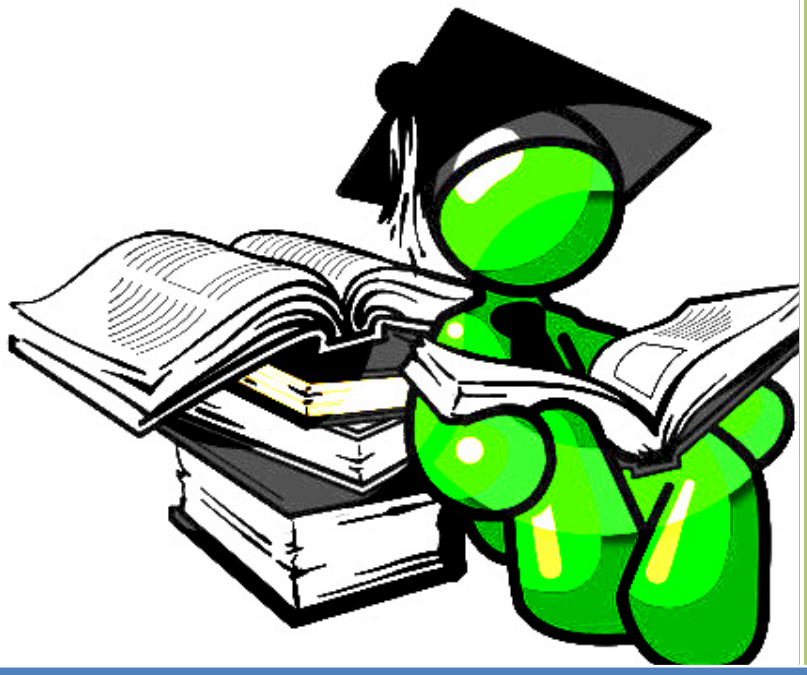
FH-2015



ACADEMIC BOOK

PADMABHUSHAN VASANTDADA PATIL PRATISHTHAN'S
COLLEGE OF ENGINEERING
SINCERITY SACRIFICE
SYSTEM
1990
Empower The Knowledge

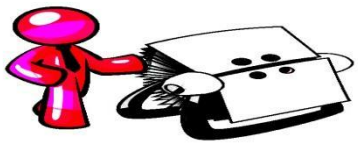
SEMESRTER IV

SE-ELECTRONICS

FH-2015

ACADEMIC BOOK

INDEX



Department of Electronics Engineering
FH OF 2014 -SEM – IV /VI / VIII

Rules and Regulations

College Timings:

The college timing is from 8:45 AM to 4:45 PM .The students must follow the college timing.

Academic calendar and Time table:

The details of academic curriculum and activities are mentioned in the academic book. The students are required to strictly follow the class Time table and academic calendar.

Attendance:

All students are hereby informed that attendance for lectures/practical/tutorials is compulsory. Mumbai University does not allow students to appear for examination if their attendance is less than 75%.But for the good academic performance of the students, the department expects 100 % attendance in theory and practical separately.

Defaulters:

Defaulters list will be displayed monthly. The defaulter students are required to bring their parents/guardians within four days after the display of defaulters list. If students remain defaulter consistently he/she has to face the consequences as laid by the Mumbai University.

Assembly/prayer:

The Assembly /Prayer starts at 8:50 AM. The student must remain present in their respective classes for the prayer. The students reporting the college late will be treated as late comers and their attendance will be noted in the separate register. After three late marks the students are expected to bring their parents /guardians to the college.

Identity card:
Student must wear ID during college hours in the campus.

Mobile Phone:
Use of cell phone is strictly prohibited in the college premises.

Examination:
As per the university norms, there will be two term test i.e Mid Term test and End Term test in the semester which is an integral part of Internal Assessment for every subject. Both the examination will be based on 40 % and 70 % of theory syllabus respectively for each subject and will be conducted as per the dates mentioned in the academic calendar. Attendance for both internal examination IS COMPULSORY .As per the university norms, no retest will be conducted under any circumstances. Separate passing heads is compulsory for internal and external examination for individual subjects. If the student fails in any of the exam he/she has to reappear in the concerned subject after the declaration of the result.

Practicals/tutorials/Assignments:
The Student should compulsory bring their rough and fair journal for the concerned subject for every practical and tutorials and get it checked regularly. Failing to do so, they will not be allowed for the practical. The Assignments for every subject should be submitted on regular basis.
The student must abide by the above mentioned rules and regulations laid down by the department for their better and brighter future.

FH-2015

ELECTRICAL MACHINES

Mrs.NILIMA ZADE

Subject Plan

GROUP NAME:ELECTRICAL ENGINEERING

COURSE TITLE:Electrical Machines

COURSE CODE:EXE 406

SEM : IV(FH 2015)

PRE-REQUISITE:This subject requires the student should haveknowledge in the basic Electrical engineering and circuit theory

OBJECTIVES :

1. To understand the performance, working and characteristics of various electrical machines such as DC and AC machines
2. To understand the performance, working of various special types of machines and their drives such as stepper motor, switched reluctance motor BLDC motor and their applications.
3. To understand the performance, working of permanent magnet synchronous motor.
4. To emphasize intuitive understanding and practical implementations of the theoretical concepts.
5. To develop an appreciation of the application of his/her knowledge in actual industry and project work.
6. To prepare the students to excel in post graduate studies.

OUTCOME :

On completion of the module, the students should be able to:

1. Understand working various rotating machines.
2. Understand characteristics and application of AC and DC motors
3. Understand characteristics and application of Stepper motor , switched reluctance motor, BLDC motor, and PMSM.
4. Understand basic drives for various special machines.

LEARNING RESOURCES: -

RECOMMENDED BOOKS:-

1. Bimbhra P.S., *Electric Machinery* , Khanna Publisher,
2. G.K. Dubey, *Fundamentals of electrical drives*, Narosa Publications
3. Nagrath I.J., Kothari D.P., *Electric Machines*, TMH Publishcations
4. A.E. Fitzgerald, Kingsly, Stephen., *Electric Machinery,* McGraw Hill

COURSE MATERIALS MADE AVAILABLE

1. Course instructional objectives & outcomes
2. Syllabus
3. Chapterwise Question Bank

Evaluation :

Theory Exam	60M
Mid and End Term test (Average marks)	20 M
Total	80 M

Chapterwise Plan

Subject Title:ELECTRICAL MACHINES

Chapter No. : 1

Chapter Name : DC MACHINES

Approximate Time Needed : 10hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Introduction to the rotating electrical machines, magnetic circuits.
2	Emf induced in rotating conductor in magnetic field
3	Emf induced in a coil in magnetic field. Construction Dc machines
4	Significance of commutator and brushes ,Mmf and flux density waveforms
5	Working principle of DC motor, types of motors and voltage equations
6	Torque equation and Characteristics of DC motors
7	Starters for shunt and series motors
8	Speed control of DC shunt motors
9	Speed control of DC series motors
10	Numerical based on above

Objectives:

The Student will learn fundamental concepts of

1. Generating and motoring action
2. Different types of dc motor and its characteristics
3. Starting and speed control of de motor

Lesson Outcome:

after completion of this module student will be able to

1. Understand generating and motoring action of dc machines
2. Understand Different types of dc motor and its characteristics
3. Understand Starting and speed control of de motor

Model Questions:

1. Explain significance of back emf.
2. Explain Characteristics of series and shunt dc motor.
3. Write short note on speed control of DC motor.

Chapterwise Plan

Subject Title: ELECTRICAL MACHINES

Chapter No. : 2

Chapter Name : Three Phase Induction Motor

Approximate Time Needed : 8hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
11	Introduction to AC machines. Construction
12	Rotating magnetic field
13	Working principle of three phase induction motor
14	Equivalent Circuit, Torque slip characteristic
15	Power stages and motor test
16	Starting methods
17	Speed control
18	numerical

Objectives:

1. working principle of 3 phase induction motor
2. Characteristics , speed control and starting of 3 phase Induction motor

Lesson Outcomes:

after completion of this module student will be able to

1. Understand basic basic principle of 3 phase IM
2. Characteristics speed control and starting of 3 phase IM.

Model Questions:

1. Explain why 3 phase Induction motor is called as rotating transformer.
2. Explain rotating magnetic field and synchronous speed.
3. Explain different starting methods of 3 phase IM.

Chapterwise Plan

Subject Title: ELECTRICAL MACHINES

Chapter No. : 3

Chapter Name :Single Phase Induction Motor

Approximate Time Needed : 4 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
19	Working principle , double field revolving theory
20	Construction and starting of 1 phase IM
21	Starting methods of 1 phase IM
22	Equivalent circuit

Objectives:

The Student will learn fundamental concepts of single phase induction motor working.

Outcome: after completion of this module student will be able to understand 1 phase IM's working and construction.

Model Questions:

1. Explain why single phase motors are not self starting.
2. Write short note on stating methods of 1 phase IM

Chapterwise Plan

Subject Title: ELECTRICAL MACHINES

Chapter No. : 4

Chapter Name :

Permanent magnet synchronous motor

Approximate Time Needed : 08hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
23	Working principle
24	Emf equation
25	Torque equation
26	Starting of PMSM

Objectives:

The Student will learn fundamentals of PMSM

Lesson Outcomes

after completion of this module student will be able to

1. Understand PMSM.

Model Question.

1. Explain working of PMSM
2. Explain emf and torque equations.

Chapterwise Plan

Subject Title: ELECTRICAL MACHINES

Chapter No. : 5

Chapter Name :**Brushless DC Motor**

Approximate Time Needed : 06hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
27	Construction and working principle of stepper motor
28	Single stack and multi stack variable reluctance stepper motor
29	Torque generation
30	Characteristics of VR stepper motor.
31	Drive circuits
32	PM stepper motor and Application

Objectives:

The Student will learn special purpose machine

Outcomes:

after completion of this module student will be able to understand stepper motor operation.

Model Questions:

1. Explain working of single stack VR stepper motor.
2. Write short note on Drive circuit for Stepper motor.

Chapterwise Plan

Subject Title: ELECTRICAL MACHINES

Chapter No. : 6

Chapter Name :Stepper Motor

Approximate Time Needed : 10hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
33	Construction and working principle of stepper motor
34	Single stack and multi stack variable reluctance stepper motor
35	Torque generation
36	Characteristics of VR stepper motor.
37	Drive circuits
38	PM stepper motor and Application

Objectives:

Student will learn special purpose machine

Lesson Outcomes:

after completion of this module student will be able to understand stepper motor operation.

Model Questions:

3. Explain working of single stack VR stepper motor.
4. Write short note on Drive circuit for Stepper motor.

Chapterwise Plan

Subject Title: ELECTRICAL MACHINES

Chapter No. : 7

Chapter Name :Switched Reluctance Motor

Approximate Time Needed : 4hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
39	Constructional features and working principle
40	Operation and control requirement
41	Convertor circuits
42	Speed control

Objective: Student will learn about switched reluctance motor

Outcome: after completion of this module student will be able to understand application of switched reluctsnce motor.

Model Questions

1. Explain Constructional features and working principle of SRM
2. Explain Convertor circuits

FH-2015

MICROPROCESSOR AND PERIPHERALS

Mrs.PRIYA GUPTA

Subject Plan

GROUP NAME	**: Microprocessor and Microcontroller**
COURSE TITLE	**: Microprocessors & Peripherals**
COURSE CODE	**: EXC 403**
SEM	**: IV (FH 2015)**
PRE-REQUISITE	: Microprocessor & Microcontroller

RATIONALE

This course aims to create a strong foundation by studying the basics of Microprocessors and interfacing to various peripherals which will lead to a well designed Microprocessor based System. The course is a pre-requisite for all further courses in Microcontrollers and Embedded systems.

OBJECTIVES :

7. To introduce the students with Intel 8085 Microprocessor
8. To introduce the Intel 8086 Architecture.
9. To learn Instruction Set of 8086 and programming and its Interrupts.
10. To provide a thorough understanding and knowledge of designing the 8086 CPU module, peripherals controllers & system design.

OUTCOME :

1. Student will be able to understand & design microprocessor based system
2. Student will be able to understand assembly language programming.
3. Student will be able to learn & understand concept of interfacing of peripherals devices & their applications.

LEARNING RESOURCES: -

RECOMMENDED BOOKS: -

1. Microprocessor architecture and applications with 8085: By Ramesh Gaonkar (Penram International Publication).
2. 8086/8088 family: Design Programming and Interfacing: By John Uffenbeck (Pearson Education).
3. 8086 Microprocessor Programming and Interfacing the PC: By Kenneth Ayala
4. Microcomputer Systems: 8086/8088 family Architecture, Programming and Design: ByLiu & Gibson (PHI Publication).
5. Microprocessor and Interfacing: By Douglas Hall (TMH Publication).

COURSE MATERIALS MADE AVAILABLE

1. Course instructional objectives & outcomes
2. Syllabus
3. Chapterwise Question Bank

Evaluation :

Theory Exam	80 M
Internal assessment:-. The average marks of Mid-term test (20 M) & End-term test (20 M) will be considered as final IA marks	20 M
Oral	25 M
Term Work	25 M
Total	150 M

List of Experiments

Atleast 10 experiments based on the entire syllabus

Expt. No.	Name of the Experiments
1	Write a program to arrange block of data in i) Ascending and (ii) Descending order.
2	Write a program to find out any power of a number

3	Write a programmable delay
4	Write a program to find out largest number in an array
5	Experiment on String instructions (e.g Reversing of string & palindrome)
6	Write a programme to multiply 32 bit numbers
7	Menu driven programming
8	Write a program for code conversion
9	Programming the 8255 to read or write to port (any one application)
10	Programming the 8259 to demonstrate rotating priority, Specific priority ,etc

Chapterwise Plan

Subject Title: Microprocessor & Peripherals

Chapter No. : 1

Chapter Name : Introduction to Intel 8085 Microprocessor

Approximate Time Needed : 06 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Basic function of Microprocessors. System bus, Architecture
2	Pin configuration
3	Programmer's model of intel 8085 microprocessor. Basic function of Microprocessors.
4	System bus, Architecture
5	Pin configuration
6	Programmer's model of intel 8085 microprocessor

Objectives:

To teach students:

1. Introduction and overview of 8085 microprocessor.
2. Need of co-processor in system.
3. Working of 8085.
4. Pin diagram & Architecture
5. Addressing modes.

Lesson Outcome:

Students will able to

1. Advantages and disadvantages 8085

2. Timing diagram various instructions.

Model Questions:

1. What is Microprocessor?
2. Explain bus architecture of 8085.
3. Explain different addressing modes.
4. Draw pin diagram of 8o85 Microprocessor.

Chapterwise Plan

Subject Title: Microprocessor & Peripherals

Chapter No. : 2

Chapter Name : Intel 8086 Architecture

Approximate Time Needed : 06 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Major features of 8086 Processor
2	8086/8088 CPU Architecture
3	Pipeline operation
4	Programmer's model & memory segmentation

Objectives:

To teach students:

1. Introduction and overview of 8085 microprocessor.
2. Need of co-processor in system.
3. Working of 8085.
4. Pin diagram & Architecture
5. Addressing modes.

Lesson Outcome:

Students will able to

1. Advantages and disadvantages 8085
2. Timing diagrams & various instructions.

Model Questions:

1. What is Difference between 8086 &8085.
2. Explain Memory Segmentation in 8086
3. Draw pin diagram & explain architecture of 8086
4. Compare silent features of 8086 & 8088

Chapterwise Plan

Subject Title: Microprocessor & Peripherals

Chapter No. : 3

Chapter Name : 8086 assembly language programming

Approximate Time Needed : 10 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Addressing modes
2	8086 instruction formats and instruction set
3	Data transfer, arithmetic, bit manipulation
4	String Instructions
5	program execution transfer and program control instructions
6	assemble language

Objectives:

To teach students:

1. Instruction format of 8086.
2. Various instructions of 8086.
3. After learning instructions students will learn to write assembly programs of 8086.

Lesson Outcome:

Students will able to

1. How to write assembly language program in 8086 using various instructions.
2. Debugging program.

Model Questions:

1. List the various addressing modes of 8086 with examples.
2. Explain string instructions with examples.
3. Explain data transfer, arithmetic instruction with example
4. Write a program for 8 bit Addition.

