Approval: 12th Senate Meeting

Course Name : Transmission Lines and Basic Microwave Engineering
Course Number : EE-507
Course Credits : 3-1-0-4
Prerequisite : Consent of the faculty member
Intended for : UG/PG
Distribution : Discipline Elective for 3rd and 4th year BTech in EE, MTech in EE and MS & PhD in the area
Semester : Even

Preamble: The proposed course is a basic course towards RF and microwave engineering. This course along with Electromagnetic theory course is required to understand the basics of transmission and generation of microwaves. Through this course student will be introduced to latest research area/topics in RF systems such as: Introduction to Left-Handed Medium, Electromagnetic-Band gap structures and wireless power transfer. This course may act as prerequisite for the advanced courses such as Antennas and propagation, Microwave Integrated Circuits (MIC) and Solid-State Microwave devises.

Course objective: To understand following aspects of Transmission lines and basic microwave devices

a) Transmission, reflection and losses in different type of transmission lines and impedance matching concept. Propagation in Metallic and Dielectric wave guides: mode analysis.

b) Working of basic microwave components/devise.

c) Basics of Transmission lines based on Left-Handed Medium and Electromagnetic Band-Gap Structures

Course Contents:

1. Introduction to transmission lines - Basic Transmission line equations: Two line theory, capacitance and inductance in transmission lines and impedance of loaded and unloaded transmission line. Reflections and VSWR: Scattering matrix and impedance transformation. Smith chart: Stub matching. **[10]**

2. Guided EM waves - Wave propagation in different types of transmission lines: Co-axial, microstrip, strip-lines, co-planar lines and co-planar wave guides lines. Loss and loss-less transmission lines. Metallic and dielectric wave guides: Propagation of modes. **[11]**

3. Introduction to Left Handed medium - Wave Propagation in Left-Handed medium: metamaterial-transmission line approach. Introduction to Electromagnetic Band-gap (EBG) structures. **[8]**

4. Basic microwave devices - H-Plane, E-Plane and Magic-T, Wave-Guide Couplers. Ferrites & ferrite devices. Diodes: Schottky, PIN, Varactor. Bipolar Junction Transistors (BJT). **[10]**

5. Microwave Resonators - Series and parallel resonators, Transmission line resonators, Dielectric resonators and its applications. Microwave cavity: Klystron, Magnetron, TWT. Excitation techniques of resonators. **[10]**

6. Microwave propagation - Effects of atmosphere and ground on microwave propagation, plasma Effects, microwave heating. Introduction to wire-less power transfer. Biological effects of microwave radiation and safety. **[7]**

Note: All the Units will have tutorials and in the end of course there will be a presentation assignment in which student (or a group) will present latest advancement in any-one of the topics taught in class

Text Book:

1. R K Shevgaonkar: Electromagnetic Waves, McGraw Hill Education, India 2006.
2. David M Pozar: Microwave Engineering, Fourth Edition, John Wiley & Sons Publications.

Reference:

1. C. Caloz and T. Itho, "Electromagnetic Metamaterial: Transmission Line Theory and Microwave Applications", Wileys Publications.
2. Research Papers as instructed by course Instructors.