ADVANCED MICROWAVE GUIDED-STRUCTURES AND ANALYSIS

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TYPE OF COURSE : New | Core | UG/PG
COURSE DURATION : 12 Weeks (26-Jul' 21 - 15-Oct' 21)
EXAM DATE : 24 Oct 2021

INTENDED AUDIENCE : Teachers from Colleges / Institutions / Universities / Research Scholars / Undergraduate and Post-Graduate Students / Industry Professionals

INDUSTRIES APPLICABLE TO : ISRO, DRDO, BEL, SAMEER, Astra Microwave, Qualcomm, Intel, Ansys, Wipro, Keysight Technology, Agilent, Anritsu, WiPL-D, Altair Engineering, Mistral Solutions Pvt. Ltd, Verdant Telemetry and Antenna Systems, Data Patterns, Syratron Technologies Pvt Ltd.

COURSE OUTLINE : The course begins with an exposition to a complete characterization of Scattering Matrix Parameters.Thereafter, Maxwell's Equations in both instantaneous and time-harmonic forms are covered. The treatment is extended to analyze the Power Conservation for both instantaneous and time-harmonic fields. Next, the wave equation in a homogeneous medium and radiated fields from a current source in a homogenous medium is analyzed in terms of vector and scalar magnetic / electric potentials. The phenomenon of reflection and transmission of waves at conducting and dielectric interfaces for normal and oblique incidences is studied. A thorough characterization of the rectangular waveguide follows in terms of modes of propagation, power flow, power dissipation, followed by the treatment of the rectangular resonator. A discussion of the reciprocity concept leads to the evaluation of modes excited by a current source in a waveguide. A treatment of related guided structures including hybrid guides follows. The cylindrical wave function is introduced which is used to analyze propagation characteristics in circular guides and the circular cavity.

ABOUT INSTRUCTOR :

Prof. Bratin Ghosh received his Bachelors in Electronics and Telecommunication Engineering in 1990 from Jadavpur University, Kolkata, Master of Technology in Electronics and Electrical Communication Engineering with specialization in Microwave Engineering in 1994 from the Indian Institute of Technology, Kharagpur and Ph.D. in Applied Electromagnetics in 2002 from the University of Manitoba, Canada. Thereafter, he completed his postdoctoral from the Royal Military College of Canada. He is currently Professor in the Department of Electronics and Electrical Communication Engineering, Indian Institute of Technology, Kharagpur. He is a TPC member and an invited / keynote speaker and chaired sessions in many national and international conferences and seminars.

COURSE PLAN :

Week-1: Scattering Matrix Concepts
Week-2: Instantaneous form of Maxwell's equations : Differential and Integral forms, Generalized Current Concept, Poynting Vector and Conservation of Power
Week-3: Time Harmonic form of Maxwell's equations : Poynting Vector and Conservation of Power
Week-4: Wave Equation and Solution, Relation between Wavenumbers in a Homogeneous Medium, Radiation from an Electric Current Source in a Homogeneous Medium
Week-5: Radiation from a Magnetic Current Source in a Homogeneous Medium and its application to the Green's function computation for electromagnetic field problems
Week-6: Rectangular Waveguide I : Solution to the TM to z and TE to z Modes from the z-directed Magnetic and Electric Vector Potentials, Potential Functions in the Rectangular Waveguide, Cut-off Frequency, Dominant Mode, Propagation and Attenuation Constants
Week-7: Rectangular Waveguide II : Characteristic Impedances of TE to z and TM to z Modes, Computation of Power Flow, Computation of Power Dissipation on Waveguide Walls
Week-8: Rectangular Cavity Resonator : Potential Functions of TM and TE modes for the Cavity, Resonant Frequency, Field Computation in the Cavity, Computation of Stored Energy and Quality Factor.
Week-9: The Reciprocity Theorem, Computation of Amplitudes of Forward and Backward Propagating Waves for Electric and Magnetic Current Sources in the Waveguide
Week-10: Analysis of Guided Structures : Partially-Filled Rectangular Waveguide, Dielectric Slab Guide, Non-Radiating Dielectric Guides
Week-11: Cylindrical Wave Functions, TE and TM modes in Circular Waveguides : Potential Functions in the Circular Waveguide, Cut-off Frequency, Propagation Constant, Circular Cavity
Week-12: Application to the Coupling Problem : Aperture-Coupled, Probe-Coupled and Waveguide Coupled structures.