Chapterwise Plan

Subject Title: Microprocessor & Peripherals

Chapter No. : 4

Chapter Name : 8086 Interrupts

Approximate Time Needed : 04 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Interrupts types in 8086
2	Dedicated Interrupts
3	Software Interrupts

Objectives:

To teach students:

1. What is Interrupts
2. What is dedicated Interrupts

Lesson Outcome:

Students will able to

1. Advantages and disadvantages Interrupts

Model Questions:

1. List the various addressing modes of 8086 with examples.
2. Explain string instructions with examples.
3. Explain data transfer, arithmetic instruction with example
4. Write a program for 8 bit Addition.

Chapterwise Plan

Subject Title: Microprocessor & Peripherals

Chapter No. : 5

Chapter Name : Designing the 8086 CPU module

Approximate Time Needed : 10 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Architecture and organization of 8086/8088microprocessors family
2	Bus interface unit
3	8086/8088 hardware pin
4	Minimum mode of operation
5	Maximum mode of operation
6	Timing diagram of 8086 family microprocessors, simplified read/ write bus cycles
7	Timing diagram
8	8086/8088 memory addressing
9	Address decoding
10	Memory system design of 8086 family
11	Memory system design of 8086 family
12	Minimum mode of operation, Maximum mode of operation Timing Diagram

Objectives:

To teach students:

1. Architecture and organization of 8086/8088 microprocessors family
2. Bus interface unit, 8086/8088 hardware pin

3. Minimum mode of operation, Maximum mode of operation
4. Timing diagram of 8086 family microprocessors, simplified read/ write bus cycles
5. Address decoding,
6. Memory system design of 8086 family .Memory system design of 8086 family
7. Input/output port addressing and decoding
8. Minimum mode of operation, Maximum mode of operation Timing Diagram

Lesson Outcome:

Students will able to

1. Draw Timing diagrams in maximum mode & minimum mode
2. Explain BIU

.

Model Questions:

1. Explain Architecture and organization of 8086/8088 microprocessors family
2. Explain BIU
3. Explain Different Address decoding Techniques.

Chapterwise Plan

Subject Title: Microprocessor & Peripherals

Chapter No. : 6

Chapter Name : Peripheral Controllers for 8086 family & system Design

Approximate Time Needed : 08 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Functional Blok diagram & description , control word formats, operating modes & applications of 8255 PPI,8259 PIC & 8237 DMAC
2	Interfacing of the above peripheral controllers.
3	Keyboard & display interface using 8155

Objectives:

To teach students:

1. Various peripheral devices which are normally used in microprocessor based system.
2. Interfacing of these peripheral devices with 8086.

Lesson Outcome:

Students will able to

1. Interfacing various peripheral devices with 8086.

Model Questions:

1. Explain the various modes of 8237.

2. Explain Interfacing of 8086 with 8255 in Handshake mode
3. Draw block diagram of 8259 & Explain in brief.
4. Draw pin diagram of Keyboard & display interface using 8155

Chapterwise Plan

Subject Title: Microprocessor & Peripherals

Chapter No. : 7

Chapter Name : Multiprocessor systems

Approximate Time Needed : 08 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Study of multiprocessor system namely Closely coupled system (CCS) Loosely Coupled System (LCS)
2	CCS with the case study of maths processor
3	Various system bus arbitration schemes in LCS
4	Role of the bus arbiter (inel 8289) in LCS

Objectives:

To teach students:

1. What is Multiprocessor system
2. CCS & LCS
3. Various bus arbitration

Lesson Outcome:

Students will able to

1. Function of Multiprocessor
2. Role of CCS & LCS

3. Role of the bus arbiter

Model Questions:

1. Explain different functions of multiprocessors.
2. What is the Bus Arbiter
3. Explain Role of CCS & LCS

Assignments

ASSIGNMENT 1 (DATE : 03th FEB 2015)

1. Explain the various addressing modes of 8086.
2. Draw & explain pin diagram of 8o85 Microprocessor.
3. What is Difference between 8086 &8085?
4. Explain Memory Segmentation in 8086.
5. Draw pin diagram & explain architecture of 8086

ASSIGNMENT 2 (DATE : 10th MARCH 2015)

1. Explain string instructions with examples.
2. Explain data transfer, arithmetic instruction with example
3. Write a program for 8 bit Addition.
4. Explain the various modes of 8237.

ASSIGNMENT 3 (DATE : 30th MARCH 2015)

1. Explain Interfacing of 8086 with 8255 in Handshake mode
2. Draw block diagram of 8259 & Explain in brief.
3. Draw pin diagram of Keyboard & display interface using 8155

2915/14 Sem-IV (ETRX)
Microprocessors & Peripherals

QP Code : NP-19758

(3 Hours) **[Total Marks : 80**

N.B. : 1.Question no. 1 is compulsory
2. Solve any three from the remaining five questions.
3. Assume suitable additional data if necessary.

Q1) Answer the following questions: (20 marks)
a) Explain flag register of 8085 microprocessor.
b) What is REP prefix? How it functions for string instructions?
c) Explain the feature of pipelining and queue in 8086 architecture.
d) Explain the significance of HOLD, RESET and READY signals in 8086 processor.
e) For 8086 op-code fetch machine cycle explain the significance of each T-state.

Q2)a) Draw and explain the instruction template format of 8086 processor ? (10marks)
b) Explain programmable interrupt controller 8259 – features and operation. (10 marks)

Q3) a) Explain 8086-8087 coprocessor configuration in maximum mode of operation. (10 marks)
b) Explain the following 8086 instructions
a) CMPSB b) DIV AX c) LOOPE again d) REP SCASB e) XLATB (10marks)

Q4) a) Write a detailed note on the interrupt structure of 8086 processor. (6 marks)
b) What are the basic modes of operation of 8255, Explain with the format of control register. (4marks)

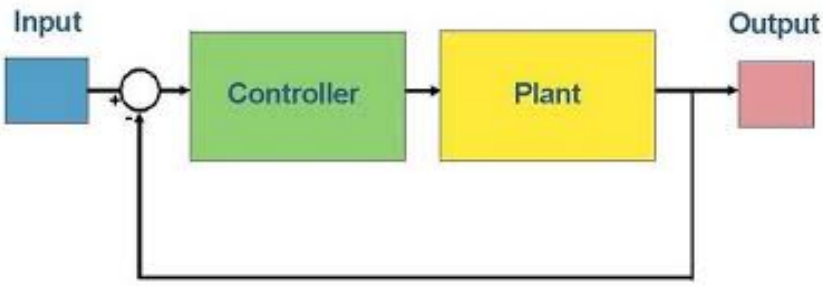
b) Explain the need for DMA and modes of DMA data transfer. (10 marks)

Q5) a) Explain the architecture of 8086 processor. What is the need for memory segmentation.

b) Explain the need for DMA and modes of DMA data transfer. (10 marks)

Q5) a) Explain the architecture of 8086 processor. What is the need for memory segmentation. (10 marks)
b) With the help of a neat flowchart/algorithm write a program in 8086 assembly to arrange a set of ten 8-bit numbers initialized in data segment in ascending order. (10 marks)

Q6) a) Write a brief note on programmable peripheral interface (PPI) IC – 8255 and its modes of operation. (10 marks)
b) Using string instructions write a program in 8086 assembly to copy a block ten bytes initialized in data segment to extra segment. Assume the necessary details. (10 marks)



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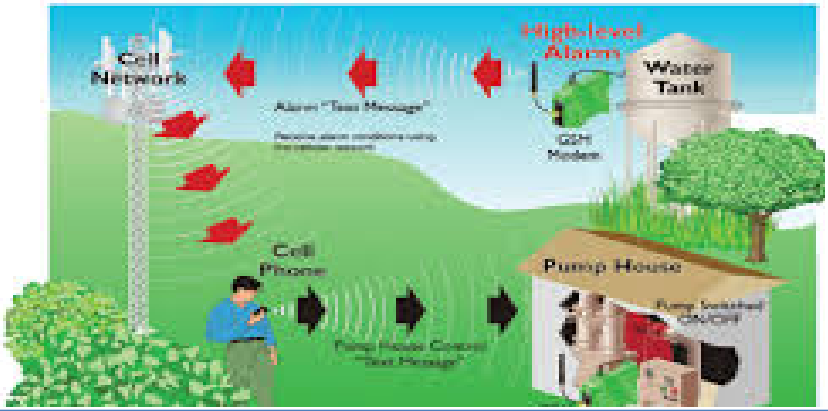


PRINCIPAL OF CONTROL SYSTEMS

PADMABHUSHAN VASANTDADA PATIL PRATISHTHAN'S
COLLEGE OF ENGINEERING
SINCERITY
SACRIFICE
SYSTEM
1990
Empower The Knowledge

Mr.PRAMOD BHAVARTHE

Subject Plan

GROUP NAME: CONTROL SYSTEM
COURSE TITLE:Principles of Control Systems **COURSE CODE:EXC 404** **SEM : IV(FH 2015)**
PRE-REQUISITE:**Differential equations; Laplace transforms and Matrices.**

OBJECTIVES :

1) To study the fundamental concepts of Control systems and mathematical modeling of the system.
2) To study the concept of time response and frequency response of the system.
3) To study the basics of stability analysis of the system and design of simple controllers

OUTCOME :

4. Students will be able to derive the mathematical model of different type of the systems.
5. Students will understand the basic concepts of control system
6. Students will understand the analysis of systems in time and frequency domain.
7. Students will be able to apply the control theory to design the conventional PID controller widely used in the industries.

LEARNING RESOURCES: -

Text Book:

1) J. Nagrath, M. Gopal, Control Systems Engineering, New Age International, Fifth Edition, 2012.
2) Dhanesh N. Manik, Control Systems, Cengage Learning, First Edition, 2012.
3) M. Gopal, Control Systems: Principle and design, Tata McGraw Hill, First Edition, 1998
4) Richard C. Dorf and Robert H. Bishop, Modern Control System, Pearson, Eleventh Edition, 2013.
5) Norman S. Nice, Control Systems Engineering, John Wiley and Sons, Fifth Edition, 2010

6) Rajeev Gupta, Control Systems Engineering, Wiley India, First Edition, 2011.

COURSE MATERIALS MADE AVAILABLE

4. Course instructional objectives & outcomes

5. Syllabus

6. Chapterwise Question Bank

Evaluation :

Theory Exam	80 M
Internal assessment:-. The average marks of Mid-term test (20 M) & End-term test (20 M) will be considered as final IA marks	20 M
Oral	25 M
Term Work	25 M
Total	150 M

List of Experiments

Atleast 10 experiments based on the entire syllabus

Expt.No.	Name of the Experiments
1	Study of Transfer Function, Pole-Zero plot by using scilab/xcos
2	To find step response of I & II order system by using scilab/xcos
3	Introduction to D.C. machines
4	To perform speed control of dc shunt motor
5	To calculate closed loop characteristics of 2^{nd} order system
6	To find steady state response for type 0,1 & 2 systems
7	To find root locus of given system by using scilab/xcos
8	To find Bode plot of given system by using scilab/xcos
9	To perform speed/torque characteristics of dc shunt motors
10	To find state space modeling by using scilab/xcos
11	To perform load characteristics of dc shunt motors

Chapterwise Plan

Subject Title: :-Principles of Control Systems

Chapter No. : 1

Chapter Name : Introduction to control system analysis

Approximate Time Needed : 06hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Introduction, Some Basic definition
2	Open loop and closed loop systems;
3	feedback and feed-forward control structure , Types of models
4	Types of models
5	Standard test signals; Transient and steady state behavior of first and second order systems
6	Steady state errors in feedback control systems and their types.

Objectives:

The student will learn

1. Open loop and closed loop systems
2. feedback and feed-forward control structure
3. Types of models
4. Transient and steady state behavior of first and second order systems

Lesson Outcome:

On completion of this module, the student is expected to be familiar with the following concepts

1. System
2. Open loop and closed loop systems
3. Basic Components of control systems
4. Preparation of GATE/UPSC/MPSC Exam.

Model Questions:

a) Define Following terms:-
   1) System
   2) Control System
   3) Plant
   4) Input & Output
   5) Disturbance
b) Explain Open loop & Closed loop systems with suitable examples (UQ)
c) Compare Open loop & Closed loop systems (UQ)
d) Compare feedback control system & feed forward control system. (UQ)
e) Explain following term with examples
   1) Servomechanism.
   2) Regulator.

Note: - University Question (UQ)

Chapterwise Plan

Subject Title: Principles of Control Systems

Chapter No. : 2

Chapter Name : Mathematical modeling of systems

Approximate Time Needed : 08hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
07	Models of mechanical systems
08	Models of electrical systems, Models of thermal systems
09	Block diagram reduction
10	Block diagram reduction
11	Block diagram reduction
12	Signal flow graph & Mason's gain rule.
13	Signal flow graph & Mason's gain rule.
14	Signal flow graph & Mason's gain rule.

Objectives:

The student will learn

1) Transfer function models of various systems
2) Block diagram reduction
3) Signal flow graph

Lesson Outcomes:

On completion of this module, the student is expected to be familiar with the following concepts

1) Reduction rule of block diagram
2) Mason's gain rule

3) Preparation of GATE/UPSC/MPSC Exam

Model Questions:

1) Define following terms
   a) T.E.
   b) Poles
   c) Zeros
   d) Characteristic equation
   e) Pole-zero plot
   f) Order
2) The unit impulse response a system is e^{-7t} Find its T.E.
3) The T.F. of a system is given by

$$T(s) = \frac{10(s+8)}{s(s+4)(s^2+6s+25)}$$

Obtain it's a) Poles b) Zeros c) Order d) Pole-Zero plot

4) What is block diagram representation? Explain withy suitable examples
5) Explain Block diagram reduction rule.
6) Define signal flow graph.
7) State & Explain Mason's Gain formula.

Chapterwise Plan

Subject Title: : Principles of Control Systems

Chapter No. : 3

Chapter Name : State Variable Models

Approximate Time Needed : 12hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
15	State variable models of mechanical systems
16	State variable models of mechanical systems
17	State variable models of electrical systems
18	State variable models of thermal systems
19	Concept of state transition matrix; Properties of state transition matrix
20	Solution of homogeneous systems.
21	Solution of non-homogeneous systems
22	Concept of controllability
23	Controllability analysis of LTI systems
24	Concept of observability
25	Observability analysis of LTI systems using Kalman approach.
26	Observability analysis of LTI systems using Kalman approach.

