Course Code	Course Title	L	T	P	C
1151EC116	OPTICAL AND MICROWAVE ENGINEERING	2	2	0	3

a) Course Category

Program Core

b) Preamble

Fiber optic communication provides the basic concepts of optical fibers, light propagation, effect of losses and dispersion. Microwave Engineering enlightens the formulation of Scattering matrix for various microwave components and its properties, operation of solid state based devices, O and M tubes for microwave signal generation and illustrating different microwave measurement techniques

c) Prerequisite

Waveguides and Antennas

d) Related Courses

RF & Microwave Integrated circuits, Satellite Communication, Radar and Electronic Navigational system.

e) Course Outcomes

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Describe the basics of optical fiber's and its Mode Characteristics.	K2
CO2	Explain different losses, dispersion and distortion of light in optical fiber's.	K2
CO3	Apply the properties of S parameters to study the characteristics of microwave components.	K3
CO4	Explain the working principle of different solid state based devices used for generation and amplification of microwave signal.	K2

CO5	Describe the working principle of linear beam and cross field devices for microwave generation and amplification. Explain various techniques used for microwave measurements.	K2

f) Correlation of Cos with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	M	-	-	M	-	-	-	L	-	M	-	-	-
CO3	H	M	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	M	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	M	L	-	-	-	-	-	-	-	M	L	-	-

g) Course Content

UNIT I INTRODUCTION TO OPTICAL FIBERS 12

Introduction to Telecommunications and Fiber Optics: The Evolution of Fiber Optic Systems, Basic Optical Laws and Definitions: Propagation of light inside fiber - Critical-Angle - Numerical Aperture - Acceptance-Angle -Cut-off wavelength, Mode Field Diameter, Mode Theory: V-Number, Fiber Types, Splicing Techniques and Connectors.

UNIT II LOSSES AND DISPERSION IN OPTICAL FIBERS 12

Merits and Demerits of Fiber Optics over conventional copper wire systems, Losses: Attenuation Losses - Absorption Losses - Scattering Losses - Bending Losses - Core and Cladding Losses - Total Combined Losses, Dispersion: Group-Delay - Material Dispersion - Waveguide Dispersion - Intermodal Distortion.

UNIT III MICROWAVE COMPONENTS AND TWO PORT NETWORKS 12

Introduction to Microwaves: Microwave frequencies - advantages and applications, Scattering matrix formulation: Concept of N port scattering matrix representation - S parameters properties, Passive microwave devices: bends – corners – attenuators - phase changers, S Matrix Calculations for 2 port Junction: E plane and H plane Tees - Magic Tee - Directional Coupler - Circulator and Isolator- problems.

UNIT IV MICROWAVE SOLID STATE DEVICES 12

Transit time limitations in Microwave Bipolar Transistors, Power frequency limitations Microwave Field Effect Transistors, Gunn effect: RWH theory - High-field domain and modes of operation - microwave amplification, Avalanche transit time devices: IMPATT and TRAPATT diodes, Parametric amplifiers.

UNIT V MICROWAVE TUBES AND MEASUREMENTS 12

Microwave vacuum tube based devices(Qualitative study),Limitations of conventional tubes at UHF & Microwave, Klystron: Two cavity Klystron - velocity modulation - multicavity klystron -Reflex klystron, Traveling wave tube, Magnetron Microwave measurements: Measurement of power – wavelength – impedance – SWR – attenuation - Q and Phase shift.

Total 60 Hrs

h) Learning Resources

Text Books

1. John M. Senior , “Optical Fiber Communication”, Second Edition, Pearson Education, 2007
2. Samuel Y Liao, “Microwave Devices & Circuits” Third Edition Prentice Hall of India, 2006.
3. David M. Pozar, "Microwave Engineering", Third Edition, Wiley India.2012.

Reference Books

1. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
2. Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, 4th Edition., 2010.
3. R.E.Collin, "Foundations for Microwave Engineering", Second edition, IEEE Press.Citations 2000.
4. Annapurna Das and Sisir K Das, “Microwave Engineering”, Third edition Tata McGraw Hill Inc., 2009.

Online Resources

1. https://en.wikipedia.org/wiki/Microwave_engineering
2. http://www.microwaveeng.com
3. http://www.meslmicrowave.com/microwave-integrated-circuits/overview/
4. www.nptelvideos.in/2012/12/advanced-optical-communication.html