ELECTRONIC DEVICES AND CIRCUITS

III Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AECC01	**Core**	3	1	0	4	30	70	100

Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil	Total Classes: 60

Prerequisites: There are no prerequisites to take this course.

I. COURSE OVERVIEW:

This course provides the basic knowledge over the construction and functionality of the basic electronic devices such as diodes and transistors. It also provides the information about the electronic switches and the flow of current through these switches in different biasing conditions. This course is intended to describe the different configurations to provide temperature stability and how these electronic devices can be configured to work as rectifiers, clippers, voltage regulators, clampers and amplifiers.

II. COURSE 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:

After successful completion 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. Understand

CO 2   **Apply** the pn junction characteristics for the diode applications such as switch, rectifiers, Clippers and Clampers. Apply

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. Analyze

CO 4   **Extend** the biasing techniques for bipolar and unipolar transistor amplifier circuits considering stability condition for establishing a proper operating point. Understand

CO 5   **Utilize** low frequency model for estimation of the characteristic parameters of BJT, FET amplifier circuits. Apply

CO 6   **Demonstrate** the working principle of special purpose semiconductor diodes and transistors for triggering and voltage regulation applications. Understand

IV. COURSE SYLLABUS:

MODULE – I: DIODE AND APPLICATIONS (12)

Diode - Static and Dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances, Diode Applications: Switch-Switching times. Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive Filter, Clippers-Clipping at two independent levels, Clampers-Clamping Operation, types, Clamping Circuit Theorem, Comparators.

MODULE – II: BIPOLAR JUNCTION TRANSISTOR (BJT) (12)

Principle of Operation and characteristics - Common Emitter, Common Base, Common Collector Configurations, Operating point, DC & AC load lines, Transistor Hybrid parameter model, Determination of h-parameters from transistor characteristics, Conversion of h-parameters.

MODULE – III: TRANSISTOR BIASING AND STABILIZATION (12)

Bias Stability, Fixed Bias, Collector to Base bias, Self-Bias, Bias Compensation using Diodes and Transistors.

Analysis and Design of Small Signal Low Frequency BJT Amplifiers: 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 – IV: JUNCTION FIELD EFFECT TRANSISTOR (12)

Construction, Principle of Operation, Pinch-Off Voltage, Volt- Ampere Characteristic, Comparison of BJT and FET, Biasing of FET, FET as Voltage Variable Resistor, MOSFET Construction and its Characteristics in Enhancement and Depletion modes.

MODULE – V: FET AMPLIFIERS (12)

Small Signal Model, Analysis of CS, CD, CG JFET Amplifiers. Basic Concepts of MOSFET Amplifiers. **Special Purpose Devices:** Zener Diode - Characteristics, Voltage Regulator; Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode.

V. TEXT BOOKS:

1. Jacob Millman, "Electronic Devices and Circuits", McGraw Hill Education, 3rd Edition, 2014.
2. Robert L. Boylestead, Louis Nashelsky, "Electronic Devices and Circuits Theory, Pearson, 11th Edition, 2009.

VI. REFERENCE BOOKS:

1. Horowitz, "The Art of Electrionics, Cambridge University Press, 3rd Edition, 2018.
2. David A. Bell, "Electronic Devices and Circuits", Oxford, 5th Edition, 2016.
3. J. Millman, H. Taub and Mothiki S. Prakash Rao, "Pulse, Digital and Switching Waveforms", McGraw Hill, 2nd Edition, 2008.
4. S. Salivahanan, N.Suresh Kumar, A Vallvaraj, "Electronic Devices and Circuits, TMH, 2nd Edition, 2017.

VII. WEB REFERENCES:

1. http://www-mdp.eng.cam.ac.uk/web/library/enginfo/electrical/hong1.pdf
2. https://archive.org/details/ElectronicDevicesCircuits
3. http://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/BASIC ELECTRONICS/home_page.htm
4. http://www.vidyarthiplus.in/2011/11/electronic-device-and-circuits-edc.html
5. http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html