Objectives:

The student will learn

1)State variable models of various systems

2) State transition equation

3) Controllability and observability

Outcomes:- On completion of this module, the student is expected to be familiar with the following concepts

1) State variable models
2) State transition equation
3) Preparation of GATE/UPSC/MPSC Exam

Model Questions:

1) Obtain State Variable Model of the T.F.

$$\frac{Y(s)}{U(s)} = \frac{s^2 + 3s + 3}{s^3 + 2S^2 + 3s + 1}$$

2) Check controllability &observability for the system

$$\dot{x} = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix} a$$
$$y = [1 \quad 3 \quad 0]x$$

3) Define following terms
   a) State
   b) State variables
   c) State space
   d) State vector
   e) State model
4) Derive an expression for the solution of a homogenous state equation.
5) Obtain State Variable Model of the T.F.

$$\frac{Y(s)}{U(s)} = \frac{20(10s + 1)}{s^3 + 2S^2 + 3s + 1}$$

Chapterwise Plan

Subject Title: Principles of Control Systems

Chapter No. : 4

Chapter Name Stability analysis in time domain

Approximate Time Needed : 06hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
27	Concept of absolute, relative and robust stability
28	Routh stability criterion
29	Root-locus concepts
30	General rules for constructing root-locus
31	Root-locus analysis of control systems
32	Root-locus analysis of control systems

Objectives:

The student will learn

1) Concept of stability
2) Routh stability criterion
3) Root-locus concepts

Lesson Outcomes

- On completion of this module, the student is expected to be familiar with the following concepts

1) Stability of the system
2) Routh-stability criterion
3) Preparation of GATE/UPSC/MPSC Exam

Model Questions:

1) Define the following terms
   a) Stable system
   b) Unstable system
   c) Critically stable system
   d) Conditionally stable system
2) State & explain Hurwitz's criterion
3) State & explain Routh's criterion
4) Determine the stability of the system having characteristics equation
$$s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$$
5) characteristics equation of a system is given as
$$s^3 + 3Ks^2 + (K + 2)s + 4 = 0$$
   Find range of K for stability

6) What is root locus? Explain with examples
7) Explain the method of calculating the breakaway points
8) Find the value of K for ξ=0.707 from root locus of system having
$$G(s)H(s) = \frac{K}{s(s+2)(s+8)}$$
9) Find the value of K for ξ=0.5 from root locus of system having
$$G(s)H(s) = \frac{K}{s(s+2)(s+1)}$$

Chapterwise Plan

Subject Title: Principles of Control Systems

Chapter No. : 5

Chapter Name : Stability analysis in frequency domain

Approximate Time Needed : 10hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
33	Frequency domain specifications, Response peak and peak resonating frequency
34	Relationship between time and frequency domain specification of system
35	Stability margins
36	Bode plot: Magnitude and phase plot
37	Method of plotting Bode plot
38	Stability margins on the Bode plots
39	Stability analysis using Bode plot
40	Polar plots, Nyquist stability criterions
41	Nyquist plot
42	Gain and phase margins

Objectives:

The student will learn

1) Bode plot
2) Stability analysis using Bode plot
3) Polar plots
4) Nyquist plot

Outcomes:

On completion of this module, the student is expected to be familiar with the following concepts

1) Stability margines
2) Bode plot
3) Polar plots, Nyquist plot
4) Gain and phase margins
5) Preparation of GATE/UPSC/MPSC Exam

Model Questions:

1) Sketch the bode plot for the open loop T.F. given by
$$G(s)H(s) = \frac{0.5(1+5s)}{s^2(1+0.5s)}$$
2) If $G(s)H(s) = \frac{12}{s(s+1)(s+2)}$ draw polar plot & comment on stability of a system.
3) Using Nyquist stability criterion, determine the stability of system whose open loop T.F. given by
$$G(s)H(s) = \frac{(1+s)}{s^2(s-2)}$$
4) Define Gain and phase margins
5) Write a short note on root locus techniques
6) Explain the nature of Bode plot for
   a) Poles at origin
   b) Simple pole
   c) Simple zero

Chapterwise Plan

Subject Title: : Principles of Control Systems

Chapter No. : 6

Chapter Name : Compensators and controllers

Approximate Time Needed : 10hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
43	Types of compensation
44	Need of compensation
45	Lag compensator; Lead compensator.
46	Concept of ON/OFF controllers
47	Concept of P, PI, PD and PID Controllers.
48	Concept of P, PI, PD and PID Controllers.
49	Concept of P, PI, PD and PID Controllers.
50	Introduction to Robust Control
51	Adaptive control
52	Model predictive control

Objectives:

The student will learn

1) Types of compensation
2) Lag compensator; Lead compensator
3) Concept of P, PI, PD and PID Controllers

Lesson Outcomes:

On completion of this module, the student is expected to be familiar with the following concepts

1) Adaptive control
2) Need of compensation
3) Lag compensator; Lead compensator
4) P, PI, PD and PID Controllers
5) Preparation of GATE/UPSC/MPSC Exam

Model Questions:

1) What is compensation?
2) Derive T.F. of
   a) Lead network
   b) Lag network
   c) Lag-Lead network
3) Draw & explain polar plot of
   a) Lead network
   b) Lag network
   c) Lag-Lead network
4) Draw & explain Bode plot of
   a) Lead network
   b) Lag network
   c) Lag-Lead network
5) Compare Lead-lag compensator
6) Explain the concept of on-off controller using example
7) Write short note on PI & PD controllers

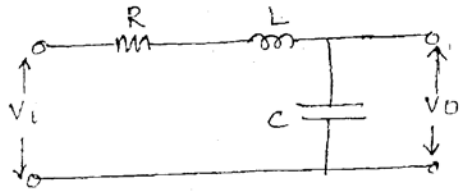
SE Sem IV (ETRX) (CBGS)
PCS 04/06/14

QP Code : **NP-19794**

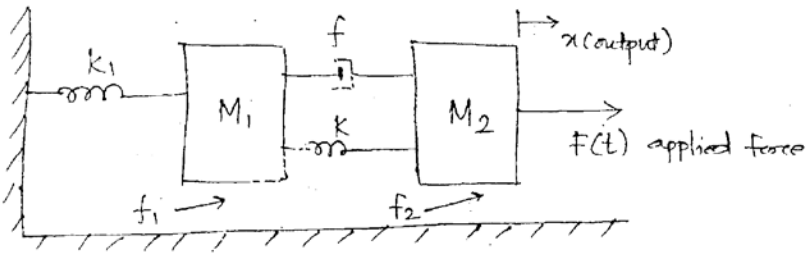
(3 Hours) [Total Marks : 80

N.B. (1) Question No. **1** is **compulsory.**
(2) Attempt any **three** questions from remaining questions.
(3) Assume suitable data wherever **necessary.**

1. Attempt any **four** :– 20
   (a) Differentiate between feedback and feed forward control system.
   (b) What is a compensator ? Why is it required ?
   (c) What are the properties of state transition matrix ?
   (d) Explain the concept of absolute, relative and robust stability.
   (e) Find the transfer function for following network.



2. (a) Obtain the transfer function of the mechanical system. 10



(b) Consider unity feedback control system with an open loop transfer function of – 10

$$G(s) = \frac{k(s+1)(s+2)}{(s+0.1)(s-1)}$$

(i) Plot the root loci showing asymptotes, centroid, break away point, the gain at which root locus crosses jw axis.
(ii) Find value of gain for which a closed system is critically damped.

Con. 13032-14. [TURN OVER

3. (a) A unity feedback control system is characterized by the open loop transfer function. 10

$$G(s) = \frac{k(s+13)}{s(s+3)(s+7)}$$

using the Routh criterion, calculate the range of values of k for system to be stable.

(b) Write a note on advances in control systems. 10

4. (a) Obtain the state variable model of the transfer function– 10

$$\frac{Y(s)}{U(s)} = \frac{s^2+3s+3}{s^2+2^2s+3s+1}$$

(b) Sketch the Bode plot for the open loop transfer function given by– 10

$$G(s)\ H(s) = \frac{0{\cdot}5(1+5s)}{s^2(1+0{\cdot}5s)}$$

5. (a) Find rise time, settling time and peak overshoot for the system given by transfer function– 5

$$G(s) = \frac{25}{(s^2+8s+25)}$$

(b) Using Nyquist criterion, determine the closed loop system having following open loop transfer function is stable or not. If not, find number of poles in right half of s plane – 5

$$G(s)\,H(s) = \frac{1+4s}{s^2(1+s)(1+2s)}$$

(c) Check controllability and observability for the system– 10

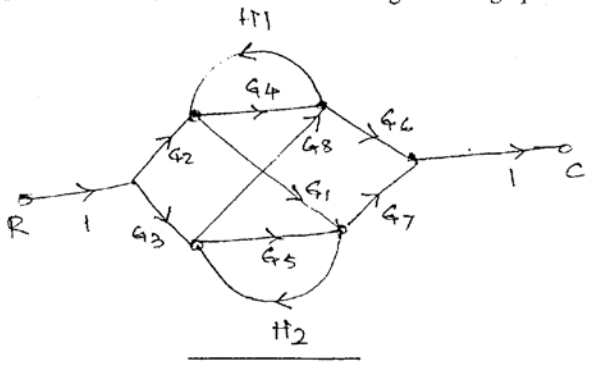
$$\dot{x} = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix} u$$

$$y = [\,1 \quad 3 \quad 0\,]\,x$$

6. (a) Explain the concept of on-off controller using example. 5

(b) Compare lead-lag compensator. 5

(c) Obtain the overall transfer function from signal flow graph. 10



Con. 13032-14.

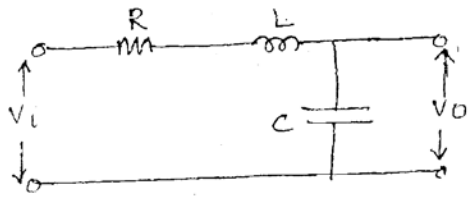
SE SEM IV (ETRX) (CBGS)
PCS 04/06/14

QP Code : **NP-19794**

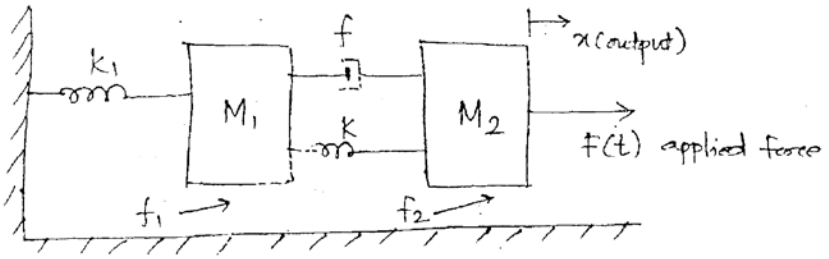
(3 Hours) [**Total Marks : 80**

N.B. (1) Question No. **1** is **compulsory.**
(2) Attempt any **three** questions from remaining questions.
(3) Assume suitable data wherever **necessary.**

1. Attempt any **four** :– 20
   (a) Differentiate between feedback and feed forward control system.
   (b) What is a compensator ? Why is it required ?
   (c) What are the properties of state transition matrix ?
   (d) Explain the concept of absolute, relative and robust stability.
   (e) Find the transfer function for following network.



2. (a) Obtain the transfer function of the mechanical system. 10



(b) Consider unity feedback control system with an open loop transfer function of – 10

$$G(s) = \frac{k(s+1)(s+2)}{(s+0{\cdot}1)(s-1)}$$

(i) Plot the root loci showing asymptotes, centroid, break away point, the gain at which root locus crosses jw axis.
(ii) Find value of gain for which a closed system is critically damped.

Con. 13032-14. [TURN OVER

3. (a) A unity feedback control system is characterized by the open loop transfer function. **10**

$$G(s) = \frac{k(s+13)}{s(s+3)(s+7)}$$

using the Routh criterion, calculate the range of values of k for system to be stable.

(b) Write a note on advances in control systems. **10**

4. (a) Obtain the state variable model of the transfer function– **10**

$$\frac{Y(s)}{U(s)} = \frac{s^2+3s+3}{s^2+2^2s+3s+1}$$

(b) Sketch the Bode plot for the open loop transfer function given by– **10**

$$G(s)\ H(s) = \frac{0{\cdot}5(1+5s)}{s^2(1+0{\cdot}5s)}$$

5. (a) Find rise time, settling time and peak overshoot for the system given by transfer function-- **5**

$$G(s) = \frac{25}{(s^2+8s+25)}$$

(b) Using Nyquist criterion, determine the closed loop system having following open loop transfer function is stable or not. If not, find number of poles in right half of s plane – **5**

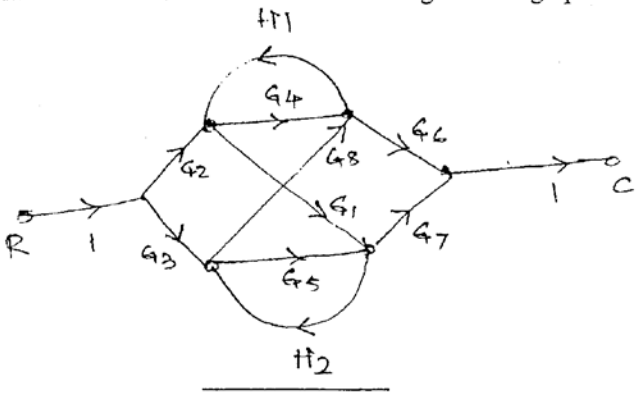
$$G(s)\,H(s) = \frac{1+4s}{s^2(1+s)(1+2s)}$$

(c) Check controllability and observability for the system– **10**

$$\dot{x} = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix} u$$

$$y = [\,1 \quad 3 \quad 0\,]\,x$$

6. (a) Explain the concept of on-off controller using example. **5**
(b) Compare lead-lag compensator. **5**
(c) Obtain the overall transfer function from signal flow graph. **10**



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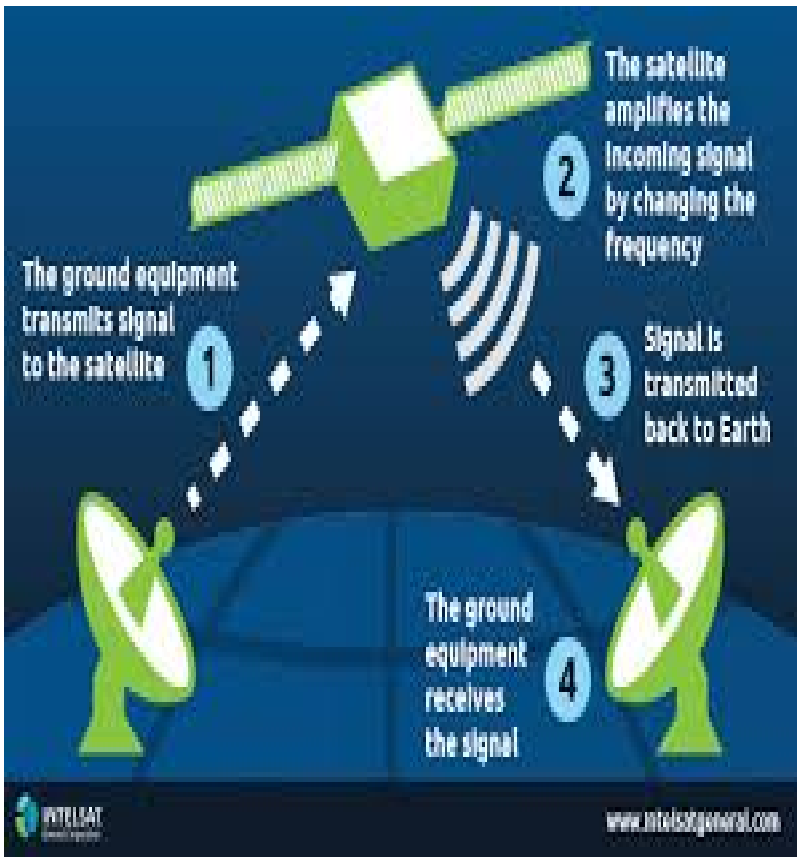

FH-2015

FUNDAMENTALS OF COMMUNICATION ENGINEERING

PADMABHUSHAN VASANTDADA PATIL PRATISHTHAN'S
COLLEGE OF ENGINEERING
SINCERITY
SACRIFICE
SYSTEM
1990
Empower The Knowledge

Mrs.LEENA GOVEKAR

Subject Plan

Cover Page: Subject Overview
Semester : SE/IV/ELEX/ (CBGS) FH2015

Subject Title: Fundamentals of Communication Engineering	
Total Contact Hours: 52 hrs	**Duration of Exams: 3 hrs**
Total Exam Marks : 80+20 + 25 + 25+25 = 175	**Total I. A. Marks: 75**
Lesson Plan Author: /Leena Govekar	**Date: 05/12/2014**
Checked By :	**Date:**

Prerequisites:

Basic Electronic Devices and Circuits and measurements

Objectives:

1. To understand basics of wireless communication systems.
2. To understand modulation and demodulation techniques.
3. To understand working of transmitters and receivers
4. To understand the basic concept of Digital communication

Outcomes:

1. Students will be able to understand the components of wireless communication systems
2. Students will be able to understand various modulation techniques and their applications
3. Students will be able to understand difference between analog and digital communication

Materials and Resources Required:

Text Book:

1.Wayne Tomasi "Electronics communication systems" Pearson education, Third edition, 2001.

