

EC433-RF AND MICROWAVE ENGINEERING

Course Description & Objectives:

This course will provide all students with the fundamental concepts associated with RF/microwave circuits and components. The course will allow students to become expert in new and evolving areas of microwave engineering including RF.

Course Outcomes:

- a. To discuss the microwave amplifiers and oscillators basic operation, characteristics, parameters, limitations.*
- b. To discuss various microwave components like E&H plane Tee, Magic tee Junctions & phase shifters.*
- c. Analyze and design basic microwave amplifiers and oscillators, particularly two cavity klystron, reflex klystron and magnetron.*
- d. To discuss various microwave amplifiers and oscillators like CFA, BWO and TED's .*
- e. Become proficient with microwave measurement of power, frequency and VSWR, impedance for the analysis and design of circuits*

UNIT I - RF Amplifier Design & Basic Oscillator, Mixer model :

Introduction to RF concepts. Characteristics of amplifiers, Types of amplifiers, Amplifier power relation & problems, Power gain definitions, derivation and relations & problems, Basic Oscillators, Mixer models

UNIT II - Microwave Components :

Introduction: Microwave Frequencies and Band Designations. Microwave Junctions: E-plane Tee Junction, H-plane Tee Junction, Magic Tee Junction, fields and currents in Microwave Tee junctions, Applications of Magic Tee, Directional couplers, Faraday Rotation In Ferrite Devices- Gytrators, Circulators, Isolators.

UNIT III - Microwave Linear Beam Tubes (O TYPE) :

Limitations of Conventional tubes at Microwave frequencies, Two Cavity Klystron Amplifiers: Velocity modulation process, bunching process, output power and beam loading. Multicavity Klystron amplifiers: Beam current density, output current and output power. Reflex Klystron Oscillator: Velocity modulation, Power output and efficiency.

UNIT IV - Microwave Cross Field Tubes (M TYPE) & Microwave Solid-State Devices :

Magnetron Oscillators- Cylindrical Magnetron, Cross field Amplifiers. Transferred Electron Devices: GUNN-EFFECT Diodes, RWH Theory, Modes of operations.

UNIT V - Microwave Measurements :

Components of Microwave Bench Set-Up, Microwave power measurement, Impedance measurements, Attenuation Measurement, VSWR measurement, Frequency measurement.

TEXT BOOKS :

1. Reinhold Ludwig Pavel Bretchko '*RF circuit design , theory applications*' Pearson and Asia Education , Edition 2000 (Chapter 9.1 - 9.4 & 10.1 - 10.3).
2. Samuel Y Liao, "Microwave Devices and Circuits", 3rd ed., Pearson Education, 2003.

REFERENCE BOOKS :

1. M. Kulkarni, "Micro Wave and Radar Engineering", Umesh Publications, 1998.
2. John Wiley, R.E. Collin, "Foundations for Microwave Engineering", 2nd ed., IEEE Press, 2002.
3. M.L. Sisodia and G.S.Raghuvanshi, Wiley Eastern Ltd., "Microwave Circuits and Passive Devices", New Age International Publishers Ltd., 1995.
4. Peter A. Rizzi, "Microwave Engineering Passive Circuits", PHI, 1999.
5. R. Chatterjee, Affiliated East , "Elements of Microwave Engineering", West Press Pvt. Ltd., New Delhi, 1988.