INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

MICROWAVE COMPONENTS AND CIRCUITS								
VII Semester: ECE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AECD54	**Elective**	3	-	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Microwave and radar engineering								

I. COURSE OVERVIEW:

This course deals the essential Microwave components and the design aspects of Microwave Integrated Circuits. Modern microwave engineering involves predominantly circuit analysis and design in contrast to the filed theory orientation of a generation ago. Applications of microwave engineering technology for personal communication systems, wireless local area networks, radio frequency identification tagging and direct broad cast satellite television.

II. COURSES OBJECTIVES:

The students will try to learn

- **I.** Analyze the microwave passive components such as couplers, filters, and resonators, as well as active components like microwave diodes, transistors, and amplifiers.
- **II.** Develop the skills to design, analyze, and optimize microwave circuits, including matching networks, amplifiers, oscillators, and mixers.
- **III.** Explore the various applications of microwave engineering in areas such as wireless communication, radar systems, satellite communication, and medical imaging.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

- **CO1:** Identify the importance of microwave components in wireless communication systems and choose them correctly according to system's specification.
- **CO2:** Understand how transmission lines and waveguides are used in the design of microwave components such as filters, couplers, and antennas.
- **CO3:** Analyze the microwave networks using various techniques, such as S-parameter analysis, network synthesis, and impedance matching.
- **CO4:** Examine the transmission matrices to predict the behavior of microwave signals passing through complex microwave systems.
- **CO5:** Categorize microwave resonators using measurement techniques such as reflection and transmission measurements.
- **CO6:** Outline the theory and principles of microwave control circuits, including their use in modulators, switches, phase shifters, and attenuators.

IV. COURSE CONTENT:

MODULE –I: Microwave components (09)
Introduction- Scattering matrix formulation. Passive microwave devices, terminations, bends, corners, attenuators, phase changers, directional couplers and hybrid junctions.

MODULE - II: Transmission lines and waveguides (09)
General solutions for TEM, TE and TM waves, parallel plate waveguide, rectangular waveguide, circular waveguide, coaxial line, stripline and microstrip

MODULE –III: Microwave network analysis (10)

Microwave network representations; limitations ofconventional voltage and current measurements at microwave frequencies; conceptof incident and reflected waves; scattering parameters and their physicalsignificance; properties of S-parameters for reciprocal, lossless and symmetricnetworks; measurement of S-parameters.

Conversion between S, Z, Y and ABCD parameters;signal-flow graphs; cascading of microwave networks; reference-planetransformation; impedance and admittance matrices; analysis of two-portmicrowave networks.

MODULE –IV: Microwave Resonators and impedance transformation techniques (10)
Introduction, resonator parameters, cavity resonators, planar microstrip resonant structures, dielectric resonators, YIG resonators, resonator measurements, narrow-band transformation techniques and wideband transformation techniques.

MODULE –V: Microwave control circuits (10)
Pin Diode and MESFET modeling for control circuits, design of switches, design of phase shifters, design of limiter circuits and design of variable attenuators

V. TEXT BOOKS:

1. Microwave Engineering, David Pozar, 1997, John Wiley
2. Inder Bahl, Prakash Bhartia- Microwave solid state circuit design- 2003, John Wiley

VI. REFERENCE BOOKS:

1. A. Das, “Microwave Engineering”, Tata McGraw Hill, 2000.
2. B.Bhat, S. K. Koul,,”Stripline like transmission lines for Microwave Integrated Circuits”, New age International Pvt. Ltd. Publishers 2007

VII. ELECTRONICS RESOURCES:

1. NPTEL :: Microwave Engineering
2. NPTEL :: Microwave Integrated circuits

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Definition and terminology
4. Tech-talk topics
5. Assignments
6. Model question paper - I
7. Model question paper - II
8. Lecture notes
9. Early learning readiness videos (ELRV)
10. Power point presentations