2. Kennedy and Davis "Electronics communication system ",Tata McGraw Hill
3. R.P. Sing and S.D. Sapre, "Communication systems Analog and Digital", Tata McGraw Hill
4. Taub and Schilling "Principles of communication systems", Tata McGraw Hill
5. Roy Blake, "Electronics communication system", Thomson learning, second edition.
6. B.P. Lathi "Modern Digital and analog Communication system" Third edition, OXFORD
7. Robert J. Schoenbeck "Electronics communications modulation and transmission".
8. Lean W couch "Digital and Analog communication system", Pearson education, Sixth edition.
9. Roddy Coolen, "Electronic Communications" PHI

Evaluation:

Theory Exam	80 mks
Internal assessment	20 mks
Practical and Oral	50 mks
Term Work	25 mks
Total	175 mks

Chapterwise Plan

Subject Title:- Fundamentals of Communication Engineering

Chapter No. : 1 **Chapter Name:Elements of Communication System**	Approximate Time Needed :08 hrs

Lesson Schedule :

Class No.	Portion Covered per Lecture
1	Maxwell's equations for static and time varying fields
2	wave equation for free space and dielectric mediums,
3	propagation terms and definition
4	electromagnetic frequency spectrum,
5	Basic communication system: Block diagram representation
6	Signal representation, noise in communication signals and channels
7	signal-to-noise ratio, noise factor
8	noise figure, equivalent noise temperature

Objectives: The student will learn

5. Maxwell's equations
6. propagation terms and definition
7. Basic communication system
8. Noise analysis

Assignments: Refer Assignments

Model Questions:

Q.1) Explain basic Elements of Communication System
Q.2) Define Modulation & Demodulation.
Q.3) what is the need of modulation.
Q.4) Define noise .Explain types of noise in detail.
Q.4) Write a short note on following

I) Thermal Noise.
II) Shot Noise.
III) Partition Noise.
IV) Low frequency or Flicker noise.
V) High frequency or transit time noise.

VI) Correlated Noise.
VII) Resistance Equivalent Noise.
VIII) Noise Due to Several Amplifiers in Cascade.
IX) Cascade Connection of Amplifiers (Friss Formula).
X) Equivalent Noise Temperature.

Q.5) Define following

I) Signal to Noise Ratio (S/N)
II) Noise Factor (F)
III) Noise Figure (NF)

Chapterwise Plan

Subject Title: Fundamentals of Communication Engineering

Chapter No. : 2	**Approximate Time Needed :12 hrs**
Chapter Name: Amplitude Modulation	

Lesson Schedule :

Class No.	Portion Covered per Lecture
1	Principles of Amplitude Modulation (AM)
2	Modulation index of AM
3	Generation of AM:- Low Level Modulator
4	Generation of AM:- High Level Modulator
5	Modulator Circuits
6	Different types of AM
7	DSB-SC
8	SSB-SC
9	VSB
10	ISB
11	Problems
12	problems

Objectives: The student will learn

1. Principles of Amplitude Modulation (AM)
2. Generation of AM
3. Different types of AM

Assignments:Refer Assignments

Model Questions:

1) Define amplitude modulation & derive equation for AM wave.
2) Define modulation index & derive equation for m.
3) Write a short note on frequency spectrum of AM wave & B/W of AM wave.
4) Explain concept of over modulation.
5) Give the expression for Average power of AM wave.
6) Write a short note on transmission efficiency of AM.
7) Explain Low level modulation & high level modulation.
8) Give the difference between Low level modulation & high level modulation.
9) Explain low level emitter modulator with the help of circuit diagram.

10) Explain with help of neat diagram & waveforms working of collector modulated class C amplifier.
11) Explain with help of neat diagram & waveforms working of grid modulated class C amplifier.
12) Explain with help of neat diagram & waveforms working of plate modulated class C amplifier.
13) Write a short note on AM transmitter.
14) Give Comparison between Sideband Suppression methods.
15) Give the Comparison between SSB, DSB, ISB and VSB.

Chapterwise Plan

Subject Title: Fundamentals of Communication Engineering

Chapter No. : 3	**Approximate Time Needed :10hrs**
Chapter Name : Angle modulation	

Lesson Schedule :

Class No.	Portion Covered per Lecture
1	Principles of frequency Modulation (AM) & phase modulation (PM)
2	Modulation index of FM & PM
3	FM Noise Triangle
4	Pre-emphasis & De-emphasis in FM
5	Direct FM Modulator
6	Indirect FM modulators
7	Direct FM Transmitters
8	Indirect FM Transmitters
9	Problems
10	problems

Objectives: The student will learn

1. Principles of frequency Modulation (AM) & phase modulation (PM)
2. FM Noise Triangle
3. Pre-emphasis & De-emphasis in FM
4. Direct & Indirect FM Modulator
5. Direct & Indirect FM transmitters

Assignments: Refer Assignments

Model Questions:

Q.1) Define FM & PM.
Q.2) Write a short note on FM noise triangle
Q.3) Explain Pre-emphasis & De-emphasis in FM
Q.4) Give the difference between Wideband & Narrowband FM
Q.5) Write a note on FM reactance modulator
Q.6) Write a note on Crosby direct FM transmitter
Q.7) Explain Phase-Locked-Loop (PLL) direct FM transmitter
Q.8) Explain Armstrong indirect FM transmitter in detail
Q.9) Give the Comparison between FM & PM
Q.10) Give the Comparison between FM & AM

Chapterwise Plan

Subject Title: Fundamentals of Communication Engineering

Chapter No. : 4	**Approximate Time Needed: 06hrs**
Chapter Name: Radio Receivers	

Lesson Schedule :

Class No.	Portion Covered per Lecture
1	Receiver Characteristics
2	TRF Receivers and Super heterodyne Receivers,
3	Choice of IF,
4	AGC in AM Receivers
5	AFC in AM Receivers
6	AGC & AFC in FM Receivers

Objectives: The student will learn

1. Receiver Characteristics.
2. TRF Receivers and Super heterodyne Receivers.
3. AGC & AFC in AM & FM Receivers.

Assignments: Refer Assignments

Model Questions:

Q.1) Explain Receiver Characteristics
Q.2) Explain TRF Receivers in detail
Q.3) Explain Super heterodyne Receivers in detail
Q.4) Explain Super heterodyne Receivers
Q.5) write a short note on Choice of IF
Q.6) Explain AGC in AM Receivers
Q.7) Explain AFC in AM Receivers
Q.8) Explain AGC & AFC in FM Receivers

Chapterwise Plan

Subject Title: Fundamentals of Communication Engineering

Chapter No. : 5	**Approximate Time Needed: 06hrs**
Chapter Name: Analog Pulse Modulation	

Lesson Schedule :

Class No.	Portion Covered per Lecture
1	Sampling theorem for low pass signals & band pass signals
2	Aliasing
3	Sampling Techniques
4	Modulation & Demodulation of Pulse Amplitude Modulation (PAM)
5	Modulation & Demodulation of Pulse Width Modulation (PWM)
6	Modulation & Demodulation of Pulse Position Modulation (PPM)

Objectives: The student will learn

1. Sampling theorem for low pass signals & band pass signals
2. Sampling Techniques
3. Modulation & Demodulation of Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM) & Pulse Position Modulation (PPM)

Assignments: Refer Assignments

Model Questions:

Q.1) Give the Sampling theorem for low pass signals with proof
Q.2) Write a short note on Aliasing
Q.3) Explain different Sampling Techniques
Q.4) Write short note on
  a) PWM
  b) PAM
  c) PPM
Q.5) Give the Comparison between PAM, PWM & PPM

Chapterwise Plan

Subject Title: Fundamentals of Communication Engineering

Chapter No. : 6	**Approximate Time Needed :10hrs**
Chapter Name : Digital Pulse Modulation	

Lesson Schedule :

Class No.	Portion Covered per Lecture
1	Comparison of digital signal transmission and analog signal transmission
2	Pulse- code modulation (PCM) -Principle
3	Pulse- code modulation (PCM) – Sampling
4	Pulse- code modulation (PCM) – Quantizing, DR
5	Pulse- code modulation (PCM) -Coding Methods
6	Delta Modulation (DM):
7	Adaptive Delta Modulation (ADM)
8	Comparison between PCM, DM & ADM
9	Frequency-Division Multiplexing (FDM)
10	Time-Division Multiplexing (TDM)

Objectives: The student will learn

1. Pulse- code modulation (PCM)
2. Delta Modulation (DM) & Adaptive Delta Modulation (ADM)
3. Frequency-Division Multiplexing (FDM) &Time-Division Multiplexing (TDM)

Assignments: Refer Assignments

Model Questions:

Q.1) Explain PCM in detail

Q.2) Write a short note on DM & ADM

Q.3) Write a short note on FDM & TDM

Q.4) Give the comparison between FDM & TDM.

SE ETRX Sem-IV 10/6/2014

Fundamentals of C.E.

QP Code : NP-19833

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No. 1 is **compulsory**.
(2) Solve any **three** questions from the remaining **five** questions.
(3) Assume **suitable** data if **necessary**.

1. Give brief answers to any **four** of the following :– **20**
   (a) Explain ground wave propagation of electromagnetic radiations.
   (b) Draw the spectrum of an amplitude modulated wave and explain its components.
   (c) Give advantages and disadvantages of SSB over full carrier DSB amplitude modulated wave.
   (d) Discuss the factors that influence the modulation index of an FM wave.
   (e) How is adaptive delta modulation superior to delta modulation ?

2. (a) What is a DSBSC wave ? Explain its generation using balanced modulator. **10**
   (b) Discuss the factors that influence the choice of IF in superheterodyne receivers. **5**
   (c) The maximum deviation allowed in a FM broadcast system is 75 kHz. If the modulating signal is a single tone sinusoidal of frequency 15 kHz, find the bandwidth of the FM signal. How does the bandwidth change if the modulating frequency is doubled ? **5**

3. (a) How can you use a varactor diode in the generation of FM wave ? Explain in detail. **10**
   (b) List out the advantages and disadvantages of FM over AM. **5**
   (c) Calculate the thermal noise power available from any resistor at a temperature of 290 K for a bandwidth of 1 MHz. Calculate also the corresponding noise voltage if the resistance, R = 100 Ω. **5**

4. (a) Draw the PAM, PWM and PPM waveforms in time domain assuming a sinusoidal modulating signal. Explain them in brief. **10**
   (b) What do you understand by signal multiplexing ? Explain TDM and FDM with suitable examples. **10**

5. (a) Explain the working of a superheterodyne receiver with the help of a neat block diagram. Show the waveforms at the output of each block. **10**
   (b) Compare analog and digital transmission systems. **5**
   (c) What is VSB ? Mention its application. **5**

6. Write short notes on any **four** of the following :– **20**
   (a) Pre-emphasis and de-emphasis
   (b) Automatic gain control
   (c) Ratio detector
   (d) Electromagnetic spectrum
   (e) Noise figure.

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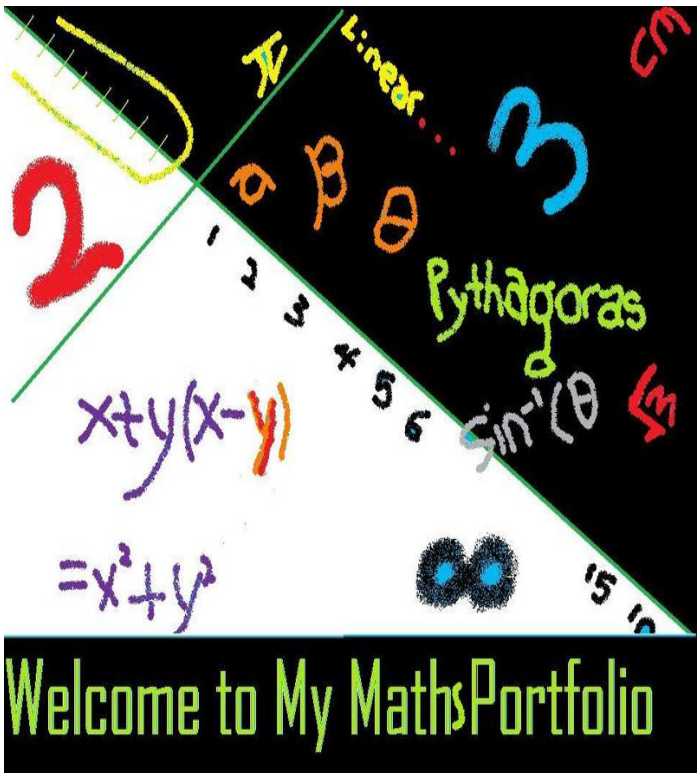
Con. 13341-14.



FH-2015

APPLIED MATHEMATICS-IV

PADMABHUSHAN VASANTDADA PATIL PRATISHTHAN'S
COLLEGE OF ENGINEERING
SINCERITY
SACRIFICE
SYSTEM
1990
Empower The Knowledge

Mrs.AARTI KURKURE

Subject Plan

APPLIED MATHEMATICS

COURSE TITLE : APPLIED MATHEMATICS-IV

COURSE CODE : EXC 401

SEM : IV (FH 2015)

PRE-REQUISITE : **The students should have the basic knowledge of Algebra, Differential and integral calculus.**

NO. OF LECTURES/WEEK: 04 **NO. OF TUTURIALS/WEEK: 01**

SUBJECT INCHARGE: A. D. KURKURE

OBJECTIVES

This course will present the method of calculus of variations (CoV), basic concepts of vector spaces, matrix theory, concept of ROC and residue theory with applications.

- To provide students with a sound foundation in mathematics and prepare them for graduate studies in Electronics Engineering
- To provide students with mathematics fundamental necessary to formulate, solve and analyze engineering problems.
- To provide opportunity for students to work as part of teams on multi disciplinary projects.

OUTCOMES

Students will able to apply method of calculus of variations to specific systems, demonstrate ability to manipulate matrices and compute eigenvalues and eigenvectors, Identify and classify zeros, singular points, residues and their applications.

- Students will demonstrate an ability to identify formulate and solve communication Engineering problem using applied mathematics.
- Students can also participate and succeed in competitive exams like GATE, GRE.

OUTCOME :

LEARNING RESOURCES: -

RECOMMENDED BOOKS: -

1A Text Book of Applied Mathematics Vol. I & II byP.N.Wartilar & J.N.Wartikar, Pune, Vidyarthi

Griha Prakashan., Pune
2. Mathematical Methods in Science and Engineering ,ADatta (2012)
3. Higher Engg. Mathematics by Dr. B.S. Grewal, Khanna Publication
4. Todd K.Moon and Wynn C. Stirling, Mathematical Methods and algorithms for Signal Processing,
Pearson Education..
5. Kreyszig E., Advanced Engineering Mathematics, 9th edition, John Wiley, 2006.
6. Linear Algebra Hoffman & Kunze (Indian editions) 2002
7. Linear Algebra Anton & Torres(2012) 9th Indian Edition.
8. Complex Analysis – Schaum Series.

COURSE MATERIALS MADE AVAILABLE

7. Course instructional objectives & outcomes

8. Syllabus

9. Modulewise Question Bank

Evaluation :

Theory Exam	80 M
Internal assessment:-. The average marks of Mid-term test (20 M) & End-term test (20 M) will be considered as final IA marks	20 M
Term Work	25 M
Total	120 M

Modulewise Plan

Subject Title: APPLIED MATHEMATICS-IV

Module : 1

Chapter Name : Linear Algebra: Matrix Theory

Approximate Time Needed : 15 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Characteristic equation, Eigen values and Eigen vector
2	properties of Eigenvalues and Eigen vectors
3	Problems on Eigen values and Eigen vector
4	Cayley-Hamilton theorem, examples based on verification of Cayley-Hamilton theorem
5	Problems on Cayley-Hamilton theorem
6	Similarity of matrices, Diagonalisation of matrix
7	Similarity of matrices, Diagonalisation of matrix
8	derogatory and non-derogatory matrices
9	Functions of square matrix
10	Functions of square matrix
11	Quadratic forms over real field, reduction Quadraticform to a diagonalcanonical form, rank, index, signature of quadratic form,
12	Sylvester's law of inertia, value-class of a quadratic form of definite, semi- definite and indefinite
13	Sylvester's law of inertia, value-class of a quadratic form of definite, semi- definite and indefinite

Objectives:

Become familiar with the concept of Eigen values and Eigen vector

Lesson Outcome:

Students will able to calculate Eigen values and Eigen vector

Model Questions:

1 Find the eigen values and eigen vectors of the following matrices**:**

(i) $\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ **(ii)** $\begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

(iii) $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ **(iv)** $\begin{bmatrix} 2 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 3 & 4 \end{bmatrix}$

(v) $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ **(vi)** $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$

(vii) $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ **(viii)** $\begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$

2 Prove that Eigen values of a hermitian matrix are real.

3 Prove that Eigen values of a real symmetric matrix are all real .

4 Prove that Eigen values of a skew Hermitian matrix are either purely imaginary or zero.

5 Prove that the Eigen values of a Unitary matrix are of unit modules

6 Prove that the Eigen values of a real symmetric matrix are purely imaginary or zero.

7 Show that the matrices A and A' have the same eigen values.

8 If λ is an eigen value of A then show that $\overline{\lambda}$ is an eigen value of A^{θ}.

9 If $\lambda_1, \lambda_2 .....\lambda_n$ are eigen values of A then show that $k_1\lambda_1, k_2\lambda_2 .....k_n\lambda_n$ are the eigen values of KA.

