ELECTRONIC DEVICES
SEMESTER – III (EC / TC)

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18EC33**	**CIE Marks**	**40**
Number of LectureHours/Week	**03**	**SEE marks**	**60**
Total Number ofLecture Hours	**40 (8 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 03

Course Objectives: This course will enable students to:

- Understand the basics of semiconductor physics and electronic devices.
- Describe the mathematical models BJTs and FETs along with the constructional details.
- Understand the construction and working principles of optoelectronic devices
- Understand the fabrication process of semiconductor devices and CMOS process integration.

Module-1	**RBT Level**
Semiconductors Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Direct and Indirect semiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect. **(Text 1: 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.2.1, 3.2.3, 3.2.4, 3.4.1, 3.4.2, 3.4.3, 3.4.5).**	**L1,L2**
Module-2	
P-N Junctions Forward and Reverse biased junctions- Qualitative description of Current flow at a junction, reverse bias, Reverse bias breakdown-Zener breakdown, avalanche breakdown, Rectifiers. **(Text 1: 5.3.1, 5.3.3, 5.4, 5.4.1, 5.4.2, 5.4.3)** Optoelectronic Devices Photodiodes: Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. Light Emitting Diode: Light Emitting materials**.(Text 1: 8.1.1, 8.1.2, 8.1.3, 8.2, 8.2.1)**	**L1,L2**
Module – 3	
Bipolar Junction Transistor Fundamentals of BJT operation, Amplification with BJTS, BJT Fabrication, The coupled Diode model (Ebers-Moll Model), Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown, Base Resistance and Emitter crowding. **(Text 1: 7.1, 7.2, 7.3, 7.5.1, 7.6, 7.7.1, 7.7.2, 7.7.3, 7.7.5).**	**L1,L2**
Module-4	
Field Effect Transistors Basic pn JFET Operation, Equivalent Circuit and Frequency Limitations, MOSFET- Two terminal MOS structure- Energy band diagram, Ideal Capacitance – Voltage Characteristics and Frequency Effects, Basic MOSFET Operation- MOSFET structure, Current-Voltage Characteristics.	**L1,L2**

(Text 2: 9.1.1, 9.4, 9.6.1, 9.6.2, 9.7.1, 9.7.2, 9.8.1, 9.8.2).	
Module-5	
Fabrication of p-n junctions Thermal Oxidation, Diffusion, Rapid Thermal Processing, Ion implantation, chemical vapour deposition, photolithography, Etching, metallization. **(Text 1: 5.1)** **Integrated Circuits** Background, Evolution of ICs, CMOS Process Integration, Integration of Other Circuit Elements. **(Text 1: 9.1, 9.2, 9.3.1, 9.3.2).**	**L1,L2**
Course outcomes: After studying this course, students will be able to: • Understand the principles of semiconductor Physics • Understand the principles and characteristics of different types of semiconductor devices • Understand the fabrication process of semiconductor devices • Utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.	
Question paper pattern: • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60.	
Text Books: 1. Ben. G. Streetman, Sanjay Kumar Banergee, "Solid State Electronic Devices", 7thEdition, Pearson Education, 2016, ISBN 978-93-325-5508-2. 2. Donald A Neamen, Dhrubes Biswas, "Semiconductor Physics and Devices", 4th Edition, MCGraw Hill Education, 2012, ISBN 978-0-07-107010-2.	
Reference Book: 1. S. M. Sze, Kwok K. Ng, "Physics of Semiconductor Devices", 3rd Edition, Wiley, 2018. 2. A. Bar-Lev, "Semiconductor and Electronic Devices", 3rd Edition, PHI, 1993.	