# Electronics Devices and Circuits

| Course Code | 23EC2501 | Year | III | Semester | I |
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| Course Category | OE-1 | Branch | ECE | Course Type | Theory |
| Credits | 3 | L-T-P | 3-0-0 | Pre requisites | |
| Continuous Internal Evaluation | 30 | Semester End Evaluation | 70 | Total Marks | 100 |

| Course Outcomes | | |
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| Upon successful completion of the course, the student will be able to | | BL |
| CO1 | Understand the semiconductor physics, their concepts and characteristics of p-n junction diode | L2 |
| CO2 | Understand V-I characteristics of various semiconductor devices. | L2 |
| CO3 | Illustrate the operation of transistor and its characteristics in various configurations, Biasing of transistor | L3 |
| CO4 | Analyze the transistor using h-parameters and its equivalent model. | L4 |
| CO5 | Describe the operation of FET and MOSFET, their application as an amplifier. | L2 |

**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 | PO 10 | PO 11 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | | | | | | | 1 | 2 | |
| CO2 | 2 | | | | | | | | | | 1 | 2 | |
| CO3 | 3 | | | | | | | | | | 1 | 2 | |
| CO4 | 3 | 3 | | | | | | | | | 1 | 2 | |
| CO5 | 2 | | | | | | | | | | 1 | 2 | |
| Avg. | 2 | 3 | | | | | | | | | 1 | 2 | |

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| Syllabus | | |
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| Unit No. | Contents | Mapped CO |
| 1 | **Review of Semiconductor Physics:** Mobility and Conductivity, Intrinsic and extrinsic semiconductors**,** Hall effect<br>**Junction Diode Characteristics :**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, Qualitative explanation of Diode equation ( Derivation not required) , V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance. | CO1,CO2 |
| 2 | **Special Semiconductor Devices**: Zener Diode, Breakdown mechanisms, Zener diode applications, Varactor Diode, LED, Photodiode, Tunnel Diode and its characteristics with the help of energy band diagram, UJT and its | CO1,CO2 |

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| | application, PNPN Diode, SCR, Construction, operation and V-I characteristics.<br>**Diode Circuits:** Clipping (limiting) circuits, Peak Detector, Clamping circuits, Comparators, Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, Inductor filter, Capacitor filter | |
| **3** | **Transistor Characteristics:** Junction transistor, transistor current components, transistor equation in CB configuration, transistor as an amplifier, characteristics of transistor in Common Base and Common Emitter configurations, punch through/ reach through, typical transistor junction voltage values.<br>**Transistor Biasing and Thermal Stabilization :**Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in $V_{BE}$, Ic, and β, Stability factors, (S,S$^{'}$,S$^{''}$), Bias compensation, Thermal runaway, Thermal stability. | CO3,CO4 |
| **4** | **Small Signal Low Frequency Transistor Amplifier Models**<br>**BJT:** Two port network, Transistor hybrid model, determination of h-parameters, Millers theorem and Dual of Millers theorem, Analysis of CB, CE and CC amplifiers using exact analysis, Comparison of transistor amplifiers | CO3,CO4 |
| **5** | **FET:** FET types, JFET operation and characteristics (qualitative explanation only), small signal model of JFET.<br>**MOSFET:** MOSFET Structure, Operation of MOSFET, MOSFET as a variable resistor, derivation of V-I characteristics of MOSFET, Comparison of Bipolar and MOS devices.<br>**CMOS amplifiers:** General Considerations, Common Source Stage, Common Gate Stage, Source Follower, comparison of FET amplifiers. | CO5 |

| **Learning Resources** |
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| **Text Books** |
| 1. J. Millman ,Electronic Devices and Circuits, C. C. Halkias, Mc-Graw Hill Education 1991.<br>2. J. Millman,C. Halkias ,Integrated Electronics-, Mc-Graw Hill Education.2nd Ed.,2017.<br>3. BehzadRazavi ,Fundamentals of Microelectronics, Wiley, 3rd Ed.,, 2021. |
| **Reference Books** |
| 1. Robert L. Boylestad and LouiNashelsky, Electronics devices & circuit theory-, Pearson,11th 5th Ed., 2015.<br>2. David A. Bell ,Electronic Devices and Circuits - Oxford University Press, 5th Ed., 2008.<br>3. S. Salivahanan, N. Suresh Kumar ,Electronic Devices and Circuits-, Mc-Graw Hill, 5th Ed., 2022. |
| **e-Resources & other Digital Material** |
| 1. https://nptel.ac.in/courses/117106086<br>2. https://nptel.ac.in/courses/108105058 |