Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETC504	RF Modeling and Antennas	4	-	--	4	-	--	4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		ETC 404: Wave Theory and Propagation
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Analyze and Design RF Filters
	CO2	Analyze the radiation mechanism and fundamental parameters of Antennas.
	CO3	Able to Demonstrate knowledge of antennas in communication systems.
	CO4	Able to discriminate between antennas on the basis of their electrical performance.
	CO5	Able to design different microstrip Antennas and Antenna Arrays.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Behavior of Active and Passive Components in RF range**		1,2	04
	1.1	Frequency Spectrum, hazards of Electromagnetic Radiations, and fundamentals of radio frequency design		
	1.2	High Frequency behavior, equivalent circuit and frequency response of resistor, capacitor, inductor, diode, BJT, and FET		
	1.3	Characteristics, structure and applications of coaxial line, stripline, microstrip line, and coplanar lines		
2	**Filter Design**		1,2,4	12
	2.1	Analysis of infinite periodic structures terminated Periodic structures, k-β diagrams and wave velocities.		
	2.2	**Image Parameter Method:** Image impedances and transfer functions for two port networks, constant-k filter sections, m-derived filter sections, and composite filters		
	2.3	**Insertion Loss Method:** Characterization by power loss ratio, maximally flat, equal ripple, and linear phase low pass filter prototype.		
	2.4	**Filter transformations:** impedances, frequency scaling, and band pass and band stop		
	2.5	Richard's transformation, Kuroda's identity, impedance, and admittance inverters		
3	**Fundamentals of Antenna**		3,4	14
	3.1	Conceptual understanding and radiation mechanism		

	3.2	**Fundamental Parameters of Antennas:** Radiation pattern, radiation power density, radiation intensity , beam width, directivity, antenna efficiency, gain, beam efficiency, bandwidth, input impedance, antenna radiation efficiency, antenna vector effective length and equivalent areas, maximum directivity and maximum effective areas.		
	3.3	Friss transmission equation, antenna temperature		
	3.4	Vector potential *A* for an electric current source *J*, vector potential *F* for an magnetic current source *M*, electric and magnetic fields for electric *J* and Magnetic *M* current sources, and concept of near and far field radiation.		
4	**Wire Antennas**		1,2,3,5	10
	4.1	**Infinitesimal dipole and small dipole:** Radiation field, near field, far field directivity, region separation		
	4.2	**Finite Length dipole**: Basic parameters of half wavelength dipole, folded dipole		
	4.3	Monopole antenna		
	4.4	Ground Effects		
	4.5	Linear elements near or on infinite perfect conductors		
	4.6	**Loop antennas**: Basic parameters		
5	**Antenna Arrays:**		1,3	04
	5.1	Linear arrays, planner arrays, and circular arrays		
	5.2	Array of two isotropic point sources, non-isotropic sources		
	5.3	Principle of pattern multiplication,		
	5.4	Linear arrays of n elements, broadside, radiation pattern, directivity, beam width and null directions, array factor		
	5.5	Antenna analysis using Binomial, Dolph-Tschebyscheff, Yagi Uda antenna		
6	**Special types of antennas**		3	08
	6.1	**Frequency Independent Antennas:** Log periodic and helical antennas **Microstrip Antennas: C**haracteristics, applications and limitations		
	6.2	**Reflector Antennas and Horn Antennas:** Characteristics, applications andlimitations		
			Total	**52**

References

1. David M Pozar, "*Microwave Engineering*", John Wieley and Sons, Inc. Hobokenh, New Jersey, Fourth Edition, 2012
2. Costantine A. Balanis, "*Antenna Theory Analysis And Design*", John Wiley Publication
3. John D. Kraus, " *Antennas*", Tata McGraw Hill publication
4. Annapurna Das and Sisir K Das, "*Microwave Engineering*", Tata McGraw Hill,New Delhi, Second Edition, 2009
5. Reinhold Ludwig and Pavel Bretchko, "*RF Circuit Design*", Pearson Education Asia.