generator loading in AVR loop?

Added load does not change the basic features of the AVR loop, it will however affect the values of both gain factor Kf and the field constant. High loading will make the generator work at higher magnetic saturation levels. This means smaller changes in |E| for incremental increases in if, translating into the reduction of KF. The field time constant will likewise decreases as generator loading closing the armature current paths. This circumstance permits the formation of transient stator currents the existence of which yields a lower effective field induction.

11. What are the functions of ALFC?

The basic role of ALFC's is to maintain desired MW output of a generator unit and assist in controlling the frequency of large interconnection. The ALFC also helps to keep the net interchange of power between pool members at predetermined values. Control should be applied in such a fashion that highly differing response characteristics of units of various types are recognized. Also unnecessary power output changes should be kept at a minimum in order to reduce wear of control valves.

12. Specify the dis.adv of ALFC loop?

The ALFC loop will main control only during normal changes in load and frequency. It is typically unable to provide adequate control during emergency situations, when large MW imbalances occur.

13. How is the real power in a power system controlled?

The real power in a power system is being controlled by controlling the driving torque of the individual turbines of the system.

14. What is the need for large mechanical forces in speed-governing system?

Very large mechanical forces are needed to position the main valve against the high stream pressure and these forces are obtained via several stages of hydraulic amplifiers

UNIT-III - REACTIVE POWER -VOLTAGE CONTROL

1. What are the sources of reactive power? How it is controlled?

The sources of reactive power are generators, capacitors, and reactors.
These are controlled by field excitation.
Give some excitation system amplifier.
The excitation system amplifiers are,

a) Magnetic amplifier
b) Rotating amplifier
c) Modern electronic amplifier.

2. When is feedback stability compensation used?

High loop gain is needed for static accuracy but this causes undesirable dynamic response, possibly instability. This conflicting situation is resolved by adding feedback stabling compensation to the AVR loop.

3. Give the characteristics of line compensators?

The characteristics of line compensators are,
a. Ferranti effect is minimized.
b. Under excited operation of synchronous generator is not required.

4. What is known as bank of capacitors? How it is adjusted?

When a number of capacitors are connected in parallel to get the desired capacitance, it is known as bank of capacitors. These can be adjusted in steps by switching (mechanical).

5. What is the disadvantage of switched capacitors are employed for compensation?

When switched capacitors are employed for compensation, these should be disconnected immediately under light load conditions to avoid excessive voltage rise and Ferro resonance in presence of transformers.

6. What are the effects of capacitor in series compensation circuit?

The effects of capacitor in series compensation circuit are,

Voltage drop in the line reduces.
Prevents voltage collapse.
Steady state power transfer increases.
Transient stability limit increases.

7. Give two kinds of capacitors used in shunt compensator?

The two kinds of capacitors used in shunt compensator are, a. Static Var Compensator (SVC) : These are banks of capacitors (sometimes inductors also for use under light load conditions).

8. What is synchronous condenser?

It is a synchronous motor running at no-load and having excitation adjustable over a wide range. It feeds positive VARs into the line under overexcited conditions and negative VARs when under excited.

9. Write about Static VAR Compensator (SVC).

These comprise capacitor bank fixed or switched or fixed capacitor bank and switched reactor bank in parallel. These compensators draw reactive power from the line thereby regulating voltage, improve stability (steady state and dynamic), control overvoltage and reduce voltage and current unbalances. In HVDC application these compensators provide the required reactive power and damp out sub harmonic oscillations.

10. What is Static VAR Switches or Systems?

Static VAR compensators use switching for var control. These are also called static VAR switches or systems. It means that terminology wise SVC=SVS. And we will use these interchangeably.

11. Give some of the Static compensators schemes.

a. Saturated reactor
b. Thyristor- Controlled Reactor (TCR)
c. Thyristor Switched capacitor (TSC)
d. Combined TCR and TSC compensator.

12. What is tap changing transformers?

All power transformers and many distribution transformers have taps in one or more windings for changing the turn's ratio. It is called tap changing transformers.

13. Write the types of tape changing transformers.

a. Off- load tap changing transformers.
b. Tap changing under load transformers.

14. What is the use of off-load tap changer and TCUL ?

The off- load tap changers are used when it is expected that the ratio will need to be changed only infrequently, because of load growth or some seasonal change. TCUL is used when changes in ratio may be frequent or when it is undesirably to de-energize the transformer to change the tap.

UNIT-IV – COMMITMENT AND ECONOMIC DISPATCH

1. Define economic dispatch problem?

The objective of economic dispatch problem is to minimize the operating cost of active power generation.

2. Define incremental cost?

The rate of change of fuel cost with active power generation is called incremental cost. Write the load balance equation? Pg-pd-pl=0.

3. Define base point?

The present operating point of the system is called base point.

4. Define participation factor?

The change in generation required to meet power demand is called as participation factor.

5. Define hydrothermal scheduling problem?

The objective is to minimize the thermal generation cost with the constraints of water availability.

6. Define Uncommitment?

Commitment of minmum generator to meet the required demand.

7. Define spinning reserve?

It is the term describe the total amount of generation availability from all units synchronized on the system.

8. What is meant by scheduled reserve?

These include quick start diesel turbine units as well as most hydro units and pumped storage hydro units that can be brought online, synchronized and brought up to full capacity quickly.

9. What are the thermal unit constraint?

Minimum up time, minimum down time crew constraints.

10. Define minimum up time?

Once the unit is running, it should not be turned off immediately.

11. Define min.down time?

Once the unit is decommited, there is a minimum time before it can be recommended.

12. Define crew constraints?

If a plant consist of two (or) more units, all the units cannot be turned on at the same time since there are not enough crew members to attend both units while starting up.

