

## Electronic Devices and Circuits

|                                       |          |                                |       |                       |        |
|---------------------------------------|----------|--------------------------------|-------|-----------------------|--------|
| <b>Course Code</b>                    | 23EC3301 | <b>Year</b>                    | II    | <b>Semester</b>       | I      |
| <b>Course Category</b>                | PC       | <b>Branch</b>                  | ECE   | <b>Course Type</b>    | Theory |
| <b>Credits</b>                        | 3        | <b>L-T-P</b>                   | 3-0-0 | <b>Pre requisites</b> | -      |
| <b>Continuous Internal Evaluation</b> | 30       | <b>Semester End Evaluation</b> | 70    | <b>Total Marks</b>    | 100    |

| Course Outcomes   |  |    |
|---|--|----|
| Upon successful completion of the course, the student will be able to |  | BL |
| <b>CO1</b>  | Describe the basic concepts of different types of semiconductor devices.   | L2 |
| <b>CO2</b>  | Apply different circuit analysis methods to solve the problems on biasing circuits and rectifier circuits.           | L3 |
| <b>CO3</b>  | Apply circuit analysis techniques to find solutions to amplifier circuits based on small-signal low-frequency models | L3 |
| <b>CO4</b>  | Analyze amplifiers using small-signal low-frequency models.  | L4 |

| Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of Correlations ( 3:High, 2:Medium, 1:Low ) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| <b>CO1</b>   | 2   |     |     |     |     |     |     |     |     | 2    | 2    | 2    | 1    | 1    |
| <b>CO2</b>   | 3   |     |     |     |     |     |     |     |     | 2    | 2    | 2    | 1    | 1    |
| <b>CO3</b>   | 3   |     |     |     |     |     |     |     |     | 2    | 2    | 2    | 1    | 1    |
| <b>CO4</b>   |     | 3   |     |     |     |     |     |     |     | 2    | 2    | 2    | 1    | 1    |
| <b>Avg.</b>  | 3   | 3   |     |     |     |     |     |     |     | 2    | 2    | 2    | 1    | 1    |

| Syllabus |   |               |
|----------|---|---------------|
| Unit No. | Contents  | Mapped CO     |
| 1        | <p><b>Junction Diode Characteristics:</b> Energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in p-n junction Diode, Diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance</p> <p><b>Special Semiconductor Devices:</b> Zener Diode, Varactor Diode, LED, Tunnel Diode, UJT.</p> | CO1, CO2      |
| 2        | <p><b>Diode Circuits:</b> The Diode as a circuit element, clipping circuits, clamping circuits, comparators, half-wave and full-wave rectifiers without filter and with inductor filter, capacitor filter, L section and <math>\pi</math>- section filters, comparison of various filter circuits in terms of ripple factors.</p>   | CO1, CO2      |
| 3        | <p><b>Transistor Characteristics:</b> Junction transistor, transistor current components, transistor equation in CB configuration, transistor as an amplifier, Common Base, Common Emitter and Common Collector configurations, Photo transistor, typical transistor junction voltage values.</p> <p><b>Transistor Biasing and Thermal Stabilization :</b> Need for biasing,</p>  | CO1, CO2, CO3 |

|   |  |                    |
|---|--|--------------------|
|   | operating point, load line analysis, BJT biasing methods, basic stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in $I_{CO}$ , $V_{BE}$ , and $\beta$ , Stability factors ( $S, S', S''$ ), Bias compensation, Thermal runaway, Thermal stability.   |                    |
| 4 | <b>Small Signal Low Frequency Transistor Amplifier (BJT):</b> Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers. | CO1, CO2, CO3, CO4 |
| 5 | <b>FET:</b> Types, structure, operation, characteristics, biasing, small signal model, comparison of BJT and FET.<br><b>Small Signal Low Frequency Transistor Amplifier (FET):</b> General Considerations, Common Source Stage, Common Gate Stage, Source Follower, comparison of FET amplifiers.  | CO1, CO2, CO3, CO4 |

#### Learning Resources

##### Text Books

1. J. Millman, C. C. Halkias and Satyabrata Jit, Millman's Electronic Devices and Circuits, Mc-Graw Hill Education, 4<sup>th</sup> edition, 2015.
2. Balbir Kumar and Shail B. Jain, Electronic Devices and Circuits, PHI, 2007.

##### Reference Books

1. J. Millman, C. Halkias, and Ch. D. Parikh, Millman's Integrated Electronics, Mc-Graw Hill Education, 2<sup>nd</sup> Edition, 2009.
2. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits Theory Pearson/PrenticeHall, 10<sup>th</sup> Edition, 2009.
3. Sedra A.S. and K.C. Smith, Microelectronic Circuits, Oxford University Press, 6<sup>th</sup> Edition, 2011.
4. Mottershead Allen, Electronic Devices and Circuits; An introduction, PHI, 1979

##### e-Resources & other Digital Material

1. [https://onlinecourses.swayam2.ac.in/nou23\\_ec06/preview](https://onlinecourses.swayam2.ac.in/nou23_ec06/preview)
2. [https://onlinecourses.nptel.ac.in/noc21\\_ee80/preview](https://onlinecourses.nptel.ac.in/noc21_ee80/preview)
3. [https://onlinecourses.nptel.ac.in/noc21\\_ee80/preview](https://onlinecourses.nptel.ac.in/noc21_ee80/preview)
4. <https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/>