EE 441: Analog Electronics (EE/IE)

L T P
(3 – 1 – 3)
Theory Marks =100
Sessional Marks = 50
Laboratory Marks = 50
Time = 3 hours

1. **Bond Model of silicon crystal**:

Intrinsic carrier concentration, Effect of doping on carrier concentration. Holes and electrons, Majority and Minority carriers, Mobility and diffusion constants. Passage of current through semi-conducting material – drift and diffusion process. Recombination and carrier life time. Effect of temperature.

2. **The p-n junction, Basic construction**:

Abrupt junction and graded junctions, Symmetric and asymmetrically doped devices. Built-in field and depletion region approximation. Study of volt-amp characteristics. Low level injection approximation. Analysis of current flow through a diode. Dynamic behavior of diode and the capacitances associated with a diode device, Effect of temperature on the current.

Current models of a diode piecewise linear static model and dynamic incremental model. Practical circuits employing diodes: diode gates and switches and power rectifying circuits. Power filters.

3. **The Bipolar junction Transistor**:

Basic construction and the physical behavior of the device. Low level injection condition. Forward Active Region (FAR) and the study of the flow of carriers through the BJT control valve action. Volt-amp curves, base with modulation and early voltage. Static circuit models. Ebers-moll equations for the currents of a B.J.T. for all bias conditions. A simple amplifier circuit and biasing methods. The common base, common emitter and the common collector connections.

Small signal operation of the transistor amplifier, incremental models for the B.J.T. the hybrid II model. Analysis of amplifiers with the help of incremental models, simplified low frequency operation. Gain, input and output impedances of amplifiers. Some ideas about high speed analysis such as Miller effect and dominant pole approximation determination of the hybrid II parameters, introductory ideas about two port y and h-parameter analysis.

4. **Multiple stage transistor amplifiers:**

PNP and NPN combinations. Voltage and current biasing methods. Gain calculation. Frequency response of amplifiers. High power circuits and their efficiencies. Some ideas about distortion.

5. Feed-back in amplifiers:

The usefulness of this concept. Negative and Positive fee-back. Their effects on the performance of amplifiers. Positive feed-back to produce oscillations and simple oscillator circuit, RC and LC oscillators with simple analysis. Introduction to device fabrication methods and some ideas about I.C.S. and the way they are made. Simple descriptions of processes such as diffusion, photolithography, ion implantation, metallization and crystal growing techniques.

6. **Simple IC layout**:

Use of SPIC for computer aided analysis of electronic circuits (not for university examination).

Books:

1. Electronic Principles Physics, Models and Circuits – Paul E. Gray and Campbell L Searle
2. Integrated Electronics – Millman- Halkias (PHI)

EE 444: DATA STRUCTURE (EE/IE):

L T P
(3- 1- 3)
Theory Marks= 100
Sessional Marks=50
Laboratory Marks = 50
Time= 3 hours

Continuous data structure:

Arrays, stacks and queues

Non-Continuous data structure:

Linear linked lists, binary search trees, balanced trees.

Sorting and Searching, Searching hash techniques.

Heap data structures and dynamic storage allocation techniques.

File organization techniques.

****Note:** The C and C^{++} languages shall be used to describe the algorithms and data structure. Some basic features of project oriented languages shall be covered in the course.

Books/References:

1. M.A.Weiss-Data Structures & Algorithms Analysis in C^{++} , Addition Wesley.

2. L. Tannenbaum- Data Structures Using C , PHI.

3. Lipshutz- Theory and problems of Data Structure, McGraw Hill.

4. Neil Graham- Learning with C^{++}, McGraw Hill.

L T P

EE 443: Electrical Measurements and Measuring Instruments (EE/IE) (3 – 1 -2)

Theory Marks =100
Sessional Marks = 50
Laboratory Marks = 50
Time = 3 hours

1. **Characteristic of instruments and measuring systems**:

Static characteristic – accuracy, sensitivity, reproducibility, drift, static error and dead zone. Dynamic characteristic- response to step and sinusoidal signals. Errors occurring in measurement.

