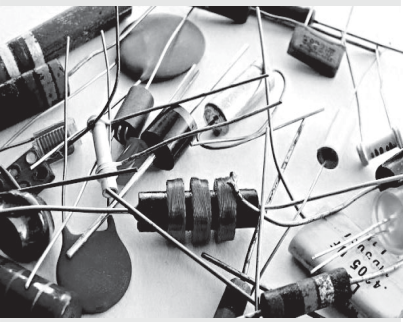

16EC202 ELECTRONIC DEVICES AND CIRCUITS

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P
45	-	30

WA/RA	SSH/HSH	CS	SA	S	BS
20	48	-	12	3	2

Course Description and Objectives:

This course is aimed at offering fundamental concepts of semiconductor devices and circuits. The objective of the course is to introduce the student to Junction Diode, Transistor, FET and other basic devices that are designed with semiconductor materials. As a first-level course in electronics, it forms the basis for the understanding of advanced electronic courses that are offered in subsequent semesters.

Course Outcomes:

The student will be able to:

- understand semiconductor devices through energy band diagrams.
- analyze characteristics of semiconductor junctions.
- differentiate between bipolar and unipolar conduction.
- understand physics of optical devices.
- understand the usefulness of semiconductor devices in circuit making.
- use these basic circuits to develop various useful applications.

SKILLS :

- ✓ *Identify a Semiconductor Diode for a specific application and power handling capacity.*
- ✓ *Identify the transistor type for a given application (switch/amplifier).*
- ✓ *Recognize the required specifications of the transistor.*
- ✓ *Identify the amplification factor of the given transistor.*
- ✓ *Test the working condition of the transistor.*

UNIT - 1 **L-9**

P-N JUNCTION DIODE: Formation of P-N junction, Energy band diagram of open circuited P-N junction, Operation of forward and reverse biased P-N junction diode, Volt-Ampere characteristics, Temperature dependence on V–I characteristic, Diode resistances and capacitances, Diode equation, Special diodes-Breakdown Mechanisms in a Semi Conductor Diode, Zener diode, V-I characteristics and zener diode as voltage regulator, Tunnel diode, Varactor diode, SCR, LED and photodiode.

UNIT - 2 **L-9**

DIODE APPLICATIONS: The P-N junction diode as a rectifier - Half wave rectifier, Full wave rectifier and bridge rectifier, Harmonic components in a rectifier circuit; Filters - Analysis and comparison of various filters, Inductor filter, Capacitor filter, L- section filter and ð-section filter in terms of ripple factor, A simple regulated power supply circuit; Clipping and clamping circuits - Elementary diode clippers and clamping circuits.

UNIT - 3 **L-9**

TRANSISTOR: Bipolar junction transistor (BJT) - Construction, Principle of operation of PNP and NPN transistors, Characteristics of transistor in common emitter, Common base and common collector configurations; Field effect transistor (FET)-Construction, Symbol and principle of operation of JFET, Pinch-off voltage, JFET characteristics, Comparison of BJT and FET; MOSFET - Construction, working and V-I characteristics of enhancement and depletion MOSFET.

UNIT - 4 **L-8**

BJT and FET BIASING: Transistor biasing and thermal stabilization, DC and AC load lines, Operating point, types of BJT biasing, Thermal runaway and thermal stability, Stabilization against variations in V_{BE}, â and I_{co} , Stability factors, Bias compensation using diodes and transistors **,** Biasing of FET.

UNIT - 5 **L-10**

SINGLE STAGE BJT AND FET AMPLIFIERS: Transistor as an amplifier, Two port network representation and h parameter model of a transistor, Exact and approximate analysis of CE small signal low frequency transistor model, Expressions for voltage gain, Current gain, Input impedance and output impedance using h-parameters, Comparison of transistor amplifier configurations in terms of A_i, R_i, A_v, R_o; FET amplifiers - FET small signal model, Analysis of FET amplifiers (CS, CD and CG configurations) at low frequencies, Expressions for voltage gain, Input impedance and output impedance.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

1. Understand the V-I characteristics of P-N junction diode and hence determine the diode forward, reverse currents, static and dynamic resistances.
2. Analyze the V-I characteristics of zener diode under reverse biased condition and observe the application as voltage regulator.
3. Calculate the efficiency and ripple factor of all rectifiers and analyze their performance with and without filter.
4. Understand the input and o/p characteristics of all BJT configurations in active region and determine its current amplification factors.
5. Understand the drain and transfer characteristics of FET and determine its amplification factor.
6. Understand the diode application as a clipper.

ACTIVITIES:

- *Choose a diode for a Cell-phone/ Laptop/ Tablet adapter/ for various ratings.*
- *Design voltage regulator using zener diode.*
- *Design three types of biasing circuits and determine the stability factors in each case.*
- *Transistor as an amplifier for the given specifications.*
- *Design a wideband amplifier with FET.*

LIST OF EXPERIMENTS Total hours-30

1. P-N Junction diode characteristics.
2. Zener diode characteristics and Zener diode as Voltage regulator.
3. To determine the ripple factor and efficiency of Half wave Rectifier with and without filter.
4. To determine the ripple factor and efficiency of Center tapped Full wave Rectifier with and without filter.
5. To determine the ripple factor and efficiency of Bridge Rectifier with and without filter.
6. Construction of various diode clipping circuits.
7. Transistor CB characteristics (Input and Output).
8. Transistor CE characteristics (Input and Output).
9. Transistor CC characteristics (Input and Output).
10. FET characteristics.

TEXT BOOKS:

1. J Millman and C.C.Halkias, "Electronic Devices and Circuits", 9th edition, Tata Mc-Graw Hill, 2012.
2. R L Boylestad and Louis Nashelsky, "Electronic Devices and Circuits", 9th edition, Pearson/Prentice Hall, 2006.

REFERENCE BOOKS:

1. J Taub and C C Halkias, "Electronic Circuits", 8th edition, Tata Mc-Graw Hill, 2015.
2. Salivahanan, Kumar and Vallavaraj, "Electronic Devices and Circuits", Tata Mc-Graw Hill, 4th edition, 2008.
3. J Millman and K Taub, "Electronic Circuits and Applications", 4th edition, Tata Mc-Graw Hill, 2011.
4. K Thomson, "Electronic Switching Circuits", 2nd edition, Oxford University Press, 2012.
5. K Satya Prasad, "Electronic Devices and Circuits", 2nd edition, VGS Publications, 2014.
6. K K Vara Prasad, "Electronic Devices and Applications", 2nd edition, Oxford University Press, 2014.