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| **Course File Index** |
| **Name of the Course: Electronic Devices & Circuit** |
| **Code of the course: 3EE1A** |
| **Name of Faculty: Mrs. Sonali Chadha** |
| **Vision of Institute: To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.** |
| **Mission of Institute:  • Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning. • Identify, based on informed perception of Indian, regional and global needs, areas of focus and provide platform to gain knowledge and solutions.  • Offer opportunities for interaction between academia and industry. • Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.** |
| **Vision of Department: To emerge as a Center of Excellence in teaching in the area of Electrical Engineering; to serve as a valuable resource for society by promoting excellence.** |
| **Mission of Department:  M1: To provide professional and ethical guidance to the students to make them employable. M2: To improve quality of education through different quality development programs for faculty and students. M3: To encourage students to acquire practical knowledge through projects and participation in national and international events. M4 : To prepare our students for upcoming challenges of life through guidance for competitive examinations.** |

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| S. No. | UNITS | Lecture No. | Topic to be discussed | Objective of lecture | Outcome of Lecture | Book referred | From page to |
| 1 | **UNIT I : Semiconductor Physics** | 1 | Introduction to semiconductor, Mobility and conductivity, charge densities in a semiconductor | To have a basic knowledge of material types (n- type & p-type)& Relationship betweent current density & others | Understanding of the concept of bandgap in semiconductors, to distinguish direct and indirect bandgap semiconductors, and to relate the bandgap | Millman's Integrated Electronics | 20 to 26 |
| 2 | 2 | Fermi Dirac distribution & Boltzmann approximation | To understand how the Fermi-Dirac statistics affect the energy of electrons in a metal. | Understanding of free electron and hole doping of semiconductors to determine Fermi level position | Millman's Integrated Electronics | 806-808 |
| 3 | 3 | carrier concentrations and Fermi levels in semiconductor | To understand how the Fermi-Dirac statistics affect the energy of electrons in a metal. | calculate the free carrier concentrations at variable temperatures. | Millman's Integrated Electronics | 22-24, 816-817 |
| 4 | 4 | Generation and recombination of charges, diffusion | To have a deep knowledge of how diffussion occurs in semiconductors | Knowledge of the formation of p-n junction through diffusion . | Millman's Integrated Electronics | 33 |
| 5 | 5 | Continuity equation & Transport equations | Understanding of the mechanisms of and Contunity transport Equation | How to satisfy the condition of conservation and describes the flow of electrons through semiconductor device due to application of voltage | Millman's Integrated Electronics | 37 |
| 6 | 6 | Mass action Law & Hall effect | To have a proper knowledge of material types | Understanding of the mechanisms of Hall Effect | Millman's Integrated Electronics | 26,29 |
| 7 | 7 | Numerical | Implementation of formulas | To know how much he has gained from the unit. |  | RTU PAPER |
| 8 | UNIT II : Junction Diodes | 8 | Formation of homogenous and hetrojuntion diodes and their energy band diagrams | Understanding of the concept of bandgap in semiconductors | The effect of the bandgap discontinuities and the different material parameters | 1. Millman's Integrated Electronics 2. EDC boylestad | 49 10 |
| 9 | 9 | calculation of contact potential and depletion width, V-I characteristics | To study behaviour of diode and formation of depletion width | to explain the diode operation and draw its I-V characteristics | Millman's Integrated Electronics | 41 |
| 10 | 10 | Small signal models of diode, Diode as a circuit element, diode parameters and load line concept | to virtulize the relationship between Q point and the device characteristics. | To determine the operating condition of the device by which the performance of device can be judged | 1. EDC boylestad 2. EDC J.B. Gupta | 56 84 |
| 11 | 11 | C-V characteristics and dopant profile & Transient behavior of PN diode | study the transient effects in a p-n junction diode due to a sudden change in current. | Applying the knowledge of transient in switching application od device in industries | 1. EDC J.B. Gupta 2. Millman's Integrated Electronics | 76 60 |
| 12 | 12 | Applications of diodes in rectifier, voltage multipliers, Breakdown diodes | Understand the Circuit behaviour of Rectifiers & multipliers . | emphasis on the use of diode in limiting and rectifying circuits | EDC boylestad | 75,98 |
| 13 | 13 | Schottky diodes, and Zener diode as voltage regulator, UJT | Recognizing the specification of each type of these devices | implementation of various devices in industrial world depending upon application | EDC J.B. Gupta | 107,95-97 |
| 14 | 14 | Introduction to clipping circuits | to design and analyze diode clipping circuits | to use basic devices to protect the sensitive circuits from transient effects. | EDC boylestad | 78 to 85, RTU PAPER |
| 15 | 15 | Numerical | EDC boylestad |
| 16 | 16 | Introduction to clamping circuits | to design and analyze diode in clamping circuits. | to use basic devices to protect the sensitive circuits from transient effects. | EDC boylestad |
| 17 | 17 | Numerical | EDC boylestad |
