

# Content Product

## Detailed syllabus

### ELECTRONIC DEVICES AND CIRCUITS

#### UNIT I - PN JUNCTION DEVICES

**Formation of n-type and p-type semiconductor-** Doped semiconductors, N-type semiconductor, Formation and conduction in N-type semiconductor, P-type semiconductor, Formation and conduction in P-type semiconductor. **Majority and Minority carriers-** Majority and Minority carriers, Conduction in semiconductors. **PN junction diode-** PN junction diode, Introduction to PN junction, Formation of PN junction, Formation of depletion region, Barrier potential, Band Structure of PN Junction. **Operation of PN junction diode** - Operation of PN junction diode, Biasing of PN junction diode, Forward biasing of PN junction diode, Effect on the depletion region and barrier potential, Reverse biasing of PN junction diode, Breakdown in reverse biased, Comparison of breakdown mechanism, V-I characteristics of a diode. **Diode equation** - Diode equation. **Diode resistance** - Diode resistance, Forward resistance, Reverse resistance. **Diode capacitances** - Diode capacitances, Transition capacitance, Diffusion capacitance. **Specifications and applications of diodes** - Diode – Variants, Diode numbering, Specifications of diodes, Applications of PN junction diodes. **Solved problems for semiconductor-** Problem to calculate reverse and forward resistance, Problem to calculate DC and dynamic forward resistance, Problem to calculate diode current, Problem to calculate forward diode current, Problem to calculate forward voltage drop. **Rectifiers-**Need of rectifier, Classification of rectifiers. **Halfwave rectifier** - Halfwave rectifier, Halfwave rectifier parameters, Average DC load current and Average DC load voltage, R.M.S. value of load current and load voltage, DC power output and AC power input, Rectifier efficiency, Ripple factor and Load current, Peak Inverse Voltage (PIV) and Transformer Utilization Factor (TUF), Voltage regulation, Advantages and disadvantages of HWR. **Center tapped full wave rectifier** - Center tapped full wave rectifier, Full wave rectifier, Maximum load current, Average DC load current and voltage, RMS value, power input and power output, Rectifier efficiency, Ripple factor, Load current, Peak Inverse Voltage (PIV), Transformer Utilization Factor (TUF), Voltage regulation, Advantages and disadvantages of Full Wave Rectifier (FWR). **Full wave bridge rectifier-** Full wave bridge rectifier, Full wave bridge rectifier, Expression for various parameters, Advantages and disadvantages of Bridge Rectifier (BR), Comparison of half wave, full wave and bridge rectifier. **Display devices-** Introduction of displays, Seven segment display using LED's, 5 x 7 Dot matrix display using LED. **Light Emitting Diode (LED)-** Introduction of Light Emitting Diode (LED), Construction of LED, Basic operation of LED, Advantages and Disadvantages of LED, Applications of LED. **LASER diode-** Introduction to laser diode, Operation of laser diode, Characteristics of laser diode, Classification and applications. **Zener diode** -Introduction to Zener diode, Zener breakdown, Avalanche breakdown, Differences between Zener and Avalanche break downs. **Zener diode characteristics** - V-I Characteristics of Zener diode, Specifications of Zener Diode, Application of Zener Diode. **Voltage regulators** - Introduction of voltage regulation, Types of voltage regulators, Zener diode shunt regulator, Stability factor for Zener voltage regulator, Advantages and disadvantages of Zener voltage regulator, Transistor shunt regulator, Emitter follower series voltage regulator.

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### UNIT-II – TRANSISTORS

**Transistor**- Introduction of transistor, Formation of transistor, Types of transistor, PNP transistor, NPN transistor, Transistor as an amplifier in CB configuration, Transistor configurations, Operation region of a transistor (CB configuration). **Transistor configurations** - Common base configuration, Common emitter configuration, Common collector configuration. **Characteristics of transistor** - Input characteristics of a transistor in a CB configuration, Output characteristics of a Transistor in CB configuration, Three regions in the output characteristics of CB - Configuration, Input characteristics of CE configuration, Output characteristics of CE configuration, Three regions in the output characteristics of CE-Configuration, Input and Output characteristics of CC configuration.

