

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E Semester: 3

Instrumentation and Control Engineering

Subject Code 131101

Subject Name Basic Electronics

| Sr.No | Course Content |
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| 1 | Energy Bands in Solids: Charged Particles, Field Intensity, Potential Energy, The eV Unit of Energy, The Nature of the Atom, Atomic Energy Levels, Electronic Structure of The Elements, The Energy Band Theory of Crystals, Insulators, Semiconductors and Metals |
| 2 | Transport Phenomena in Semiconductors: Mobility and Conductivity, Electrons and Holes in an Intrinsic Semiconductor, Donor and Acceptor Impurities, Charge Densities in a Semiconductor, Electrical Properties of Ge and Si, The Hall Effect, Conductivity Modulation, Generation and Recombination of Charges, Diffusion, The Continuity Equation, Injected Minority –Carrier Charge, The Potential Variation within a Graded Semiconductor |
| 3 | Junction –Diode Characteristics: Open –Circuited p-n Junction, p-n Junction as a Rectifier, Current Components in a p-n Diode, Volt-Ampere Characteristic, Temperature Dependence of the V/I Characteristic, Diode Resistance, Space Charge , Transition Capacitance, Charge-Control Description of a Diode , Diffusion Capacitance , Junction Diode Switching Times, Breakdown Diodes, Tunnel Diode, Semiconductor Photodiode, Photovoltaic Effect, Light –Emitting Diodes |
| 4 | Diode Circuits: Diode as a Circuit Element, Load-Line Concept, Piecewise Linear Diode Model, Clipping Circuits, Clipping at Two Independent Levels, Comparators, Sampling Gate, Rectifiers, Other Full-Wave Circuits, Capacitor Filters, Additional Diode Circuits |
| 5 | Transistor Characteristics: Junction Transistor, Transistor Current Components, Transistor as an Amplifier, Transistor Construction, CB Configuration, CE Configuration, CE Cutoff region, CE Saturation Region, Typical Transistor, CE Current Gain, CC Configuration, Analytical Expressions for Transistor Characteristics Maximum Voltage Rating, Phototransistor |

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| 6 | <p>Transistor at Low Frequencies:</p> <p>Graphical Analysis of the CE configuration, Two-Port Devices and the Hybrid Model, Transistor Hybrid Model, h-Parameters, Conversion Formulas for the Parameters of Three Transistor Configurations, Analysis of a Transistor Amplifier Circuit Using h Parameters, Thevenin's and Norton's Theorems and Corollaries, Emitter Follower, Comparison of Transistor Amplifier Configurations, Linear Analysis of a Transistor Circuit, Miller's Theorem and its Dual, Cascading Transistor Amplifiers, Simplified CE Hybrid Model, Simplified Calculations for the CC Configuration, CE Amplifier with an Emitter Resistance, High Input Resistance Transistor Circuits</p> |
| 7 | <p>Transistor Biasing and Thermal Stabilization:</p> <p>Operating Point, Bias Stability, Self-Bias, Stabilization against Variations in I_{CO}, V_{BE} and β, General Remarks on Collector-Current Stability, Bias Compensation, Thermistor and Sensistor Compensation, Thermal Runaway, Thermal Stability</p> |
| 8 | <p>Field Effect Transistors:</p> <p>Junction FET, Pinch-Off Voltage, JFET Volt-Ampere Characteristics, FET Small-Signal Model, MOSFET, Digital MOSFET Circuits, Low Frequency CS and CD Amplifiers, Biasing the FET, The FET as a Voltage Variable Resistor, CS Amplifier at High Frequencies, CD Amplifier at High Frequencies</p> |
| 9 | <p>Power Circuits and Systems:</p> <p>Class A large Signal Amplifiers, Second Harmonic Distortion, Higher –Order Harmonic Generation, Transformer Coupled Audio Power Amplifier, Efficiency, Push-Pull Amplifiers, Class B Amplifiers, Class AB Operation, Regulated Power Supplies, Series Voltage Regulator</p> |

Reference Books:

1. Integrated Electronics By Jacob Millman and Christos C. Halkias, Tata McGraw Hill Publication
2. Electronics Devices by Floyd, Pearson Publication [Seventh edition]
3. Electronic Devices and Circuit Theory by Robert Boylestad and Louis Nashelsky [Ninth Edition]