10 If $\lambda_1, \lambda_2 .....\lambda_n$ are eigen values of A then show that $\frac{1}{\lambda_1}, \frac{1}{\lambda_2} ..... \frac{1}{\lambda_n}$ are the eigen values of A^{-1}

11 If λ is an eigen values of a matrix with corresponding eigen vector X prove that λ^n

is an eigen values of A^n with corresponding eigen vector X.

12 If λ is an eigen value of a non singular matrix A then show that $\frac{|A|}{\lambda}$ is an eigen value of adjA.

13 If A = $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$, find the characteristic roots and characteristic vectors of $A^3 + I$.

14 Prove that the eigen values of $\begin{bmatrix} \frac{(1+i)}{2} & \frac{-(1-i)}{2} \\ \frac{(1+i)}{2} & \frac{(1-i)}{2} \end{bmatrix}$ are of unit modulus .

15 Find the sum and product of the eigen values of $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 5 & 6 \\ 7 & 4 & 3 & 2 \\ 4 & 3 & 0 & 5 \end{bmatrix}$.

16 Using Cayley – Hamilton theorem , find the inverse of the following matrices

(i) $\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ (ii) $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

(iii) $\begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{bmatrix}$ (iv) $\begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$

v. $\begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$ hence find A^{-2}

17 Find the characteristic equation of the matrix A = $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and use it to find the matrix represented by $A^5 + 5A^4 - 6A^3 + 2A^2 - 4A + 7I$.
Also express $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ as a linear polynomial in A.

18 Find the characteristic equation of the matrix A = $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and use it to find the matrix represented by $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$.

19 Show that the following matrices are Diagonalizable . Find the transforming matrix and the Diagonal matrix .

(i) $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ (ii) $\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$

(iii) $\begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ (iv) $\begin{bmatrix} 1 & -6 & -4 \\ 0 & 4 & 2 \\ 0 & -6 & -3 \end{bmatrix}$

20 Show that the matrix A = $\begin{bmatrix} 2 & 3 & 4 \\ 0 & 2 & -1 \\ 0 & 0 & 1 \end{bmatrix}$ is not similar to a diagonal matrix.

21 If A = $\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ and $\begin{bmatrix} 2 & 0 \\ 1/2 & 2 \end{bmatrix}$ prove that both A and B are not diagonable but AB is diagonal.

22 If A = $\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ find A^{50}

23 Find $e^{A} and 4^{a}$ if A = $\begin{bmatrix} 3/2 & 1/2 \\ 1/2 & 3/2 \end{bmatrix}$

24 If A = $\begin{bmatrix} -1 & 4 \\ 2 & 1 \end{bmatrix}$, then prove that 3tanA = A tan3.

25 If A = $\begin{bmatrix} \pi & \pi/4 \\ 0 & \pi/2 \end{bmatrix}$,find cosA.

26 If A = $\begin{bmatrix} 1 & 2 & -2 \\ 0 & 2 & 1 \\ 0 & 0 & -1 \end{bmatrix}$ find A^{100}.

27 Show that the matrix A = $\begin{bmatrix} 5 & -6 & -6 \\ -1 & 4 & 2 \\ 3 & -6 & -4 \end{bmatrix}$ is derogatory.

28 Show that the matrix A = $\begin{bmatrix} 7 & 4 & -1 \\ 4 & 7 & -1 \\ -4 & -4 & 4 \end{bmatrix}$ is derogatory.

29 Show that the matrix A = $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{bmatrix}$ is non- derogatory.

30 Show that the matrix A = $\begin{bmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$ is non – derogatory.

31 Find eigen values and eigen vectors of A^3 where A = $\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$. Is A derogatory ?

Find the value of μ which satisfies the equation $A^{100}X = \mu X$ where A= $\begin{bmatrix} 2 & 1 & -1 \\ 0 & -2 & -2 \\ 1 & 1 & 0 \end{bmatrix}$

51) Show that the following quadratic form $q = X^T AX$

(a) $6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4zx$ is positive definite

(i) using congruent reduction (ii) using orthogonal reduction

(b) $8x^2 + 7y^2 + 3z^2 - 12xy - 8yz + 4zx$ to a sum of squares and find the corresponding linear transformation , rank, index and signature **(M-08)**

(c) $21x_1^2 + 11x_2^2 + 2x_3^2 - 30x_1x_2 + 12x_1x_3 - 8x_2x_3$ find the canonical from by congruent reduction and find the rank, index, signature and value class;write the linear transformation which brings about the normal reduction;find a non-zero set of values of x,y,z which makes the quadratic from 0(is positive semi-definite) **(M-09)**

(d) $2x_1^2 + x_2^2 - 3x_3^2 - 4x_1x_3 + 12x_1x_2 - 8x_2x_3$ is indefinite by reducing it to the canonical form; find the rank, index, signature and value class on each case**(M-07, D-09,D-10)**

52) Reduce the following quadratic form $q = X^T AX$

(a) $3x^2 + 5y^2 + 3z^2 - 2xy - 2yz + 2zx$ to canonical form by orthogonal transformation and hence find the rank, index and signature **(D-07)**

(b) $5x^2 + 26y^2 + 10z^2 + 6xy + 4yz + 14zx$ to the canonical form by congruent reduction and find the rank, index, signature and value class; find a non-zero set of values of x, y, z which makes the quadratic from 0

(c) $3x_1^2 + 3x_3^2 + 4x_1x_2 + 8x_1x_3 + 4x_2x_3$ to the form $\lambda_1^2 x_1^2 + \lambda_2^2 x_2^2 + \lambda_3^2 x_3^2$ **(D-05)**

(d) $2x^2 + 9y^2 + 6z^2 + 8xy + 8yz + 6zx$ to sum of squares form by linear transformation and find the rank, index and signature**(D-08)**

53) Find the rank, index, signature and value class of the quadratic form $x^2 - 2y^2 + 3z^2 - 4yz + 6zx$ **(D-06)**

Modulewise Plan

Subject Title: APPLIED MATHEMATICS-IV

Module : 2

Chapter Name : Complex Variables: Integration

Approximate Time Needed : 15 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Line Integral,
2	Line Integral
3	Cauchy's Integral theorem for simply connected region Cauchy's Integral formula
4	Cauchy's Integral formula
5	Taylor's and Laurent's series
6	Taylor's and Laurent's series
7	Zeros, singularities, poles of f(z), residues
8	Cauchy's Residue theorem
9	Applications of Residue theorem to evaluate real Integrals
10	Applications of Residue theorem to evaluate real Integrals
11	Miscellaneous problems

Objectives:

To understand concept of complex integration

Lesson Outcomes:

The student will be able to Identify and classify zeros, singular points, residues and their application

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Model Ques

COMPLEX INTEGRATION

1 Evaluate the integral $\int_0^{1+i}(x-y+ix^2)dz$

(i) along the line from z = 0 to z = 1+i. $(\frac{1}{3}(i-1))$

(ii) along the real axis from z = 0 to z = 1 and then along the line parallel to the imaginary axis from z = 1 to z = 1+i. $(\frac{1}{2}+\frac{5}{6}i)$

(iii) along the imaginary axis from z =0 to z = i and then along the line parallel to the real axis from z = i to z=i+1**.** $(\frac{1}{2}-\frac{i}{6})$

(iv) Along the parabola $y^2 = x$. $(\frac{11}{30}+\frac{i}{6})$

2 Evaluate $\int_{1-i}^{2+i}(2x+iy+1)dz$ along (i) the straight line joining (1-i) to (2+i), (ii) x = t+1 ,y = $2t^2-1$.

(4(1+2i); 4+$\frac{25}{3}i$)

3 Evaluate $\int_0^{1+i} z^2\,dz$ along (i) the line y=x (ii) the parabola x = y^2 .Is the line integral independent of the path? Explain. $(\frac{2}{3}(i-1)$,analytic)

4 Evaluate $\int_c (z-z^2)dz$ where C is the upper half of the circle $|z|=1$.what is the value of the integral for

the lower half of the same circle? $(\frac{2}{3}, \frac{-2}{3})$

5 Show that $\int_C \log z dz = 2\pi i$,where C is the unit circle in the z-plane.

6 Evaluate $\int_c \bar{z} dz$, where C is the upper half of the circle r = 1. $(i\pi)$

7 Evaluate $\int_c z^2 dz$, where C is the circle x = rcosθ, $y = r\sin\theta$,from $\theta = 0$ to $\theta = \frac{\pi}{3}$. $(\frac{-2r^3}{3})$

8 Evaluate $\int_c |z| \, dz$, along the left half of the unit circle $|z| = 1$ from z = - i to z = i. (2i)

9 Evaluate $\int (3z^2 + 2z + 1) dz$ where C is the arc of the cycloid x = a($\theta + \sin\theta$).$y = a(1 - \cos\theta)$ between $\theta = 1 to \theta = 2\pi$. $2\pi a(4\pi^2 a^2 + 2\pi a + 1)$

10 Evaluate $\int_c |z|^2 dz$, where C is the boundary of the square with vertices (0,0) ,(1,0) ,(1,1) ,(0,1). (-1+i)

11 State and prove Cauchy's Integral theorem and Cauchy's Integral Formula .

12 Evaluate $\int \frac{z+3}{z^2 - 2z + 5} dz$, where C is the circle $|z - 1| = 1$. (0)

13 Evaluate $\int_c \tan z dz$, where c is $|z| = \frac{1}{2}$ (0)

14 Evaluate $\int (8\bar{z} + 3z)\, dz$ around the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ $(6\pi a^2 i)$

15 Evaluate $\int_c \frac{e^{3z}}{z - i} dz$ where c is the curve $|z - 2| + |z + 2| = 6$. $(2\pi i e^{3i})$

16 Evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-2)(z-3)} dz$ where c is the circle $|z| = 4$. ($-4\pi i$)

17 Evaluate $\int_c \frac{z^2}{z^4 - 1} dz$, where c is the circle (i) $|z| = \frac{1}{2}, (ii)|z - 1| = 1, (iii)|z + i| = 1$ (0 , $\frac{\pi i}{2}$, $\frac{-\pi}{2}$)

18 Evaluate $\int_c \frac{dz}{z^3(z+4)}$ dz , where c is the circle $|z| = 2$.

19 Evaluate $\oint \frac{1}{(z^3 - 1)^2} dz$ where c is the circle $|z - 1| = 1$ $(\frac{-4\pi i}{9})$

20 Evaluate $\int \frac{z+2}{z^3 - 2z^2} dz$, where c is the circle $|z - 2 - i| = 2$ $(2\pi i)$

21 Evaluate $\int_c \frac{4z - 1}{z^2 - 3z - 4} dz$, where c is the ellipse $x^2 + 4y^2 = 4$. $(2\pi i)$

22 If f(ξ) $= \int_c \frac{3z^2 + 2z + 1}{z - \xi} dz$,where c is the circle $x^2 + y^2 = 4$, find the values of (i) f(3) , (ii) f'(1-i),

(iii) f'(1-i).

23 If $f(\xi) = \int \frac{4z^2 + z + 4}{z - \xi} dz$,where c is the ellipse $4x^2 + 9y^2 = 36$. Find the values of f (4) ,f (1),f (i) , f'(-1) ,f"(-i). $(0 , 18\pi i , -2\pi, -14\pi i, 16\pi i)$

24 Obtain Taylor's expansion of $f(z) = \frac{z+2}{(z-1)(z-4)}$ at z = 2.

25 Obtain Taylor's expansion of $f(z) = \frac{1-z}{z^2}$ in powers of (z-1).

26 Expand cosz as Taylor's series at $z = \frac{\pi}{2}$

27 Find Laurent's series which represents the function $f(z) = \frac{2}{(z-1)(z-2)}$ where (i) $|z| < 1$ (ii) $1 < |z| < 2$ (iii) $|z| > 2$.

28 Find all possible Laurent's expansions of the function $f(z) = \frac{7z-2}{z(z-2)(z+1)}$ about z = -1.

29 Obtain two distinct Laurent's series for $f(z) = \frac{2z-3}{z^2 - 4z - 3}$ in the powers of (z-4) indicating the region of convergence.

30 Obtain Taylor's and Laurent's expansions of $f(z) \frac{z-1}{z^2 - 2z - 3}$ indicating regions of convergence.

31 Determine the poles of the following and find the residue at each pole

(i) $\frac{3z+1}{z(z-2)}$

(ii) $\frac{z+2}{z^2(z-1)}$

(iii) $\frac{1}{(z^2+1)^3}$

32 Find the sum of the residues of the function $f(z) = \frac{\sin z}{z \cos z}$ at its poles inside the circle $|z| = 2$.

33 Evaluate $f(z) = \frac{z-3}{z^2 + 2z + 5}$, where C is the circle

(a) $|z| = 1$ (b) $|z + 1 - i| = 2$

(c) $|z + 1 + i| = 2$

33 Evaluate $\int_C \frac{e^z}{\cos \pi z}$, where C is the unit circle $|z| = 1$.

34 Evaluate $\int_c \tan z \, dz$ where C is the circle $|z| = 2$.

35 Evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2 (z-2)} dz$, where C is the circle $|z| = 3$

36 Determine the poles of the following functions and the residue at each pole: $f(z)=\dfrac{z^2-2z}{(z+1)^2(z^2+4)}$.

37 Evaluate the integrals $\oint_C \dfrac{1-2z}{z(z-1)(z-2)}\,dz$, where C is the circle $|z|=1.5$.

38 Evaluate the following integral by contour integration

(a) $\int_0^{2\pi} \dfrac{\cos 3\theta}{5-4\cos\theta}d\theta$

(b) $\int_0^{2\pi} \dfrac{\cos 2\theta}{5+4\cos\theta}d\theta$

(c) $\int_0^{2\pi} \dfrac{\cos 2\theta}{1-2a\cos\theta+a^2}d\theta,\ (0<a<1)$

(d) $\int_0^{2\pi} \dfrac{d\theta}{a+b\cos\theta}$

(e) $\int_{-\infty}^{\infty} \dfrac{x^2\,dx}{(x^2+a^2)(x^2+b^2)},\ (a>0, b>0)$

(f) $\int_{-\infty}^{\infty} \dfrac{dx}{x^4+1}$

(g) $\int_{-\infty}^{\infty} \dfrac{dx}{x^6+1}$

(h) $\int_{-\infty}^{\infty} \dfrac{x^2\,dx}{(x^2+1)(x^2+4)}$

$$\int_{-\infty}^{\infty} \frac{cos\,3x dx}{(\ x^2+1)(x^2+4)}$$

39 If f(z) = $\dfrac{\phi(z)}{\psi(z)}$,where $\phi(z)$ and $\psi(z)$ are complex polynomials of degree 2 has

(i) Pole of order 2 at z=1.

(ii) Residue at z = 1 is -1.

(iii) f (0) = f (-1) = 0 ,find f (z)

40 If f(z) = $\dfrac{\phi(z)}{\psi(z)}$,where $\phi(z)$ and $\psi(z)$ are complex polynomials of degree 3 has

(i) Pole of order 1 and 2 at z = 2, z=1 respectively.