**Solved problems for transistor**- Problem to calculate collector current and emitter current, Problem to calculate Base Current, Problem to calculate Collector Current, Problem to calculate common emitter gain, Problem to calculate Emitter Current. **Junction Field Effect Transistor (JFET)**- Introduction to field effect transistor, Terminal details of JFET, Classification of Field Effect Transistor (FET, Introduction of Junction Field Effect Transistor (JFET), Construction of N and P-channel JFET, Operation of JFET. **Characteristics of JFET** - JFET Parameters, JFET Characteristics, Advantages and Disadvantages of JFET over BJT, Features and applications of JFET, Difference between N-channel and P-channel JFET, Difference between FET and BJT. **Configurations of JFET** – Introduction, Common Source (CS) amplifier, Common Drain (CD) amplifier, Common Gate (CG) amplifier. **Solved problems for JFET**- Problem to calculate the drain current, Problem to calculate drain current and trans conductance, Problem to calculate the drain current and voltage, Problem to calculate source resistance, Problem to calculate gate source voltage. **MOSFET** - Introduction of MOSFET, MOSFET structure, Classification of MOSFET, E-MOSFET, Construction of a N-channel enhancement MOSFET, Operation of enhancement MOSFET, Drain and transfer characteristics, Comparison of D-MOSFET and E-MOSFET, Comparison between N-Channel and P-Channel MOSFET. **DMOSFET**- Construction of depletion MOSFET, Operation of MOSFET, Drain and transfer characteristics. **MOSFET biasing** – Introduction, Operation of MOSFET, Biasing enhancement MOSFET, Biasing of depletion MOSFET. **Unijunction Transistor (UJT)** - Unipolar Junction Transistor (UJT), Equivalent circuit of UJT, Working of UJT. **Characteristics of UJT**- UJT Relaxation Oscillator, Features of UJT, Applications of UJT. **Thyristors** - Types of thyristor family devices, ISI circuit symbol for power semiconductor devices, Silicon controlled rectifier, Power control using SCR, Operation of SCR, Characteristics of SCR, DC power control using SCR, Applications of SCR, DIAC (Diode A.C. Switch), TRIAC (Triode for Alternating Current). **Insulated gate bipolar transistor (IGBT)** - Insulated gate bipolar transistor (IGBT), Basic structure and working of IGBT, IGBT characteristics, Advantages, disadvantages and applications of IGBT, Types of IGBTs, Principle of operations of IGBT, Equivalent circuit of IGBT, Latch Up in IGBT, Safe operating area (SOA) of IGBT, IGBT Driving Circuits, Protection circuits for IGBT.

### UNIT III – AMPLIFIERS

**BJT small signal model**- BJT small signal model, Introduction, Hybrid parameter, Equivalent circuit for h parameter, Analysis of transistor amplifier circuit using 'h' parameters. **Small signal analysis of amplifiers** – Introduction, Small signal analysis of Common Emitter (CE) amplifier, Small signal analysis of Common Collector (CC) amplifier, Small Signal analysis of Common Base (CB) amplifier, Comparison

of transistor configurations. **Introduction to frequency response of amplifier**- Introduction to frequency response of amplifier, General shape of frequency response of amplifier, Definition of cut off frequencies and bandwidth. **Frequency response of BJT circuits**- Low frequency response of BJT, High frequency response of BJT, Hybrid pi equivalent circuit of BJT. **Small signal analysis of JFET** - Small signal analysis of JFET, Approximate a.c. equivalent circuit, Analysis of common source amplifier with fixed bias, Problem to determine input impedance, output impedance and voltage gain. **Small signal analysis of common drain amplifiers** - Common drain amplifier with fixed bias, Input impedance  $Z_i$  and output impedance, Voltage gain  $A_V$ , Problem to determine input impedance, output impedance and voltage gain. **Small signal analysis of common gate amplifiers**- Common gate amplifier with fixed bias, Input impedance  $Z_i$ , Output impedance  $Z_o$  and voltage gain  $A_V$ , Problem to determine input impedance, output impedance and voltage gain. **Frequency response of FET** - Low frequency response of FET circuits, High frequency response of FET circuits, Gain bandwidth product of FET.

