

2.4 ANALOG ELECTRONICS

L	P
2	4

RATIONALE

This course will introduce circuit realizations with components such as diodes, BJTs and transistors studied earlier to give understanding of various types of amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers. It will familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback.

COURSE OUTCOMES

After undergoing the subject, student will be able to:

- CO1: Design and analyze small signal amplifier circuits applying the biasing techniques learnt earlier.
- CO2: Cascade different amplifier configurations to obtain the required overall specifications like Gain, Bandwidth, Input and Output interfacing Impedances.
- CO3: Design and realize different classes of Power Amplifiers and tuned amplifiers useable for audio and Radio applications.
- CO4: Utilize the Concepts of negative feedback to improve the stability of amplifiers and positive feedback to generate sustained oscillations.

DETAILED CONTENTS

UNIT I

Semiconductors and Diodes: Electrons- free and valence. Conductors, Insulators, and Semiconductors- definition & energy band diagrams. Properties of semiconductors. Meaning of Hole current, electron-hole pairs, recombination, doping, acceptor and donor impurities. Intrinsic and Extrinsic, N and P type semiconductors. Diode- formation, depletion region, VI Characteristics, ratings, types and applications. Zener diode- reverse bias characteristics, voltage regulation, shunt voltage regulator, and applications. Varistor and Thermistor working and applications.

UNIT II

Transistors and MOSFETs: Transistors- definition, terminals, types, symbols, formation of NPN and PNP, ratings. Transistor biasing- definition, importance, list types, stabilisation, thermal runaway, heat sink, and voltage divider method. List configurations and applications. Alpha and Beta- definitions, relation. CE input and output characteristics- cut off, saturation, and active regions. Transistor as a switch. List applications. FET- definition, types. MOSFET- definition, types, symbols. N type enhancement mode- construction, working, characteristics, switch. List applications and ratings. Differentiate BJT and MOSFET.

UNIT III

Rectifiers, filters and regulators: Regulated power supply- block diagram and applications. Rectifiers- definition, half wave, centre tapped and bridge full wave rectifier, efficiency, ripple factor, PIV, ratings. Filters- definition, necessity, C and PI filters, Regulator-definition, working of 7805, operating voltages- 7809, 7812, 7905, 7912.

UNIT IV

Amplifiers and Oscillators: Amplifier- definition, faithful amplification, classification based on configuration, power, and frequency. Transistor CE amplifier with biasing. Working of class A, B, C, and Push pull amplifier. Two stage RC coupled amplifier working, gain in dB, frequency response. Feed back- definition, types, advantages and disadvantages, applications. Oscillators- definition, classification, LC tank circuit, criteria. RC phase shift and crystal oscillator- working, applications. CRT- construction, working and applications.

UNIT V

OP-AMP and Timers: OPAMP– definition, block diagram, operation, characteristics, applications, μ A 741 pin diagram. Definitions of virtual ground, CMRR and Slew rate. OPAMP applications– inverting, integrator, differentiator, summer, voltage follower, and comparator. Filters- definition, Working- low pass, high pass passive and active filters, applications. Timers– block diagram, pin diagram of 555, duty cycle, time constant, applications. Multi-vibrators- Astable and monostable using 555.

PRACTICAL EXERCISES

1. Familiarity with working knowledge of the following Instruments. (a) CRO (b) Multimeter (c) Function generator (d) Regulated power supply (e) Active passive components (f) Bread Board
2. Study of V-I Characteristics of a Diode.

3. Study and draw the characteristics of half wave and full wave rectifiers.
4. Study and draw the characteristics of rectifier filter circuit.
5. Study of Clipping & Clamping circuit.
6. Study zener diode characteristics.
7. Study zener diode as voltage regulator.
8. Study the characteristics of transistor in Common Base configuration.
9. Plot and study the input and output characteristics of BJT in common emitter configuration.
10. Graphical determination of small signal hybrid parameter of BJT.
11. Study and draw the characteristics of FET in common source configuration
12. Study characteristics of SCR.
13. Study of characteristics of DIAC.
14. Plot V-I characteristic of TRIAC.
15. Study and draw the characteristics of FET in common drain configuration.
16. Study the Series and Shunt Voltage Regulator.
17. Study of frequency response of active filters HP, LP & BP.

RECOMMENDED BOOKS

1. Electronics Principles and applications by Charles A Schuler and Roger L Tokhiem, Sixth Edition, Mc. Graw Hill , 2008.
2. Electronics Principles by Malvino, Mc. Graw Hill, Third edition. 2000.
3. Electronics Devices and Circuits by Allan Mottershed, PHI Learning Pvt. Ltd., First Edition.
4. Electronics Analog and Digital by I. J. Nagrath, PHI Learning Pvt. Ltd., 2013 Edition.
5. Linear Integrated Circuits by Ramakant A. Gayakwad, PHI Learning Pvt. Ltd., Fourth Edition.

SUGGESTED WEBSITES

1. <http://swayam.gov.in>

INSTRUCTIONAL STRATEGY

This is a skill based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.