FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **BACHELOR OF TECHNOLOGY (Electronics and Communication)**

Semester: **VII**

Course Code: **202060702**

Course Title: **Microwave Engineering**

Course Group: Professional Core Course

Course Objectives: To understand the theoretical principles of microwave communication underlying microwave devices and networks. The objective of this course is to present the basic principles of transmission line, characteristics of waveguide and its application of commonly used microwave active & passive devices.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50/18	50/17	25/9	25/9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction to Microwaves**: Microwave system block diagram, Microwave frequency band and its application.	02
2	**Transmission line Analysis:** Electromagnetic wave equation, Transmission line equations & its solutions, reflection and transmission coefficient, standing wave and standing wave ratio, Concept of Mode, Characteristics of TEM, TE and TM Modes, Smith Chart Analysis.	10
3	**Waveguide:** Rectangular and circular waveguides - theory and analysis, Two-port Network and its parameters, Reciprocal and lossless Network, S parameters, Properties of S parameters	10
4	**Microwave Passive Components:** Magic Tee, Wave-guide Corners, Bends, Twists, Attenuator, Circulator, Isolator and Resonator, Directional Coupler, Power Divider Solid state devices: PIN diode, Gunn Diode, Tunnel diode, Varactor diode, Schottky Barrier diode, IMPATT and TRAPATT diodes, Microwave tubes: Klystron, TWT, Magnetron	10

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5	**Microwave Measurements:** Network analyzer, Spectrum analyzer, Measurement of Power, Frequency and impedance, S parameter at microwave frequency.	**08**
6	**Effect of Microwaves Signals:** Effect of Microwaves on human body, SAR, Microwave Imaging, Electromagnetic interference / Electromagnetic Compatibility (EMI / EMC)	**05**
		45

List of Practicals / Tutorials:

1	Introduction to Microwave bench.
2	To determine the frequency and wavelength in a rectangular wave guide working in TE10 mode with slotted section
3	Observing the output of fixed and variable attenuator and plot the characteristic of variable attenuator
4	To measure impedance, admittance, SWR & return loss using Smith chart
5	To study the Isolator and circulators and measure the Insertion Loss and Isolation of Circulator
6	To study the operation of E Plane Tee, H Plane Tee and Magic Tee
7	Observing the output of microwave bench with directional coupler and measure Coupling factor, Insertion Loss and Directivity of the Directional coupler
8	To determine the standing wave ratio and reflection coefficient
9	To find the characteristic of Reflex klystron
10	Introduction to ADS/CST software
11	**Complex problem:** Design of circulator/ directional coupler using ADS/CST software

Reference Books:

1	Samuel Liao, **Microwave Devices and Circuits**, 3rd Edition, PHI.
2	Annapurna Das, Sisir K. Das, **Microwave engineering,** 3rdEdition, Tata McGraw-Hill Publishing.
3	M. Kulkarni, **Microwave and Radar Engineering**, 5th Edition, Umesh Publication.

Supplementary learning Material:	
1	NPTEL and Coursera Video lectures.
2	MIT Course materials.

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

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Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
25	20	15	15	15	10	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand basic concepts and applications of microwave systems.	**20**
CO-2	Analysis of transmission line, waveguide and measure its parameters.	**30**
CO-3	Design, test and analyze various passive and active microwave components for different applications.	**25**
CO-4	Measurement of different parameter at microwave frequency	**25**

Curriculum Revision:	
Version:	**2.0**
Drafted on (Month-Year):	June -2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025

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