2. **Measuring Instruments**:

Electro-dynamic, rectifier and induction type ammeters and voltmeters – construction, operation, errors and compensation, Electro-dynamic and induction type watt meters, Single phase induction type energy meter. MC and MI type power factor meters. Electrodynamometer type frequency meter, Synchroscope.

3. **Measurement of resistance:**

Wheaston bridge method – sensitivity of the Wheaston Bridge – precautions to be taken while making precision measurements, Limitations, Carey-Foster slid Wire Bridge.

Measurement of low resistance – Kelvin's Double Bridge.

Measurement of high resistance – direct deflection method. Measurement of volume and surface receptivity. Loss of charge method. Measurement of insulation resistance with power on.

4. **Potentiometers**:

D. C. potentiometer – basic principle. Laboratory type potentiometer. Methods of standardization. Applications- calibration of ammeters and voltmeters, measurement of resistance and power - calibration of watt meters. Volt ratio box, A. C. potentiometers – difference between A. C. and D. C. potentiometers. Types - polar and co-ordinate type. Application of A. C. potentiometer.

5. **A. C. Bridge**:

General principle, Balance equation. Sources and Detectors used in A. C. Bridges. Balance condition and Phasor diagrams of Maxwell's bridge, Anderson's bridge, Owen's bridge, De Sauty's bridge, Low voltage Schering Bridge, Heavy-side mutual inductance Bridge.

6. **Magnetic Measurement**:

Magnetic hysteresis, alternating current magnetic testing, separation of iron losses. Measurement of iron losses by the watt meter method, Cambell's bridge method and the Oscillographic method.

7. Instrument Transformer:

Use of instrument transformers – ratio, burden. Theory and operation of CTs and PTs – errors and compensation – CT testing – mutual inductance method, Silbee's method. PT testing – comparison method. Power and energy measurement using CTs and PTs. Effect of reverse polarity connection of one of the CTs on 3-phase energy meter.

8. **C.R.O.**:

Basic construction, main parts, principle of operation, Applications. (Thurst has to be to use C.R.O. through suitably designed laboratory experiments)

9. Galvenometers:

Ballastic, D'Arsonval, Vibration

Books:

1. Golding and Widdis – Electrical Measurements and measuring instruments.
2. A.K. Sawhney – Electrical and Electronic Measurements and Instrumentation

IE 451: Fundamentals of Instrumentation.

L T P
(3 – 1 - 0)
Theory Marks =100
Sessional Marks =100
Time = 3 hours

1. **Basic concept of measurement**:

Measurement system, Block-diagram representation, example. Static and dynamic characteristics, Compensation, dynamic calibration, Generalized instrumentation system block diagram representation, Selection criteria of instryments.

2. **Errors & Uncertainties in measurement**:

Definitions, classification, data quality, equipment errors, interference errors, dynamic response errors, operational errors.

3. **Statistical estimates of measurement data**:

Mean, median, mode, measures of disperson, mean deviation, standard deviation, variance, probable error. Error distribution functions—error tables (Gaussian), and applications, confidence level, significance tests. Chi-squared statistical test, Regression analysis of data, Graphical representation and curve fitting of data, best fit curves.

4. **Methods of minimization and elimination of errors due to noise in measured data, input-output configuration, filtering, averaging and correlation techniques.**

Recommended texts:-

1. Doeblin, E.O. : " Measurement System Application and Design", International Students Edition, McGraw Hill International Book Co.,1983.

2. Barry E. Jones: "Instrumentation, Measurement & Feedback", TMH, New Delhi,1983.

3. Cook,N.H.: "Physical Measurement &Analysis", Addision Wesley, 1965.

4. Doeblin E.O.:"System Dynamics –Modeling & Response",McGraw Hill,1972.

5. Holman J.P. :" Experimental Methods for Engineers" : McGraw Hill Int. Std. Edn.,1966.