COURSE CONTENT

ELECTRONIC DEVICES AND CIRCUITS								
III Semester: ECE / EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AECE02	**Core**	3	-	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Applied Physics								

I. COURSE OVERVIEW:

The course introduces the physics of semiconductor materials, constructional features and principle of operation of the semiconductor devices and its applications. It includes the biasing configurations of the semiconductor devices to provide temperature stability. Further this course provides to analyze the properties of semiconductor materials to build amplifier devices with voltage gain and current gain.

II. COURSES OBJECTIVES:

The students will try to learn

I. The operational principles, characteristics of semiconductor devices and circuits for rectification, amplification, conditioning and voltage regularization of signals.
II. The analytical skills needed to model analog and digital integrated circuits (IC) at discrete and micro circuit level
III. The foundations of basic electronic circuits necessary for building complex electronic hardware.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

CO 1 Illustrate the characteristics of semiconductor devices for determining the device parameters such as resistances, current gain and voltage gain.
CO 2 Apply the pn junction characteristics for the diode applications such as switch, rectifiers, Clippers and Clampers.
CO 3 Examine DC and AC load line analysis of BJT and FET amplifiers for optimal operating level regardless of input, load placed on the device.
CO 4 Extend the biasing techniques for bipolar and uni-polar transistor amplifier circuits considering stability condition for establishing a proper operating point.
CO 5 Utilize low frequency model for estimation of the characteristic parameters of BJT, FET amplifier circuits.
CO 6 Demonstrate the working principle of special purpose semiconductor diodes and transistors for triggering and voltage regulation applications.

IV. COURSE CONTENT:

MODULE - I: SEMICONDUCTOR DIODES (10)
p-type and n-type semiconductors, semiconductor diodes, forward and reverse biased pn Junction, Diode I-V Characteristics, ideal versus practical diodes, resistance levels, diode equivalent circuits. transition and diffusion capacitance, Zener diode, SCR, Tunnel diode, varicap diode.

MODULE –II: DIODE CIRCUITS (09)
Analysis of Rectifiers: Half-wave rectifier, full wave rectifier, bridge rectifier. Rectifiers with Capacitive Filter: Zener diode as voltage regulator. Non-linear wave shaping circuits: Clippers, Clampers, clamping circuit theorem, Voltage multiplier circuits.

MODULE –III: BIPOLAR JUNCTION TRANSISTORS AND BIASING (10)
Principle and construction operation of PNP and NPN transistors, Transistor as a device in CB, CE and CC configurations, and their characteristics.

The operating Point, DC and AC load lines, Fixed Bias, Collector Feedback Bias, Emitter Feed Back Bias, Voltage divider Bias, Stabilization, stabilization circuits.

MODULE –IV: BJT AMPLIFIERS (10)
Transistor Hybrid parameter model, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

MODULE –V: FIELD-EFFECT TRANSISTORS (09)
JFET and its characteristics, Pinch-off voltage and drain saturation current. MOSFET: MOS capacitor, n-channel enhancement-mode MOSFET. Small Signal Model, Analysis of CS, CD, CG JFET Amplifiers.

V. TEXT BOOKS:

1. Donald Neamen, “Microelectronics Circuit Analysis and Design “, McGraw Hill, 4th edition, 2010.
2. Gary S May ad Simon M Sze, Wiley, “Fundamentals of Semiconductor Fabrication”, 1st edition, 2003.

VI. REFERENCE BOOKS:

1. Robert L Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson, 11th edition, 2018.
2. S M Sze, “VLSI Technology “, 2nd edition, 2003.
3. Richard C Jaeger and Travis N Blalock, “Microelectronic Circuit Design”, McGraw Hill, 5th edition,2016.
4. Ben Streetman, “Solid State Electronic Devices “, Pearson, 7th edition, 2015.

VII . ELECTRONICS RESOURCES:

1. NPTEL :: Electrical , Electronics and Communication: Semiconductor Devices and Circuits
2. NPTEL :: Physics - NOC: Introduction to Solid State Physics
3. NPTEL :: Physics - NOC: Solid State Physics
4. https://khub.nthu.edu.tw/
5. NPTEL :: Electrical , Electronics and Communication: Fundamental of Semiconductor Devices

VIII. MATERIALS ONLINE

1. Course Outline Description
2. Lecture notes
3. PowerPoint presentation
4. Definitions and Terminology
5. Tutorial Question Bank
6. Case Studies
7. Real life Examples
8. Complex Engineering Problems
9. Tech Talk Topics
10. Concept Video Topics
11. Open-ended Exercises
12. Assignments
13. Model Question Paper – I
14. Model Question Paper – II
15. GATE Question Bank
16. Previous Question Papers and Solutions