(ii) Residue at 2 and 1 is equal to 3 and 1 respectively.

(iii) f (0) = 3/2 , f (-1) =1 ,find f (z).

Modulewise Plan

Subject Title: APPLIED MATHEMATICS-IV

Module : 3

Chapter Name : Calculus of variation

Approximate Time Needed : 10 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Euler's Langrange equation, solution of Euler's Langrange equation(only results for different cases for function) independent of a variable,
2	Euler's Langrange equation independent of another variable,
3	Euler's Langrange equation independent of differentiation of a variable and independent of both variables
4	Isoperimetric problems, several dependent variables
5	Isoperimetric problems, several dependent variables
6	Isoperimetric problems, several dependent variables
7	Functions involving higher order derivatives
8	Functions involving higher order derivatives
9	Rayleigh-Ritz method
10	Rayleigh-Ritz method

Objectives:

To understand concept of maxima and minima of Integrals

Outcome

Students in this course will apply the method of CoV to specific systems,

Model Questions:

Calculus of variation

1Find the extremals of the functional and extremum value of the following

$\int_{x_0}^{x_1} \frac{1+y^2}{y'^2}$ dx

2. $\int_{1/2}^{1}(x^2 y'^2)$dx subject to y(1/2)=1 and y(1)=2

2 $\int_0^2 (x - y')^2$ dx subject to y(1/2)=1 and y(1)=2

3 $\int_0^{\pi/2}(y'^2 - y^2)$. dx subject to y(0)= 0 and y(π/2)=1

4 .Solve the Euler's equation for $\int_{x_0}^{x_1}(x + y')y'$dx

5 .Solve the Euler's equation for $\int_{x_0}^{x_1}(1 + x^2 y')y'$dx

6 Show that an isosceles triangle has the smallest perimeter for a given area and a given base

7 .Find the surface with the smallest area which encloses agiven volume

8 .Find the extremal of the functional $\int_{t_1}^{t_2}\sqrt{(x^2 + y^2 + z^2)}$dt subject to $x^2 + y^2 + z^2$ =a^2

9 Find the extremal of the isoperimetric problem $\int_{x_0}^{x_1}(y'^2)$dx subject to $\int_{x_0}^{x_1}(y)$dx = c

10 .Find the extremal $\int_{x_0}^{x_1} 16y^2 - y'''^2 + x^2)$dx

10. Determine the function that gives the shortest distance between two points.

11.Find the extremal of $\int_{x_1}^{x_2}(y^2 - y'^2 - 2y\,coshx)$dx

12.Solve the boundary value problem $\int_0^1(2xy - y^2 - y'^2)$dx subject to y(0)= 0 and y(1)=0 by Rayleigh-Ritz method.

13.Find the plane curve of the fixed perimeter and maximum area.

Modulewise Plan

Subject Title: APPLIED MATHEMATICS-IV

Module : 4

Chapter Name : Vector Spaces

Approximate Time Needed : 12 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Vectors in n-dimensional vector space: properties, dot product, norm and distance properties in n-dimensional vector space. .
2	Vectors in n-dimensional vector space: properties, dot product, norm and distance properties in n-dimensional vector space
3	Vectors in n-dimensional vector space: properties, dot product, norm and distance properties in n-dimensional vector space
4	Metric spaces, vector spaces over real field, properties of vector spaces over real field, subspaces
5	Metric spaces, vector spaces over real field, properties of vector spaces over real field, subspaces
6	Noms and normed vector spaces
7	Norms and normed vector spaces
8	Inner products and inner product spaces
9	Inner products and inner product spaces
10	The Cauchy-Schwarz inequality, Orthogonal Subspaces,
11	Gram-Schmidt process
12	Singled valued Decomposition

Objectives:

LINEAR ALGEBRA -VECTOR SPACE

. 1. Show that the vector (2,1,4),(1,-1,2) ,(3,1,-2)forms a basis for R^3.

2 .Show that the subset S=[(1,1,) ,(3,1)]forms a basis for R^2.

3 Show that the vector (1,0,-1),(2,1,1) ,(1,2,0)forms a basis for R^3.

4 Apply the Gram –Schmidt process to the vectors (1,0,1),(1,0,-1) ,(1,3,4) to obtain an orthonormal basis for R^3 with the standard inner product.

5 Apply the Gram –Schmidt process of orthogonalisation to obtain an orthonormal basis for the subspace

Of R^4 generated by (1,1,0,1),(1,-20,0) ,and (1,0,-1,2)

6).Find which of the following are subspaces of R^3

i.W_1=Set of all ordred triplets of the form (a,2b,3c) for all a,b c ∈R

ii.W_2=Set of all ordered triplets of the form (a, 2a, 2a+1) for all a ∈R

7. Prove that {(a,b,c) ∈R^3:b=c=0} is a subspace of R^3

8 Show that S ={(a,b,c) ∈R^3:3a-b+c=0} is a subspace of R^3 but S ={(a,b,c) ∈R^3: $a^2 + b^2 + c = 4^2$} is a not subspace of R^3

9. Verify Cauchy –Schhwartz inequality for the vectors
u=(-4,2,1)& v= (8,-4,-2)

10.Construct an orthogonal basis of R^2 by applying \ Gram –Schmidt orthogonalisation to S{(3,1),(2,3)}.

11, Show That The set V of positive real numbers with operation
Addition : x+y=xy
Scalar multiplication: kx = x^k is a vector space where x,y are two real numbers and k is a scalar

12.Show That The set W=.{(1,x)/x∈ R} is a subspace of R^2 under the operation
[1,x] +[1,y]= [1,x+y] ; k[1,x] =[1,kx] ; k is a scalar.

13, Is the set W=={(a,1,1) $/a$ ∈R } is a subspace of R^3 under the usual Addition &Scalar multiplication ,

Revision & solving of question paper 06 lectures

TUTORIAL 1

(EIGEN VALUES AND EIGEN VECTORS)

1 Find the eigen values and eigen vectors of the following matrices:

(i) $\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ (ii) $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$

2 Find the characteristic equation of the matrix A = $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and use it to find the matrix represented by

$A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I.$

3 Prove that Eigen values of a hermitian matrix are real.

4 Prove that Eigen values of a real symmetric matrix are all real .

5 Prove that Eigen values of a skew Hermitian matrix are either purely imaginary or zero.

6 Prove that the Eigen values of a Unitary matrix are of unit modules.

7 Prove that the Eigen values of a real symmetric matrix are purely imaginary or zero.

8 Show that the matrices A and A' have the same eigen values.

9 Using Cayley – Hamilton theorem , find the inverse of the following matrices

(i) $\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ (ii) $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

10 If λ is an eigen value of A then show that $\overline{\lambda}$ is an eigen value of A^{θ}.

11 If λ is an eigen value of a non singular matrix A then show that $\frac{|A|}{\lambda}$ is an eigen value of adjA.

TUTORIAL 2

(, FUNCTIONS OF MATRIX, DIAGONAL & DEROGATORY MATRIX)

1 Show that the following matrices are Diagonalisable . Find the transforming matrix and the diagonal matrix .

(i) $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ (ii) $\begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$

2 Show that the matrix A = $\begin{bmatrix} 2 & 3 & 4 \\ 0 & 2 & -1 \\ 0 & 0 & 1 \end{bmatrix}$ is not similar to a diagonal matrix.

3 If A = $\begin{bmatrix} \pi & \pi/4 \\ 0 & \pi/2 \end{bmatrix}$,find cosA.

4 If A = $\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ find A^{50}

5 Show that the matrix A = $\begin{bmatrix} 7 & 4 & -1 \\ 4 & 7 & -1 \\ -4 & -4 & 4 \end{bmatrix}$ is derogatory.

6 Show that the matrix A = $\begin{bmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$ is non – derogatory.

TUTORIAL 3

(LINE INTEGRAL AND CAUCHY'S THEOREM)

1 Evaluate $\int_{1-i}^{2+i}(2x+iy+1)dz$ along (i) the straight line joining (1-i) to (2+i),

(ii) x = t+1 ,y = $2t^2-1$.

2 Evaluate $\int_{0}^{3+i} z^2\,dz$ (i) along the parabola x = $3y^2$ (ii) along the real axis from 0 to 3 and then vertically to 3+i. (iii) along the imaginary axis from 0 to i and then horizontally to 3+I Is the line integral independent of the path? Explain.

3 Evaluate $\int_c (z-z^2)dz$ where C is the upper half of the circle $|z|=1$.what is the value of the integral for the lower half of the same circle?

4 State and prove Cauchy's Integral theorem and Cauchy's Integral Formula .

5 Evaluate $\int_c \frac{\sin \pi z^2+\cos \pi z^2}{(z-2)(z-3)}dz$ where c is the circle $|z|=4$.

6 Evaluate $\int \frac{z+3}{z^2-2z+5}dz$, where C is the circle $|z-1|=1$.

7 Evaluate $\int_c \frac{dz}{z^3(z+4)}$ dz , where c is the circle $|z|=2$

8 If f (ξ) = $\int \frac{4z^2+z+4}{z-\xi}$ dz ,where c is the ellipse $4x^2+9y^2=36$. Find the values of f (4) ,f (1), f (i) , f'(-1) ,f"(-i).

9 Evaluate $\int \frac{z+2}{z^3-2z^2}$dz, where c is the circle $|z-2-i|=2$

10 Evaluate $\int_c \frac{4z-1}{z^2-3z-4}$dz, where c is the ellipse $x^2+4y^2=4$.

TUTORIAL 4

(TAYLOR'S AND LAURENTS SERIES & RESIDUES)

1 Obtain Taylor's expansion of f (z) = $\frac{\mathbf{1}}{\mathbf{(z-1)(z-3)}}$ about the point z = 4. Find the region of convergence.

2 Find all possible Laurent's expansions of the function f(z) = $\frac{7z-2}{z(z-2)(z+1)}$ about z = -1.

3 Determine the poles of the following functions and the residue at each pole:

$$f(z)=\frac{z^2-2z}{(z+1)^2(z^2+4)}.$$

4 State and prove Cauchy's Residue theorem.

5 If f(z) = $\frac{\phi(z)}{\psi(z)}$,where $\phi(z)$ and $\psi(z)$ are complex polynomials of degree 2 has

(i) Pole of order 2 at z=1.

(ii) Residue at z = 1 is -1.

(iii) f (0) = f (-1) = 0 ,find f (z)

6 Evaluate using Cauchy's Residue theorem $f(z)=\frac{z-3}{z^2+2z+5}$, where C is the circle

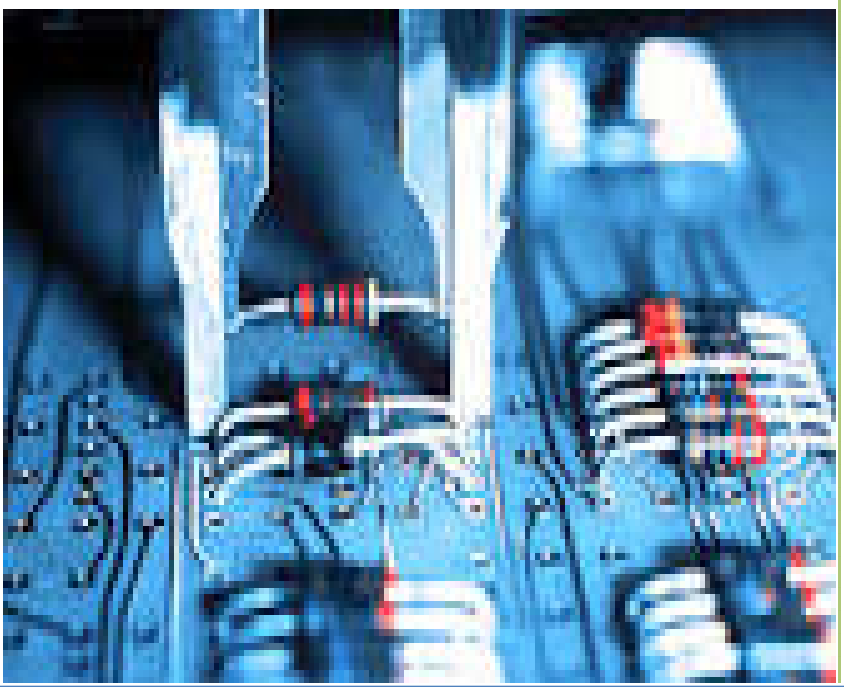
(a) $|z|=1$ (b) $|z+1-i|=2$

(c) $|z+1+i|=2$

7 Evaluate the following integral by contour integration

(a) $\int_0^{2\pi}\frac{\cos 3\theta}{5-4\cos\theta}d\theta$ (b) $\int_0^{2\pi}\frac{\cos 2\theta}{5+4\cos\theta}d\theta$

(c) $\int_{-\infty}^{\infty}\frac{x^2\,dx}{(x^2+1)(x^2+4)}$ (d) $\int_{-\infty}^{\infty}\frac{dx}{x^4+1}$



FH-2015

DISCRETE ELECTRONICS CIRCUITS

Mrs.RADHA WANODE

Subject Plan

GROUP NAME : ELECTRONIC DEVICES & CIRCUITS
COURSE TITLE: Discrete Electronic Circuit **COURSE CODE : EXC 402** **SEM : IV (FH 2015)**
PRE-REQUISITE : Electronic Devices

OBJECTIVES:

1. To understand DC biasing needed for various applications.
2. To understand DC and AC models of semiconductor devices and usefulness of the devices for various applications like amplifiers, oscillators etc.
3. To apply concepts of DC and AC modeling of semiconductor devices for the design and analysis.
4. To understand theoretical concepts and verify through laboratory and simulation experiments.
5. To deliver the core concepts and reinforce the analytical skills learned in Electronic Devices
6. To motivate students to use MOS devices for designing and analyzing electronic circuits which will help them to understand the fundamentals required for further part of Engineering

OUTCOME:

1. Students will be able to understand and the usefulness of semiconductor devices in circuit making.
2. Students will be Able to perform dc and ac analysis of the basic electronic circuits useful to conclude an application based on these.
3. They will be able to analyze and design multistage electronic circuits.
4. Mainly understanding of discrete and integrated biasing will be understood and very useful for mixed mode designs..
5. They will understand the difference between small signal and large signal amplifiers.
6. They will be able to use these basic circuits to develop various useful applications.

LEARNING RESOURCES: -

RECOMMENDED BOOKS: -

1. Donald A. Neamen, “Electronic Circuit Analysis and Design”, TATA McGraw Hill, 2nd Edition
2. Adel S. Sedra, Kenneth C. Smith and Arun N Chandorkar,” Microelectronic Circuits Theory and Applications”, International Version, OXFORD International Students Edition, Fifth Edition.
3. David A. Bell, “Electronic Devices and Circuits”, Oxford, Fifth Edition.
4. S. Salivahanan, N. Suresh Kumar,“Electronic Devices and Circuits”, Tata McGraw Hill,3rd Edition
5. Jacob Millman, Christos C Halkias, and Satyabratata TIT, “Millman’s Electronic Devices and Circuits”, McGrawHill, 3rd Edition
6. Muhammad H. Rashid, “Microelectronics Circuits Analysis and Design”, Cengage Learning, 2nd Edition
7. Jacob Millman and Arvin Grabel, “Mircroelectronics”, Tata McGraw-Hill Second Edition

COURSE MATERIALS MADE AVAILABLE

1. Course instructional objectives & outcomes
2. Syllabus
3. Chapter wise Question Bank

Evaluation:

Theory Exam	80 M
Internal assessment:-. The average marks of Mid-term test (20 M) & End-term test (20 M) will be considered as final IA marks	20 M
Practical Exam	50 M
Term Work	25 M
Total	175 M

List of Experiments

Atleast 10 experiments based on the entire syllabus

Expt. No.	Name of the Experiments
1	To study clamper circuits
2	To study series and shunt clipper circuit
3	To observe and study the Q- point variation for change in BC fixed bias and voltage divider of BJT by using LT-spice.
4	To observe and study the DC analysis of JFET by using LT-spice.
5	To study frequency response for variation in voltage for different values of frequencies
6	To perform RC phase shift oscillator
7	To perform Darlington pair
8	to perform the differential amplifier single input balance putout
9	to perform class AB power amplifier
10	To study the circuit of Hartley Oscillator.
11	To study the circuit of Collpitts or LC Oscillator & Determine the frequency of Oscillator .

