MICROWAVE and ANTENNAS

Course Code	: 18EC63	CIE Marks : 40
Lecture Hours/Week	: 03 + 2 (Tutorial)	SEE marks : 60
Total Number of Lecture Hours : 50 (10 Hrs / Module)		Exam Hours : 03
CREDITS : 04		

Course Learning Objectives: This course will enable students to:

- Describe the microwave properties and its transmission media
- Describe microwave devices for several applications
- Understand the basics of antenna theory
- Select antennas for specific applications

Module 1

Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). **(Text 1: 9.1, 9.2.1)**

Microwave Transmission Lines: 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)
L1,L2

Module 2

Microwave Network theory: Introduction, Symmetrical Z and Y-Parameters for reciprocal Networks, S matrix representation of Multi-Port Networks. **(Text1: 6.1, 6.2, 6.3)**

Microwave Passive Devices: 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) **L1,L2**

Module 3

Strip Lines: Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines. **(Text 2: 11.1, 11.2, 11.3, 11.4)**

Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Radio Communication Link, Antenna Field Zones. **(Text 3: 2.1 - 2.7, 2.9 – 2.11, 2.13)** **L1,L2,L3**

Module 4

Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Arrays of two isotropic point sources, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing.
(Text 3: 5.1 – 5.6, 5.9, 5.13)

Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole, Radiation Resistance of a Short Electric Dipole, Thin Linear Antenna (Field Analyses)
(Text 3: 6.1 - 6.5)

L1,L2,L3,L4

Module 5

Loop and Horn Antenna: Introduction, Small loop, The Loop Antenna General Case, The Loop Antenna as a special case, Radiation resistance of loops, Directivity of Circular Loop Antennas with uniform current, Horn antennas Rectangular Horn Antennas.
(Text 3: 7.1, 7.2, 7.4, 7.6, 7.7, 7.8, 7.19, 7.20)

Antenna Types: The Helix geometry, Helix modes, Practical Design considerations for the mono-filar axial mode Helical Antenna, Yagi-Uda array, Parabolic reflector
(Text 3: 8.3, 8.4, 8.5, 8.8, 9.5)

L1,L2,L3

Course outcomes: At the end of the course students will be able to:

1. Describe the use and advantages of microwave transmission
2. Analyze various parameters related to microwave transmission lines and waveguides
3. Identify microwave devices for several applications
4. Analyze various antenna parameters necessary for building a RF system
5. Recommend various antenna configurations according to the applications.

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:

1. **Microwave Engineering** – Annapurna Das, Sisir K Das, TMH, Publication, 2nd, 2010.
2. **Microwave Devices and circuits**- Samuel Y Liao, Pearson Education
3. **Antennas and Wave Propagation**- John D. Krauss, Ronald J Marhefka, Ahmad S Khan, 4th Edition, McGraw Hill Education, 2013

Reference Books:

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

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