13. What are the two approaches to treat a thermal unit to operating temperature?

The first allow the unit boiler to cool down and then heat backup to operating temperature in time for a scheduled turn on. The second requires that sufficient energy be input to the boiler to just maintain operating temperature.

14. What are the techniques for the solution of the unit commitment problem?

Priority list method dynamic programming Lagrange relation

15. What are the assumptions made in dynamic programming problem?

A state consists of an array of units with specified units operating and the rest of the time. The startup cost of a unit is independent of the time it has been offline. There are no costs for shutting down the units.

16. Define long range hydro scheduling problem?

The problem involves the long range of water availability and scheduling of reservoir water releases. For an interval of time that depends on the reservoir capacities.

17. What are the optimization technique for long range hydro scheduling problem?

Dynamic programming composite hydraulic simulation methods statistical production cost.

18. Define short range hydro scheduling problem?

It involves the hour by hour scheduling of all generators on a system to achieve minimum production condition for the given time period.

19. Define system blackout problem?

If any event occurs on a system that leaves it operating with limits violated, the event may be followed by a series of further actions that switch other equipment out of service. If the process of cascading failures continues, the entire system of it may completely collapse. This is referred as system blackout.

20. What is meant by cascading outages?

If one of the remaining lines is now too heavily loaded, it may open due to relay action, thereby causing even more load on the remaining lines. This type of process is often termed as cascading outage.

UNIT-V – COMPUTER CONTROL OF POWER SYSTEMS

1. What are the functions of control center?

System monitoring contingency analysis security constrained optimal power flow.

2. What is the function of system monitoring?

System monitoring provides upto date information about the power system.

3. Define scada system?

It stands for supervisory control and data acquisition system, allows a few operators to monitor the generation and high voltage transmission systems and to take action to correct overloads.

4. What are the states of power system?

Normal state alert mode contingency mode emergency mode. Define normal mode? The system is in secure even the occurrence of all possible outages has been simulated the system remain secure is called normal mode.

5. Define alert mode?

The occurrence of all possible outages the system does not remain in the secure is called alert mode.

6. What are the distribution factors?

Line outage distribution factor, generation outage distribution factor.

7. Define state estimation?

State estimation is the process of assigning a value to an unknown system state variable based on measurements from that system according to some criteria.

8. Define max. likelihood criterion?

The objective is to maximize the probability that estimate the state variable x, is the true value of the state variable vector (i.e, to maximize the P(x)=x).

9. Define weighted least-squares criterion?

The objective is to minimize the sum of the squares of the weighted deviations of the estimated measurements z, from the actual measurement.

10. Define minimum variance criterion?

The objective is to minimize the expected value of the squares of the deviations of the estimated components of the state variable vector from the corresponding components of the true state variable vector.

11. Define must run constraint?

Some units are given a must run status during certain times of the year for reason of voltage support on the transmission network.

12. Define fuel constraints?

A system in which some units have limited fuel or else have constraints that require them to burn aspecified amount of fuel in a given time.

13. What are the assumptions made in priority list method?

No load cost are zero unit input-output characteristics are linear between zero output and full load there are no other restrictions startup cost are affixed amount.

14. State the adv of forward DP approach?

If the start up cost of a unit is a function of the unit is a function of the time it has been offline, then a forward dynamic program approach is more suitable since the previous history of the unit can be computed at each stage.

15. State the dis.adv of dynamic programming method?

It has the necessity of forcing the dynamic programming solution to search over a small number of commitment states to reduce the number of combinations that must be tested in each period.

16. What are the known values in short term hydro scheduling problem?

The load, hydraulic inflows & uit availabilities are assumed known. What is meant by telemetry system? The states of the system were measured and transmitted to a control center by means of telemetry system.

17. What are the functions of security constraints optimal power flow?

In this function, contingency analysis is combined with an optimal power flow which seeks to make changes to the optimal dispatch of generation. As well as other adjustments, so that when a security analysis is run, no contingency result in violations.

18. Define the state of optimal dispatch?

This is the state that the power system is in prior to any contingency. It is optimal with respect to economic operation but may not be secure.

19. Define post contingency?

This is the state of the power system after a contingency has occurred. Define secure dispatch? This is state of the power system with with no contingency outages,but with correction to the operating parameters to account for security violations.

20. What are the priorities for operation of modern power system?

Operate the system in such a way that power is delivered reliably. Within the constraints placed on the system operation by reliability considerations, the system will be operated most economically.

21. What is meant by linear sensitivity factor?

Many outages become very difficult to solve if it is desired to present the results quickly. Easiest way to provide quick calculation of possible overloads is linear sensitivity factors.

22. What are linear sensitivity factors?

Generation shift factors line outage distribution factors.

23. What is the uses of line distribution factor?

It is used to apply to the testing for overloads when transmission circuits are lost.

24. What is meant by external equvalencing?

In order to simplify the calculations and memory storage the system is sub divided into 3 sub systems called as external equvalencing.

16 MARKS

1. Explain the method availabilities for providing economic operation of power system.
2. Write short notes on load v curve load duration curve energy curve.
3. Explain about spinning reserve, hot reserve, cold reserve.
4. Explain the solution technology for solving priority list method by dynamic programming method.
5. Explain about load forcasting & weather sensitive load model.
6. Explain the static state estimation of power system.
7. Explain the algorithm for system when operating non steady state condition.
8. How to detect and identify the bad data?
9. Derive the equation for loss coefficients?
10. Explain about base point and participation factor?
11. Explain the solution technique for solving hydro thermal scheduling problem?
12. Explain the operating states of power system?
13. Explain the preventive action taken for emergency and restorative control?
14. Write short note on long range hydro scheduling problem short range hydro scheduling problem.
15. Explain the mathematical technique for hydro thermal scheduling problem?
16. Explain about system equivalency?