Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ Practical	Tutorial	Total
ETC504	RF Modeling and Antennas	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETC504	RF Modeling and Antennas	20	20	20	80	-	-	-	100

Course Pre –requisite: : ETC 404: Wave Theory and Propagation

Course Objective: To teach students

- Design of different types of passive filters used for radio frequency application.
- Radiation phenomena and pattern of various antennas.
- The various characteristics of different types of antennas.

Course Outcome: On Completion of this course Student will be able to

- Analyze and design RF Filters
- Analyze the radiation mechanisms of antennas
- Demonstrate knowledge of antennas in communication systems. Ability to discriminate between antennas on the basis of their electrical performance.
- Discriminate various antennas on the basis of their electrical performance.

Module No.		Topics	Hrs.
1.		**Behavior of Active and Passive Components in RF range**	**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**	**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**	**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**	**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:**	**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**	**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 and limitations	
Total			**52**

Recommended Books:

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.

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of two tests should be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions for 2 to 5 marks will be asked.
4. Remaining questions will be selected from all the modules