| 18 | **UNIT III : Transistors** | 18 | Introduction to transistor, Characteristics, Current Components, Current Gains: alpha and beta | the basic theoretical principles of operation of transistors | Apply concepts of semiconductor devices to design and analyze circuits | EDC boylestad | 129 to 144 |
| 19 | 19 | Variation of transistor parameter with temperature and current level, Operating point | Apply fundamentals of semiconductor devices in electronics projects and use computer tools in circuit design, evaluation and analysis | Understand the basic physics and operation of BJT transistors, including structure and operational regimes (saturation, triode, etc.). | EDC boylestad | 129 to 144 |
| 20 | 20 | DC and AC analysis of single stage CE, CC (Emitter follower) and CB amplifiers | To evaluate effect of AC & DC analysis on transistor with different configuration | Understand and apply large and small-signal models of BJTs to solve for both bias points and small-signal gain, input/output | EDC boylestad | 162 to 215 , 253 to 286 |
| 21 | 21 | Stabilization techniques,Thermal runaway, Thermal stability | To have a knowledge of stablity of various devices and runaway condition | applying the various compensation technique practically to improve the performance of device | EDC boylestad | 217 |
| 22 | 22 | Ebers-Moll model for transistor | To study mechanism behind Ebers moll model | describe the origins and consequences of the elements which appear in a BJT’s equivalent circuit, both for large signals (Ebers-Moll model) | EDC J.B. Gupta | 147 |
| 23 | 23 | DC model of transistor, h-parameter equivalent circuits | To solve circuits using h parameter for low frequency signals | Explain classification of amplifiers and analyze the CE, CB, CC amplifiers using  small signal hybrid model and derive the voltage gain, current gain, input impedance and output impedance | EDC boylestad | 292 to 338 |
| 24 | 24 | Numerical | Implementation of formulas | To know how much he has gained from the unit. | EDC boylestad | Solved example, RTU paper |
| 25 | 25 | Numerical | EDC boylestad | Solved example, RTU paper |
| 26 | **UNIT IV: JFET & MOSFET** | 26 | Construction and operation of JFET | To know the basic mechanism behind working of JFET | the basic physics and operation of the Metal Oxide Semiconductor Field Effect Transistor (MOSFET) | EDC boylestad | 378 to 402 |
| 27 | 27 | MOSFET: Enhancement type and Depletion type | To know the basic mechanism behind working of MOSFET | Understand models of MOSFETs to solve for both bias points and characteristics of device. | EDC boylestad |
| 28 | 28 | Noise performances of FET, | To study effect of noise on devices | to learn how effect of noise can be reduced by using suitable technique | EDC boylestad |
| 29 | 29 | Biasing of JFET's & MOSFET’s. Low frequency single stage CS and CD (source follower) JFET amplifiers | To have a brief knowledge of why biasing is required | Understand structure, operational regimes (depletion, inversion, etc.), current-voltage characteristics for different biasing | EDC boylestad | 422 to 458 |
| 30 | 30 | Small signal models of JFET & MOSFET | analysis techniques and design principles for analog integrated amplifier circuits | Understand and apply small-signal models of JFET & MOSFETs to solve for both bias points and small-signal gain, input/output impedances, and frequency response of canonical and multi-stage amplifier topologies. | EDC boylestad | 482 to 510 |
| 31 | 31 | FET as voltage variable resistor and active load | To have a breif idea about application of device | learn how to implement the application of devices in various industrial application | EDC J.B. Gupta | 269 to 271 |
| 32 | 32 | Numerical | Implementation of formulas | To know how much he has gained from the unit. | EDC boylestad | Solved example, RTU paper |
| 33 | 33 | Numerical | EDC boylestad | Solved example, RTU paper |
| 34 | **UNIT V : Small Signal Amplifiers at Low Frequency** | 34 | Analysis of BJT and FET multistage amplifier | To know the circuit behaviour of multistage amplifier | to study the effect of frequency response of canonical and multi-stage amplifier topologies. | EDC J.B. Gupta | 305 |
| 35 | 35 | DC and RC coupled amplifiers | Analysing variation in the circuit behaviour by using various coupling technique | Method of calculating cutoff frequencies and to determine bandwidth | EDC J.B. Gupta | 305 to 309 |
| 36 | 36 | Frequency response of single and multistage amplifier, mid-band gain, gains at low and high frequency. | Design and analyze single stage & multi stage amplifiers and their frequency response, its gain band width product and effect of coupling and bypass capacitors in amplifiers. | to study the effect of frequency response of canonical and multi-stage amplifier topologies. | EDC J.B. Gupta | 305 to 309, 297 to 299 |
| 37 | 37 | Analysis of DC and differential amplifiers, Miller's Theorem & its dual | To have a basic knowledge of miller's theorem and how it can be used to simplify biasing circuits | to study relationship between miller theorm and its effects | 1.Millman's Integrated Electronics 2.EDC J.B. Gupta | 323 259, 300 |
| 38 | 38 | cascade configuration of multistage amplifiers (CE-CE, CE-CB, CS-CS and CS-CD) | Analyse various configuration of multistage amplifiers | Distinguish between the different types of cascading schemes in multi stage amplifiers. | EDC J.B. Gupta | 320 to 322 |
| 39 | 39 | Darlington pair and Bootstrapped Darlington | Know how darlington circuit works and what is the requirenment of bootstrapping | Methods of increasing input impedance using Darlington connection and bootstrapping. CS, CG and CD (FET) amplifiers. | EDC J.B. Gupta | 380 |
| 40 | 40 | Numerical | Implementation of formulas | To know how much he has gained from the unit. | EDC J.B. Gupta | Solved example, RTU paper |