### UNIT IV - MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER

**Method of coupling multistage amplifier** – Introduction, Two stage cascaded amplifier, N-stage cascaded amplifier, Selection of configuration for cascading, Methods of coupling multistage amplifier. **Differential amplifier** – Introduction, The emitter coupled differential amplifier, Types of differential amplifier, Analysis of differential amplifier, Methods of improving CMRR, Transfer characteristics of differential amplifier. **FET input stages**- FET input stages, JFET applications. **Single tuned amplifier** - Introduction of tuned amplifier, Classification of tuned amplifier, Small signal tuned amplifier, Example of small signal tuned amplifier, Single tuned capacitance coupled amplifier, Example of single tuned amplifier. **Neutralization methods** - Hazeltine neutralization, Neutrodyne neutralization, Neutralization using coil, Rice neutralization. **Power amplifier** - Features of large signal amplifier, Classification of power amplifiers, Class A power Amplifiers, Class B power Amplifiers, Class C Power Amplifier, Class AB Amplifier, Class D Amplifier. **Applications of power amplifiers** - Applications of power amplifiers, Different ICs used in power amplifiers.

### UNIT V - FEEDBACK AMPLIFIERS AND OSCILLATORS

**Negative and positive feedback**- Introduction to feedback, Positive and negative feedback, Advantages and disadvantages, Comparison of positive and negative feedback. **Block diagram of negative feedback**-Block diagram of negative feedback, General feedback structure. **Properties of negative feedback** - Properties of negative feedback, Gain Desensitivity, Bandwidth Extension, Noise Reduction, Reduction in Nonlinear Distortion. **The four basic feedback topologies** - Basic feedback topologies, Voltage amplifiers, Current amplifiers, Transconductance amplifiers, Transresistance amplifiers. **The Series-Shunt Feedback Amplifier** - The Series-Shunt Feedback Amplifier, The ideal situation, The practical situation. **The Series-Series feedback amplifier** - The Series-Series feedback amplifier, The ideal case, The practical case. **The shunt – shunt feedback amplifier** - The shunt – shunt feedback amplifier, the ideal case, The practical case. **The Shunt - series feedback amplifier** - The Shunt - series feedback amplifier, the ideal situation, The practical situation. **Oscillator** -Introduction to Oscillator, Types of oscillators, Basic theory of oscillator, Comparison between amplifier and oscillator. **Requisites and Classification of oscillators** - Requisites of an oscillators, Classification of oscillators, Applications

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of oscillators. **Barkhausen criterion** - Barkhausen criterion. **RC phase shift oscillator**- RC phase shift oscillator, RC Oscillator, RC phase shift oscillator, RC feedback network, Condition for sustained oscillations, Transistorized RC Phase Shift Oscillator, Phase shift oscillator using Op-amp, FET phase oscillators, Advantages and disadvantages of RC phase shift oscillator. **Wein bridge oscillator**- Wein bridge oscillator, Advantages and disadvantages of wein bridge oscillator, Problem to determine the frequency of oscillations. **Hartley oscillator** - Hartley oscillator, Condition for sustained oscillations, Advantages and disadvantages of hartley oscillator. **Colpitt's oscillator** - Colpitt's oscillator, Condition for sustained oscillations, Advantages and disadvantages of colpitt's oscillator. **Crystal oscillator** - Crystal oscillator, A.C equivalent circuit of a crystal, Series and Parallel resonance, Crystal Stability