
MICROWAVE ENGINEERING

PaperCode: ECS – 801

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description UNIT I ELECTROMAGNETIC WAVES

Microwave frequencies, system and unit of measure, review of Maxwell's equations and formation of electric and magnetic waves, equation in rectangular and cylindrical co-ordinates plane, uniform plane and non-uniform waves, reflections, boundary conditions plane wave propagation in free space, lossless, lossy media, good conductors, poor conductors, linear and circular polarization of electromagnetic waves.

UNIT II MICROWAVE TRANSMISSION LINES

Transmission line equation and their solutions, characteristic impedance, propagation constant standing waves and reflections. Measurement of standing waves ratio and their interpretations. Quarter and half wave-length lines, circuit properties of transmission lines. Single stub and double stub for matching. Smith chart and application.

UNIT III WAVE GUIDES, CAVITY RESONATORS AND COMPONENTS

Introduction to wave guides, solution of wave equations for rectangular and circular wave guides, TE and TM modes in rectangular guides and their field configuration, Methods of excitation of wave guides, wave guide joints and their basic accessories. Rectangular and cavity resonators, field configuration and resonant frequency. Wave guides tees, magnetic tees, hybrid rings, directional coupler, circulation and isolators.

UNIT IV MICROWAVE TUBE AND CIRCUITS

Working principle of Klystron, reflex Klystron, Magnetron, traveling wave tubes. (TWTO). Formulation of expressions for velocity modulations, transit time of electron, beam coupling co-efficient, bunching parameters of Klystron and reflex Klystron, application process in magnetron and traveling wave tube (TWT). Formulation of expression of cut-off voltage and fluxing cylindrical magnetron.

UNIT V SOLID STATE MICROWAVE DEVICES AND CIRCUITS

Stripline and micro strip circuits, microwave transistors and integrated circuits and their high frequency limitations. Circuit properties and principle of working of Varactor, Laser, Laser parametric amplifier, tunnel diodes, gun devices. IMPATT, TRAPATS, BARITT and PIN diodes and their practical applications.

Pre-requisite

Course/Paper

ELECTROMAGNETIC FIELD AND THEORY

Text Books

Samuel Y. Lio, "Microwave Devices and circuits", PHI Ltd.,

Reference Books

1. Electronics Comm. System by George Kennedy, McGraw Hill International Publication, 2006.
2. M.Kulkarni, "Microwave And Radar Engineering", Umesh Publications, 2003.
3. K.D.Prasad, "Antenna and Wave Propagation", Satya Prakashan New Delhi, 2008.

Course Outcomes:

CO1: To understand and analyze various principles involving propagation of microwaves in different media.

CO2: To analyze how transmission lines can be utilized as circuit elements and to study different impedance matching techniques.

CO3: Ability to identify and study the performance of wave guides and resonators and to study the performance of various microwave components.

CO4: To study the comparative performance and analysis of microwave tubes and circuits.

CO5: To understand the significance, types and characteristics of various microwave solid state devices and circuits.