Chapter wise Plan

Subject Title: Discrete Electronic Circuits

Chapter No. : 1

Chapter Name : Bipolar device based circuit analysis

Approximate Time Needed : 8 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Analytical analysis of Single level clippers
2	Double level Clippers and clampers
3	DC load line and region of Operation, Common Bipolar Transistor Configurations
4	Single base resistor biasing, voltage divider biasing and bias stability
5	Analysis and Design of biasing circuits
6	Graphical Analysis and AC Equivalents Circuits
7	Small Signal hybrid-pi model, early effect
8	Common-Emitter Amplifiers, Common-Collector Amplifiers, Common-Base Amplifiers

Objectives:

1. Become familiar with the Different types of clipper and clamping ckts.
2. Analyze Different types of biasing
3. Need of dc biasing.
4. Understand basic AC analysis of BJT.
5. Analyze Designing of BJT.

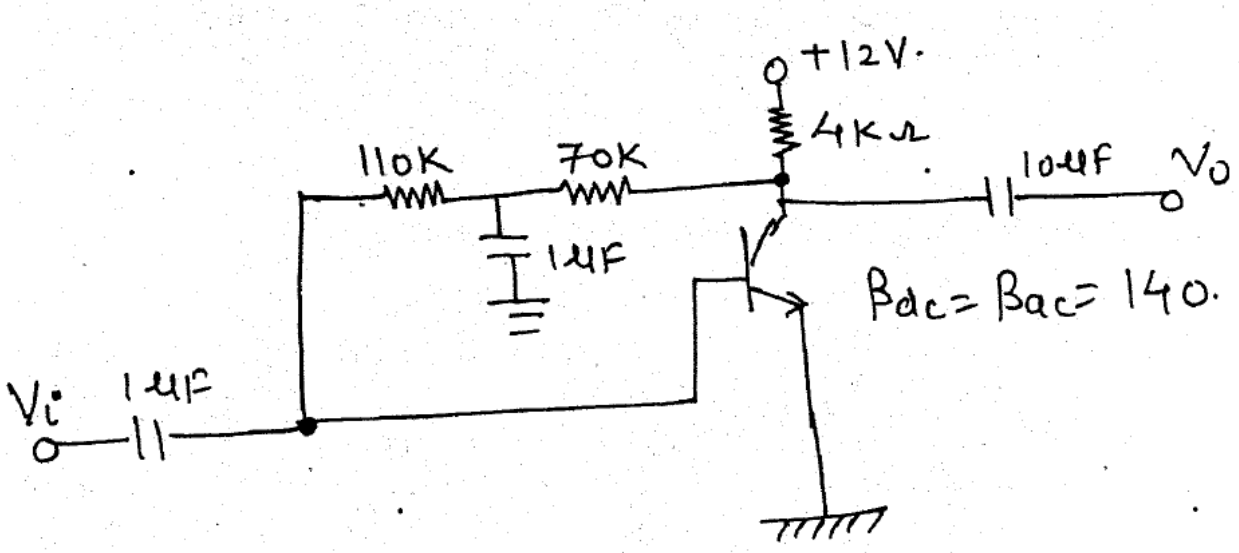
Model Questions:

1. Compare between clipping and clamping circuits.
2. Explain bias stabilization of BJT.

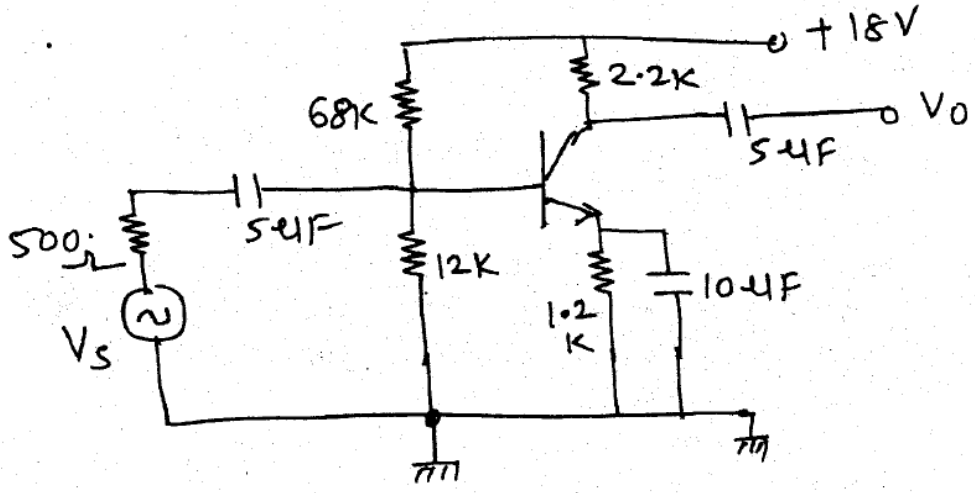
3. Explain thermal runway in BJT.
4. Explain BJT as switch.
5. Explain voltage doublers.
6. Calculate ICQ & VCEQ.
7. Design a single stage CE amplifier with following specifications :

AV>=120, S=<8, Vcc=24V, RL=10k, iCQ=3ma

8. Determine Iceq, Vceq.

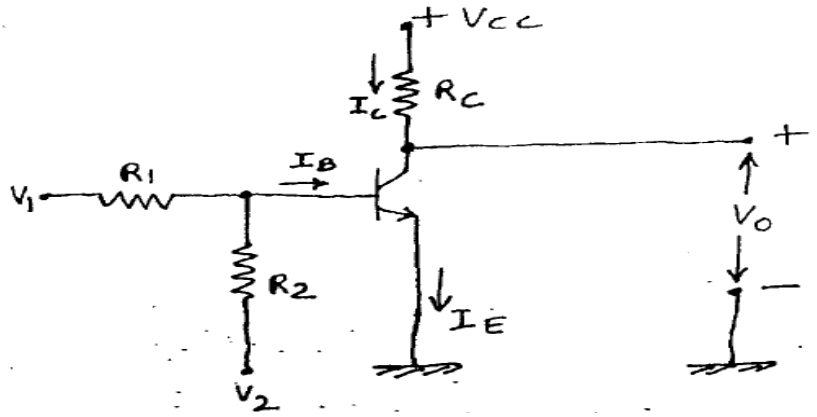


9. Determine Zi, Zo, Av,Avs for following network



For BJT
h_{fe} = 180
h_{oe} = 25 μs

10. Determine Zi, Zo, Av,Avs for following network



11. Design a single stage CE amplifier with following specifications Av>=100, VO=3V, s<=10, FL=15Hz.
12. Design a single stage CE amplifier with following specifications Av>=170, Vo=6Vrms, s<=10, FL=20Hz.
13. Draw CE rπ model with RE unbypassed and derive expression for input impedance, output impedance and voltage gain.

Chapter wise Plan

Subject Title: Discrete Electronic Circuits

Chapter No. : 2

Chapter Name : Field Effect devices based circuit analysis

Approximate Time Needed : 10 hrs

Lesson Schedule :

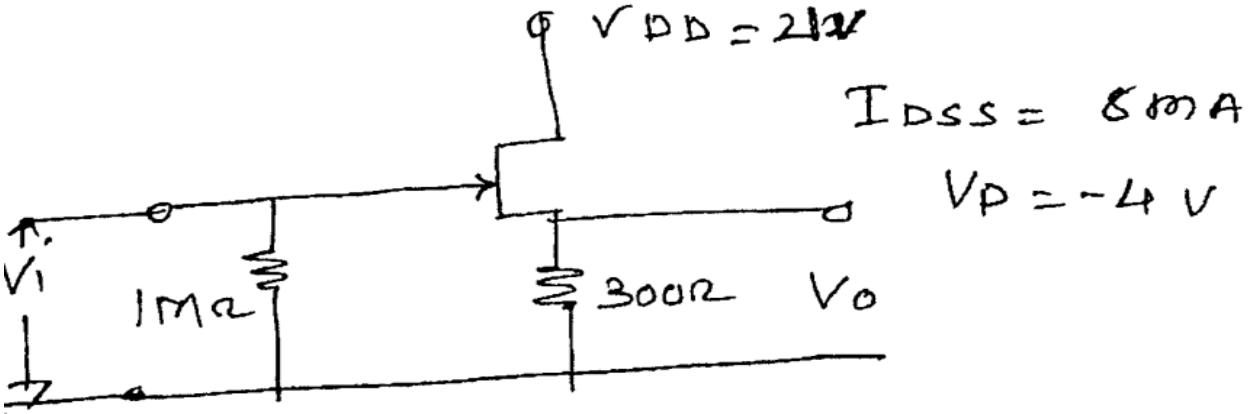
Lecture No.	Portion covered per hour
9	DC Circuit Analysis
10	Junction Field Effect Transistor (JFET): Self bias, Voltage divider bias
11	Design and Analysis of Biasing Circuits
12	Metal-Oxide Field Effect Transistor (MOSFET): Common-Source circuits, DC load line and region of operation
13	Common-MOSFETs configurations, Analysis and Design of Biasing Circuits
14	AC Analysis
15	JFET Amplifiers: Small-Signal Equivalent Circuit, Small-Signal Analysis
16	MOSFET Amplifiers: Graphical Analysis, load line and Small-Signal parameters
17	AC Equivalent Circuit, Small-Signal Model
18	Common-Source, Source Follower, Common Gate

Objectives:

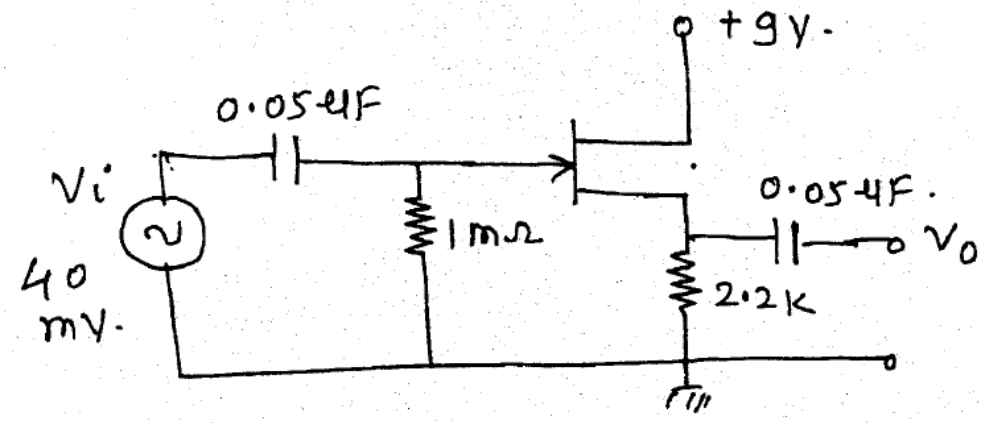
1. To understand Baising of JFET.
2. Designing of JFET.
3. AC analysis of JFET & MOSFET

Model Questions:

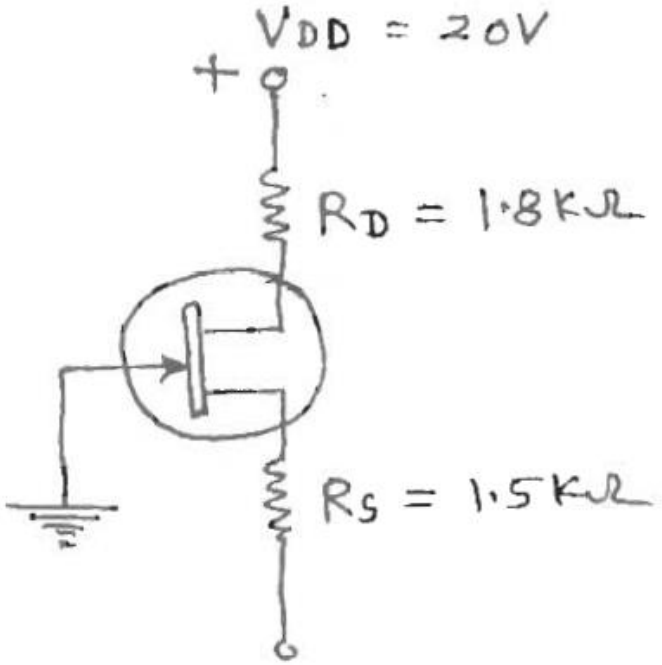
1. Draw neat diagram of CS amplifier. Derive voltage gain, current gain and ip impedance.
2. Derive condition for zero drift biasing for JFET.
3. Which biasing method cannot be used for D-MOSFET & why?
4. Explain different biasing methods for E-MOSFET.
5. Determine Av, Ri and Ro for the circuit shown in figure.



6. Calculate voltage gain and input and output impedance for following circuit.



For JFET
I_{DSS} = 16 mA
V_P = –4 V
Y_{OS} = 25 μs



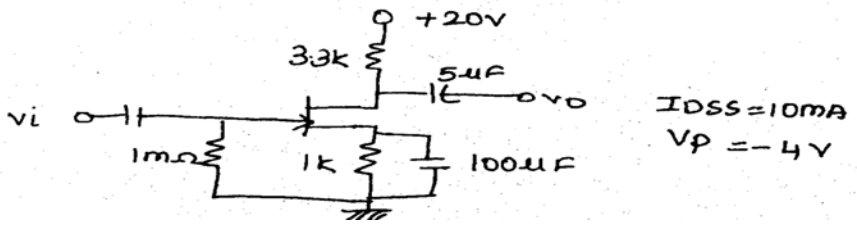
(1) I_{DQ} and V_{GSQ}
(2) V_{DS}
(3) V_D
(4) V_S

V_{SS} = –10V.

7. Given that Idss=9ma, & Vp=-3V

8. Derive the equations for Av, Zi, Z0

and determine Av, Zi and Z0 for a given network



Chapterwise Plan

Subject Title: Discrete Electronic Circuits

Chapter No. : 3

Chapter Name : Multistage analysis and Frequency Analysis of Amplifiers

Approximate Time Needed : 10 hrs

Lesson Schedule :

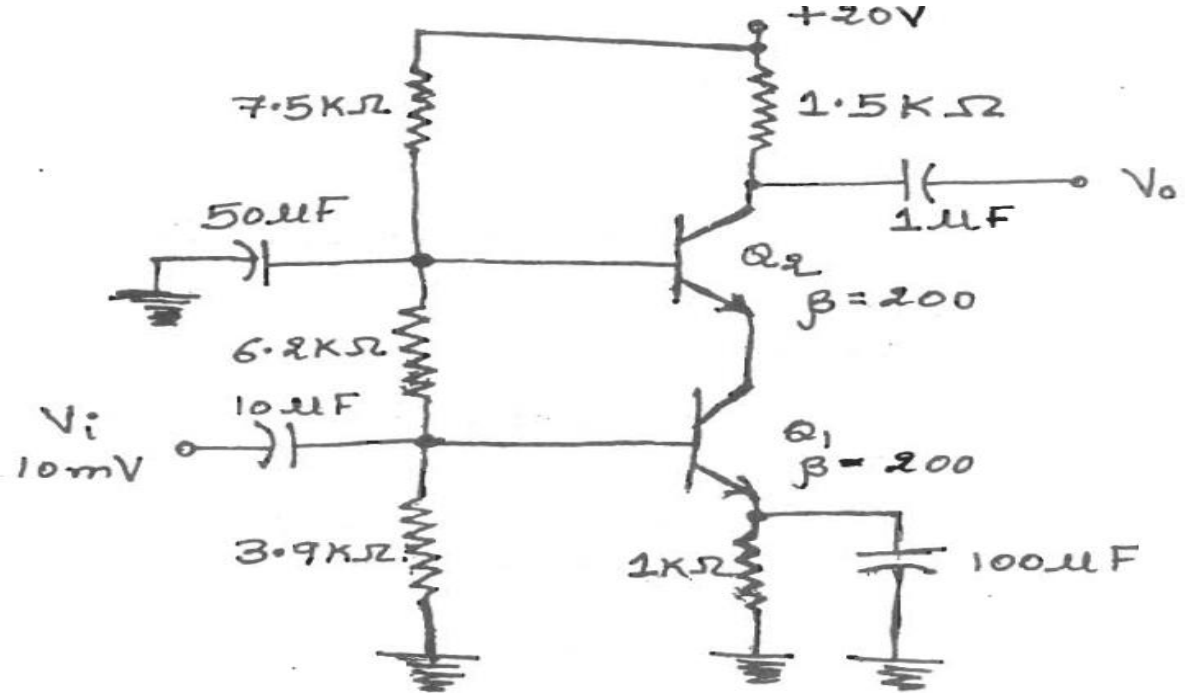
Lecture No.	Portion covered per hour
19	Multistage (CS-CS)
20	(CS-CE) cascode (CS-CG) Amplifiers
21	Darlington pair
22	Effect of capacitors (coupling, bypass, load) on frequency response of JFET
23	MOSFET Amplifiers
24	High frequency hybrid-pi equivalent circuits of MOSFET
25	Miller Effect and Miller capacitance
26	Unity gain bandwidth
27	Low and high frequency response of single stage (CS,CG, CD
28	Multistage (CS-CS).

