

## **B.E E&C SEVENTH SEMESTER SYLLABUS**

### **MICROWAVES AND ANTENNAS**

**B.E., VII Semester, Electronics & Communication Engineering**  
[As per Choice Based Credit System (CBCS) scheme]

<b>Course Code</b>	<b>15EC71</b>	<b>IA Marks</b>	<b>20</b>
<b>Number of Lecture Hours/Week</b>	<b>04</b>	<b>Exam Marks</b>	<b>80</b>
<b>Total Number of Lecture Hours</b>	<b>50 (10 Hours / Module)</b>	<b>Exam Hours</b>	<b>03</b>
<b>CREDITS – 04</b>			
<b>Course objectives:</b> This course will enable students to: <ul style="list-style-type: none"><li>• Describe the microwave properties and its transmission media</li><li>• Describe microwave devices for several applications</li><li>• Understand the basics of antenna theory</li><li>• Select antennas for specific applications</li></ul>			
<b>Module-1</b>			
<b>Microwave Tubes:</b> Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). (Text 1: 9.1, 9.2.2) <b>Microwave Transmission Lines:</b> Microwave Frequencies, Microwave devices, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Smith Chart, Single Stub matching. (Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 Except Double stub matching) <b>L1, L2</b>			
<b>Module-2</b>			
<b>Microwave Network theory:</b> Symmetrical Z and Y-Parameters for Reciprocal Networks, S matrix representation of Multi-Port Networks. (Text 1: 6.1, 6.2, 6.3) <b>Microwave Passive Devices:</b> Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees. (Text 1: 6.4.2, 6.4.14, 6.4.15, 6.4.16) <b>L1, L2</b>			
<b>Module-3</b>			
<b>Strip Lines:</b> Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines. (Text 2: Chapter 11) <b>Antenna Basics:</b> Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Bandwidth, Radio Communication Link, Antenna Field Zones & Polarization. (Text 3: 2.1- 2.11, 2.13, 2.15) <b>L1, L2, L3</b>			

#### Module-4

**Point Sources and Arrays:** Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern Multiplication, Linear Arrays of  $n$  Isotropic Point Sources of equal Amplitude and Spacing. (Text 3: 5.1 – 5.10, 5.13)

**Electric Dipoles:** Introduction, Short Electric Dipole, Fields of a Short Dipole (General and Far Field Analyses), Radiation Resistance of a Short Dipole, Thin Linear Antenna (Field Analyses), Radiation Resistances of  $\lambda/2$  Antenna. (Text 3: 6.1 -6.6)

**L1, L2, L3, L4**

#### Module-5

**Loop and Horn Antenna:** Introduction, Small loop, Comparison of Far fields of Small Loop and Short Dipole, The Loop Antenna General Case, Far field Patterns of Circular Loop Antenna with Uniform Current, Radiation Resistance of Loops, Directivity of Circular Loop Antennas with Uniform Current, Horn antennas Rectangular Horn Antennas. (Text 3: 7.1-7.8, 7.19, 7.20)

**Antenna Types:** Helical Antenna, Helical Geometry, Practical Design Considerations of Helical Antenna, Yagi-Uda array, Parabola General Properties, Log Periodic Antenna. (Text 3: 8.3, 8.5, 8.8, 9.5, 11.7) **L1, L2, L3**

**Course Outcomes:** At the end of the course, students will be able to:

- Describe the use and advantages of microwave transmission
- Analyze various parameters related to microwave transmission lines and waveguides
- Identify microwave devices for several applications
- Analyze various antenna parameters necessary for building an RF system
- Recommend various antenna configurations according to the applications

#### Text Books:

1. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2<sup>nd</sup>, 2010.
2. **Microwave Devices and circuits**- Liao, Pearson Education.
3. **Antennas and Wave Propagation**, John D. Krauss, Ronald J Marhefka and Ahmad S Khan, 4<sup>th</sup> Special Indian Edition , McGraw- Hill Education Pvt. Ltd., 2010.

#### Reference Books:

1. **Microwave Engineering** – David M Pozar, John Wiley India Pvt. Ltd. 3<sup>rd</sup>Edn, 2008.
2. **Microwave Engineering** – Sushrut Das, Oxford Higher Education, 2<sup>nd</sup>Edn, 2015.
3. **Antennas and Wave Propagation** – Harish and Sachidananda: Oxford University Press, 2007.



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