RGPV EC 7 SEM CBGS SYLLABUS

EC- 7001 Microwave Engineering

Unit-I Microwave Transmission System

General representation of EM field in terms of TEM, TE and TM components, Uniform guide structures, rectangular wave guides, Circular Wave guides, Solution in terms of various modes, Properties of propagating and evanescent modes, Dominant modes, Normalized model voltages and currents, Power flow and energy storage in modes frequency range of operation for single mode working, effect of higher order modes, Strip line and micro strip lines general properties, Comparison of coaxial, Micro strip and rectangular wave guides in terms of band width, power handling capacity, economical consideration etc.

Unit-II Microwave Networks and Component

Transmission line ports of microwave network, Scattering matrix, Properties of scattering matrix of reciprocal, Non reciprocal, loss less, Passive networks, Examples of two, three and four port networks, wave guide components like attenuator, Phase shifters and couplers, Flanges, Bends, Irises, Posts, Loads, Principle of operation and properties of E-plane, H-plane Tee junctions of wave guides, Hybrid T, Multi-hole directional coupler, Directional couplers, Microwave resonators- rectangular. Excitation of wave guide and resonators by couplers. Principles of operation of non reciprocal devices, properties of ferrites, Isolators and phase shifters.

Unit-III Microwave Solid State Devices and Application

PIN diodes, Properties and applications, Microwave detector diodes, detection characteristics, Varactor diodes, parametric amplifier fundamentals, Manley-Rowe power relation MASER, LASER , Amplifiers, Frequency converters and harmonic generators using varactor diodes, Transferred electron devices, Gunn effect, Various modes of operation of Gunn oscillator, IMPATT, TRAPATT and BARITT.

Unit-IV Microwave Vacuum Tube Devices

Interaction of electron beam with electromagnetic field, power transfer condition. Principles of working of two cavity and Reflex Klystrons, arrival time curve and oscillation conditions in reflex klystrons, mode- frequency characteristics. Effect of repeller voltage variation on power and frequency of output. Principle of working of magnetrons. Electron dynamics in planar and cylindrical magnetrons, Cutoff magnetic field, Resonant cavities in magnetron, Π-mode operation Mode separation techniques, Rising sun cavity and strapping. Principle of working of TWT amplifier. Slow wave structures, Approximate gain relationship in forward wave TWT.

Unit-V Microwave Measurements

Square law detection, Broadband and tuned detectors. Wave-guide probes, Probe and detector mounts, Slotted line arrangement and VSWR meter, Measurement of wave-guide impedance at load port by slotted line, Microwave bench components and source modulation. Measurement of scattering matrix parameters, High, Medium and low-level power measurement techniques, Characteristics of bolometers, bolometer mounts, Power measurement bridges, Microwave frequency measurement techniques, calibrated resonators (transmission and absorption type). Network Analyzer and its use in measurements.

References:

1. Liao: Microwave Devices and Circuits, Pearson Education.
2. Das: Microwave Engineering, TMH.
3. Rao: Microwave Engineering, PHI Learning.
4. Collins: Foundations of Microwave Engineering, Wiley India.
5. Srivastava and Gupta: Microwave Devices and Circuits, PHI Learning.
6. Reich: Microwave Principles, East West Press.
7. Pozar: Microwave Engineering, Wiley India.
8. Roy and Mitra: Microwave Semiconductor Devices, PHI learning.

List of Experiments:

Following illustrative practical should be simulated with the help of any RF simulation software:-

1. Study the characteristics of Klystron Tube and to determine its electronic tuning range.
2. To determine the frequency and wavelength in a rectangular wave-guide working on TE10 mode.
3. To determine the Standing Wave-Ratio and reflection coefficient.
4. To measure an unknown impedance with Smith Chart.
5. To study the V-I characteristics of Gunn Diode.
6. To study the following characteristics of Gunn Diode.

(a) Output power and frequency as a function of voltage.
(b) Square wave modulation through PIN diode.

7. Study the function of Magic Tee by measuring the following parameters.

(a) Measurement of VSWR at different ports and
(b) Measurement of isolation and coupling coefficient.

8. Study the function of Isolator / Circulator by measuring the following parameters.

(a) Input VSWR measurement of Isolator / Circulator.
(b) Measurement of insertion loss and isolation.

9. Study the function of Attenuator (Fixed and Variable type) by measuring the following parameters.

(a) Input VSWR measurement.
(b) Measurement of insertion loss and attenuation.

10. Study the function of Multi Hole Directional Coupler by measuring the following parameters.

(a) To measure main line and auxiliary line VSWR.
(b) To measure the coupling factor and directivity.

11. Study of a network analyzer and measurements using it.