

M.Tech (Microwave & Communication Engineering) PVP17

SOLID STATE MICROWAVE DEVICES

17ECMC1T4

Lecture: 4 periods/week

Credits: 4

Internal assessment: 40 marks

Semester end examination: 60 marks

Prerequisites: Microwave Engineering

Course Objectives:

- To understand microwave transistor operations
- To analyze FETs in microwave circuits
- To understand and apply GUNN devices
- To analyze Avalanche Transit-Time Devices

Learning outcomes:

Student will be able to

- Know characteristics of microwave Transistors.
- Apply BJTs and FETs in microwave circuits.
- Use Transferred-Electron Devices for various applications.
- Know the applications of Avalanche Transit-Time Devices

UNIT-I

Microwave Transistors: Introduction, Microwave Transistors- physical structure, Transistor Configurations, principle of operation, V-I characteristics, Equivalent circuit, Amplification phenomena, Power- frequency limitations, Hetero-junction Bipolar Transistors (HBTs)- physical structure, Operational Mechanism, Applications, Microwave Tunnel Diode-principle of operation, Microwave characteristics.

UNIT-II

Microwave Field Effect Transistors: Introduction, Junction Field Effect Transistor (JFET)- structure, Principle of operation, V-I characteristics, Applications, Metal Semiconductor Field Effect Transistor (MESFET)- structure, principle of operation, Equivalent circuit, Drain current, cut-off frequency and Maximum oscillation frequency, High Electron Mobility Transistor (HEMT)- Structure, operational mechanism, performance characteristics, Applications, Metal Oxide Semiconductor Field Effect Transistor (MOSFET)- structure, principle of operation, Equivalent circuit, Drain current and Trans-conductance, Maximum operation frequency, Applications. MOS Transistors and Memory Devices.

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UNIT-III

Transferred-Electron Devices: Introduction, Gunn-Effect Diodes- GaAs Diode, Ridley-Watkins-Hilsum Theory, Modes of operation, LSADiodes, InP Diodes, CdTe Diodes, Applications (Microwave Generation and Amplification).

UNIT-IV

Avalanche Transit-Time Devices: Introduction, Read Diode- Structure, Operation, Carrier current and external current, Output power and Quality factor, IMPATT Diode- Structure, Different doping profile structures, Operation, Small-signal theory , Power output and Efficiency, applications. TRAPATT- Structure, Principle of Operation, Power output and Efficiency, BARITT- Structure, Principle of Operation, Performance and Applications. Parametric Devices - structure, Nonlinear Reactance and Manley –Row Power Relations, Parametric Amplifiers, and applications.

Learning Resources

Text Books:

1. Samuel Y. Liao, “Microwave Devices and Circuits” , Third Edition, PHI.

References:

- 1.M.L. Sisodia, Vijay Lakshmi Gupta “Microwaves- Introduction to circuits, Devices and Antennas” New Age International Publishers