Objectives:

1. Learn the basic concepts and the limitations of Amplifier
2. Need of multistage amplifiers.
3. Different criteria for selection of amplifier.
4. How to select two different stages based on requirement.
5. Designing of two stage amplifiers.

Model Questions:

1. Write a short note on Darlington pair Cascade amplifier.
2. Design a two stage CS amplifier with the help of BFW11with Av=49, FL>=15Hz, VO=3v.
3. Design a two stage CS amplifier with the help of BFW11with Av=150, FL>=20Hz, VO=2.5v. Use self-bias circuit with Idq=Idss/4.
4. Design a two stage CE amplifier with with Av=3000, Vo=2.5v, S=8.
5. Design a two stage RC coupled amplifier with with Av=3000, Vo=2.5v, S=8, FL>=15Hz, Ri>=1M, Vcc=6v.
6. For following circuit find out vb1, VB2 & Vc2



7. For following circuit determine

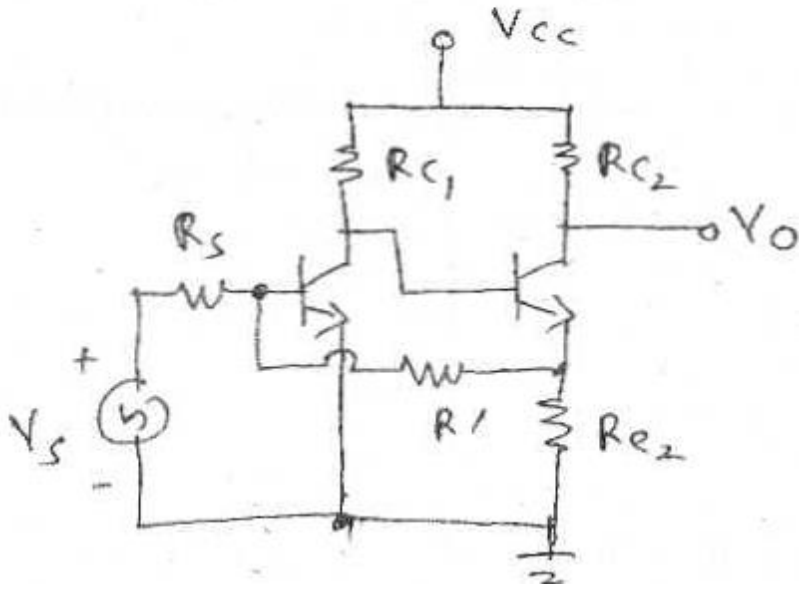
A Feedback factor β, A_{Vf}, Identify feedback type

B R_{in}, R_{inf}

C R_o, R_{of}

$RC_1 = 3$ K, $RC_2 = 500\ \Omega$, $R' = R_S = 1{\cdot}2$ KΩ

$RC_2 = 50\ \Omega$, $h_{ie} = 1{\cdot}1$ K, $h_{fe} = 50$, $V_{CC} = 15$ V.



Chapter wise Plan

Subject Title: Discrete Electronic Circuits

Chapter No. : 4

Chapter Name : Feedback Amplifiers and Oscillators

Approximate Time Needed : 08 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
29	Types of Negative Feedback, block diagram representation
30	Effect of negative feedback on Input impedance, Output impedance
31	Gain and Bandwidth with derivation, feedback topologies
32	Positive feedback and principle of oscillations, RC oscillators: Phase shift
33	Wien bridge
34	LC Oscillators: Hartley, Colpitts and clapp, Tunned Oscillator
35	Twin T Oscillator
36	Crystal Oscillator (BJT circuit analysis).

Objectives:

1. Different types of feedback system.
2. Operating principal of oscillator.
3. Analyze the Different types of oscillators.

Model Questions:

1. Explain miller input and output capacitance for inverting & non inverting amplifier.
2. Compare different types of –ve feedback amplifiers.
3. Explain RC phase shift oscillator.
4. With the help of example explain how Barkhesuean criteria can be applied to oscillator.
5. What are the characteristics of –ve fb amplifiers?

6. Give the classification of oscillator, explain any high frequency oscillator.
7. Explain crystal oscillator.
8. Explain wein bridge oscillator.

Chapter wise Plan

Subject Title: Discrete Electronic Circuits

Chapter No. : 5

Chapter Name : Differential Amplifiers

Approximate Time Needed : 10 hrs

Lesson Schedule :

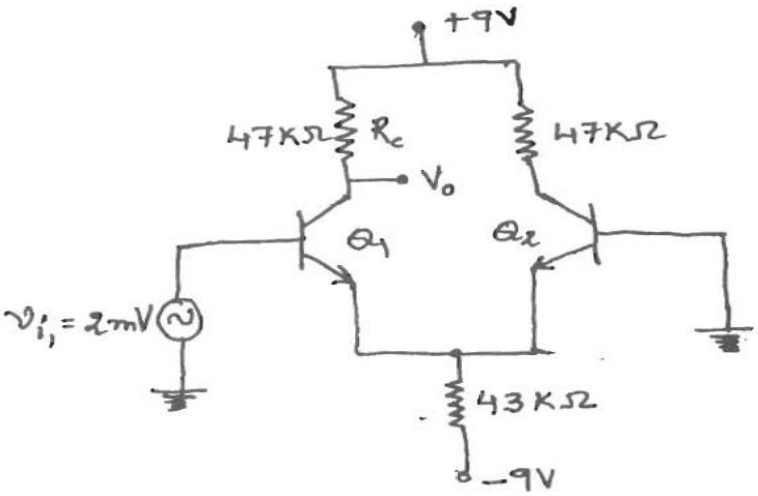
Lecture No.	Portion covered per hour
37	BJT Differential Amplifier: Terminology and qualitative description
38	DC transfer Characteristics
39	Small signal Analysis, differential and common mode gain
40	CMRR, differential and common mode input impedance.
41	MOSFET Differential Amplifiers: DC Transfer characteristics, Small signal Analysis
42	Differential and common mode gain, CMRR, differential and common mode input impedance.
43	Constant Current Sources: Two transistor (BJT, MOSFET) current source
44	Current relationship, output resistance. Improved three transistor (BJT, MOSFET) current source
45	Cascode (BJT, MOSFET) current source,
46	Wilson and Widlar current source

Objectives:

1. Basic block diagram of differential amplifiers.
2. Classification of differential amplifiers.
3. Need of constant current source.
4. Types and circuits used in constant current source.

Model Questions:

1. Explain differential amplifier with active load.
2. Explain CMRR.
3. Explain use of swamping resistor in differential amplifier.
4. Derive expression for input impedance, output impedance, voltage gain for dual input balance output differential amplifier.
5. Derive expression for common mode gain, differential mode gain, CMRR for DIBO.
6. Do the dc analysis of following circuit.



$h_{ie_1} = h_{ie_2} = 20K\Omega$

$\beta_1 = \beta_2 = 75$

7. For the following circuit perform the dc analysis & find out differential mode gain.

Chapter wise Plan

Subject Title: Digital Signal Processing and Processors

Chapter No. : 6

Chapter Name :Power Amplifiers

Approximate Time Needed : 06 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
47	Power BJTs, Power MOSFETs, Heat Sinks
48	Class A, Class BClass C and Class AB operation, Power efficiency
49	Class C and Class AB operation, Power efficiency
50	Class AB output stage with diode biasing
51	VBE multiplier biasing, input buffer transistors
52	Darlington configuration

Objectives:

1. Need of power amplifiers.
2. Different types of power amplifiers.
3. Designing of heat sink.

Model Questions:

1. Explain class A power amplifiers.
2. Cross over distortion in class B power amplifier.
3. Design a class B power amplifier to have 20W power at 8 loads.
4. Explain class B push-pull power amplifier.
5. Explain design steps of heat sink.
6. Design a class AB power amplifier to have 120 power at 15 load, Vcc=12v. Calculate the efficiency.
7. For a class B power amplifier with Vcc=20v & load of 16. Determine maximum input power, maximum output power, and maximum circuit efficiency.

University Question Paper

S.E. (ETRX) sem IV (CBSGS) M- 20

Sub: - DEC

QP Code :NP-

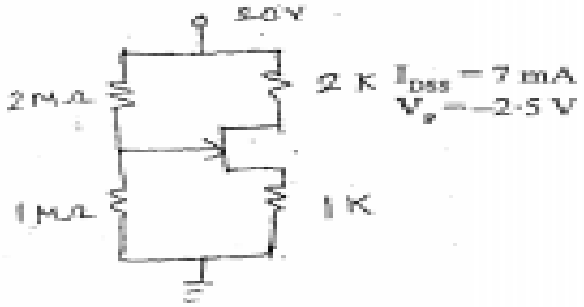
(3 hours) [Total Ma

N.B.: (1) Question no. 1 is **compulsory**.
(2) Solve any **three** out of **remaining** questions.
(3) Assume **suitable** data wherever **necessary**.

1. Solve any **four** :—
   (a) For the following clipper circuit sketch the i/p and o/p wave form write equa for Vo.

   (b) Compare BJT, JFET and MOSFET.
   (c) Which components in an amplifier (CS and CE) circuit affect low frequ response ? Explain.
   (d) State and explain Barkhansen's criteria.
   (e) Explain effect of swamping resistor in differential amplifier.
   (f) Derive expresion of efficiency of clan A Transformer coupled amplif

2. (a) Draw approximate hybrid π model of CE transistor amplifier and derive express for Av, Ai, Zi and Zo.
   (b) Determine operating point and draw DC load line for the circuit shown :—



3. (a) Draw two stage CS-CS amplifier circuit and derive expressions for Av, Zi and
   (b) State different types of negative feedback topologies and explain current seri detail using block diagram.

4. (a) Draw circuit diagram for dual i/p balanced o/p differential amplifier (using type of devices) and derive expressions for Ad, Ac, CMRR and Ri.
   (b) Draw circuit diagram of colpitt's oscillator and explain it's working. S applications, advantages and disadvantages of this circuit.

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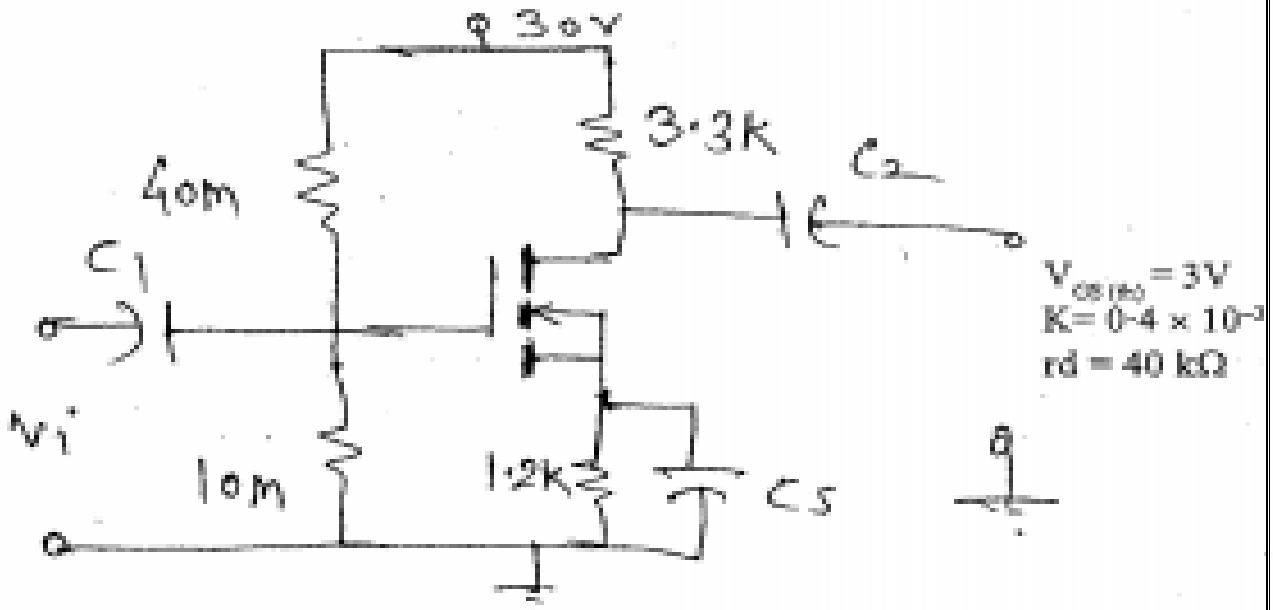
5. (a) Justify need for constant current source and explain any one in detail.
   (b) Explain working of class B (push-pull) power amplifier.

6. (a) For the circuit shown find Av, Ri and Ro.

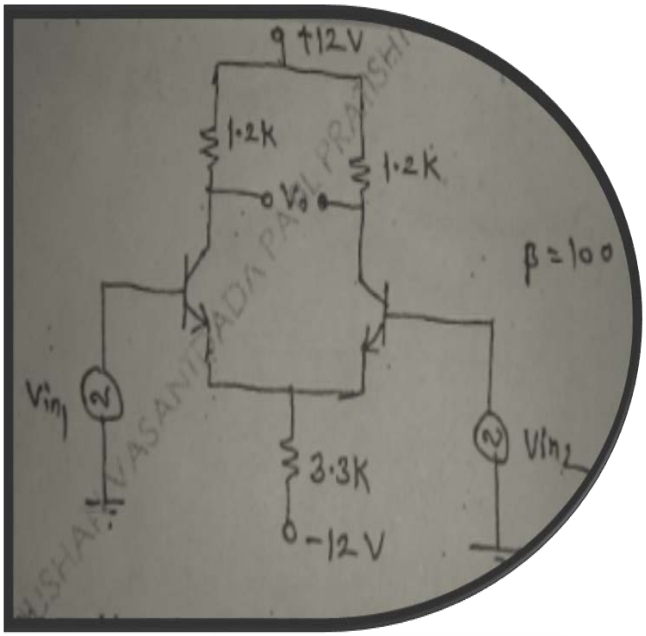


   (b) Draw High frequency model for CS JFET amplifier and explain.
   (c) Explain importance and need for biasing in amplifier.

Assignments

ASSIGNMENT 1 (DATE : 9th FEB 2015)

1. Explain working of class A transformer coupled power amplifier and derive equation of power efficiency.
2. Explain why the feedback is requied in oscillator.
3. Design voltage divider biased circuit to give Icq = 5mA, Vceq = 5V and β = 100.
4. Explain working of CASCODE Amplifier in detail.
5. For the given ciruits find Icq, Vceq, Ad, ACM, CMRR.



ASSIGNMENT 2 (DATE: 9th March 2015)

1. Draw a circuit diagram for single input balanced output differential amplifier (using any type of device) and derive the expression for Ad, CMRR and Ri.
2. Explain working of low frequency oscillator circuit and give its applications.
3. Explain current series feedback amplifier with the help of block diagram and derive expressions for Rif, Rof and Af.
4. Explain MOSFET Wilson current source.
5. What are the different biasing circuits for E MOSFET explain in detail.