

Short Syllabus

BECE305L

Antenna and Microwave Engineering (3-0-0-3)

EM Radiation and Antenna Parameters - Radiation mechanism and pattern; Linear and Planar Arrays - Two element array, N element linear array; HF, UHF and Microwave Antennas - Wire Antennas, Aperture antennas; Microwave Sources - TWT, Klystron amplifier; Microwave Passive components - ABCD, 'S' parameter and its properties; Microwave Passive circuits - T junction and resistive power divider, Filter design; Microwave Active Circuits - Microwave transistors and amplifiers.

Course Code	Course Title	L	T	P	C
BECE305L	Antenna and Microwave Engineering	3	0	0	3
Pre-requisite	BECE205L	Syllabus version			
		1.0			
Course Objectives					
<div>1. To introduce and discuss the mechanism for antenna parameters, radiating principles, fundamental characteristics and design concepts of HF, UHF, Microwave antennas and arrays.</div> <div>2. To design and analyse various passive and active microwave circuits.</div> <div>3. To familiarize the operational principles of microwave sources and to characterize microwave networks.</div>					
Course Outcome					
Students will be able to					
<div>1. Examine the radiation mechanism of electromagnetic fields and identify the various antenna parameters.</div> <div>2. Apply the design criteria to Linear, HF, UHF, microwave antenna and arrays.</div> <div>3. Comprehend the performance of different microwave sources and ferrite devices.</div> <div>4. Design and analyze the passive components at microwave frequencies.</div> <div>5. Design and analyze the various passive circuits at microwave frequencies.</div> <div>6. Infer the importance of high frequency transistors to design microwave amplifiers.</div>					
Module:1	EM Radiation and Antenna Parameters	8 hours			
Radiation mechanism - single wire, two wire and current distribution, Hertzian dipole, Dipole and monopole - Radiation pattern, beam width, field regions, radiation power density, radiation intensity, directivity and gain, bandwidth, polarization, input impedance, efficiency, antenna effective length and area, antenna temperature. Friis transmission equation, Radar range equation.					
Module:2	Linear and Planar Arrays	6 hours			
Two element array, N-element linear array - broadside array, End fire array - Directivity, radiation pattern, pattern multiplication. Non-uniform excitation - Binomial, Chebyshev distribution, Arrays: Planar array, circular array, Phased Array antenna (Qualitative study).					
Module:3	HF, UHF and Microwave Antennas	7 hours			
Wire Antennas - long wire, loop antenna - helical antenna. Yagi-Uda antenna, Frequency independent antennas - spiral and log periodic antenna - Aperture antennas – Horn antenna, Parabolic reflector antenna - Microstrip antenna.					
Module:4	Microwave Sources	5 hours			
Microwave frequencies and applications, Microwave Tubes: TWT, Klystron amplifier, Reflex Klystron & Magnetron. Semiconductor Devices: Gunn diode, Tunnel diode, IMPATT – TRAPATT - BARITT diodes, PIN Diode.					
Module:5	Microwave Passive components	6 hours			
Microwave Networks - ABCD, ‘S’ parameter and its properties. E-Plane Tee, H-Plane Tee, Magic Tee and Multi-hole directional coupler. Principle of Faraday rotation, isolator, circulator and phase shifter.					
Module:6	Microwave Passive circuits	7 hours			
T junction and resistive power divider, Wilkinson power divider, branch line coupler (equal & unequal), Rat Race Coupler, Filter design: Low pass filter (Butterworth and Chebyshev) - Richards transformation and stepped impedance methods.					

Module:7	Microwave Active Circuits		4 hours
Microwave transistors, Microwave amplifiers: Two port power gains, stability of the amplifier, Microwave oscillators.			
Module:8	Contemporary issues		2 hours
	Total Lecture hours:		45 hours
Text Book(s)			
1.	C.A. Balanis, Antenna Theory - Analysis and Design, 2016, 4 th Edition, Wiley& Sons, New York, USA.		
2.	D. M. Pozar, Microwave engineering, 2013, 4 th Edition, Wiley & Sons, USA.		
Reference Books			
1.	R Ludwig, Gene Bogdanov, RF Circuit design: Theory and applications, 2013, 2 nd Edition, Pearson India.		
2.	John D Krauss, Antennas for all Applications, 2008, 4 th Edition, Tata McGraw Hill, India.		
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test			
Recommended by Board of Studies		14-05-2022	
Approved by Academic Council		No. 66	Date 16-06-2022