Course Code: 23EC0413 **R23**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
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QUESTION BANK (DESCRIPTIVE)

Subject with Code: Antennas and Wave propagation (23EC0413) **Course & Branch**: B.Tech. – ECE

Year &Sem: III-B.Tech & I-Sem **Regulation:** R23

UNIT-I
ANTENNA BASICS & DIPOLE ANTENNAS

1	**a)**	Define antenna.	**[L1][CO1]**	**[2M]**
	b)	Define Bandwidth of antenna.	**[L1][CO1]**	**[2M]**
	c)	Define Beam Area.	**[L1][CO1]**	**[2M]**
	d)	Define Effective Height and Effective length of antenna.	**[L1][CO1]**	**[2M]**
	e)	Define Resolution of antenna.	**[L1][CO1]**	**[2M]**
2	**a)**	Explain the radiation mechanism in single wire, two wire, and dipoles.	**[L2][CO1]**	**[6M]**
	b)	Define the radiation pattern of an antenna and its types with neat sketch.	**[L2][CO1]**	**[4M]**
3	**a)**	Explain the following terms. i). Main lobe and side lobe ii). Beam width	**[L2][CO1]**	**[6M]**
	b)	Explain the following terms. i). Beam area ii). Effective height	**[L2][CO1]**	**[4M]**
4		Explain the following terms. i). Radiation intensity ii). Beam Efficiency iii). Directivity	**[L2][CO1]**	**[10M]**
5	**a)**	Define the following parameters. i). Antenna gain ii). Aperture Efficiency	**[L1][CO1]**	**[4M]**
	b)	A dipole having a length of 3 cm is operated at 1 GHz. The efficiency factor K=0.6. Calculate antenna gain and effective aperture.	**[L3][CO1]**	**[6M]**
6	**a)**	State the following antenna theorems. i). Reciprocity Theorem ii). Helmholtz theorem.	**[L1][CO1]**	**[6M]**
	b)	Write basic Maxwell's equations with other relevant relations.	**[L1][CO1]**	**[4M]**
7	**a)**	Derive and explain the expression for retarded potential.	**[L3][CO1]**	**[5M]**
	b)	An antenna receives a maximum power of 2μW from a radio station. Calculate the maximum effective area if the antenna is located in the far field station where E=50mV/m.	**[L3][CO1]**	**[5M]**
8		Derive the expression for radiated fields from the small electric dipole.	**[L3][CO1]**	**[10M]**
9		Deduce the expression for field components of Quarter wave monopole antenna.	**[L3][CO1]**	**[10M]**
10		Derive the radiation parameters of Half wave dipole using field components.	**[L3][CO1]**	**[10M]**
11	**a)**	An antenna has a radiation resistance of 72Ω, and a loss resistance is 8Ω if the power gain of 16. Calculate the directivity of the antenna and the length of half wave dipole at 30MHz.	**[L2][CO1]**	**[5M]**
	b)	Explain the current distributions on thin linear center-fed antennas of different lengths.	**[L1][CO1]**	**[5M]**

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UNIT –II
HF, VHF AND UHF ANTENNAS

1	**a)**	List few directional finding antennas.	**[L1][CO2]**	**[2M]**
	b)	What are parasitic elements?	**[L1][CO2]**	**[2M]**
	c)	Write the expression for directivity of small loop and large loop antennas.	**[L1][CO2]**	**[2M]**
	d)	Define Pitch angle.	**[L1][CO2]**	**[2M]**
	e)	State Fermat's Principe.	**[L1][CO2]**	**[2M]**
2		Derive the field components of small loop antenna.	**[L3][CO2]**	**[10M]**
3	**a)**	Write the comparison of far fields of small loop and short dipole.	**[L2][CO2]**	**[4M]**
	b)	Derive the radiation resistance for small loop and large loop.	**[L3][CO2]**	**[6M]**
4		Explain about construction and operation of Yagi-Uda antenna with neat sketch.	**[L2][CO2]**	**[10M]**
5	**a)**	Design Yagi-Uda antenna of six elements to provide a gain of 12dB if the operating frequency is 200 MHz.	**[L3][CO2]**	**[5M]**
	b)	List the advantages, disadvantages and applications of Yagi-Uda antenna	**[L1][CO2]**	**[5M]**
6	**a)**	Discuss the folded dipole antenna and its input impedance.	**[L2][CO2]**	**[6M]**
	b)	Derive the input impedance of a folded dipole antenna formed by three parallel half-wave elements.	**[L3][CO2]**	**[4M]**
7		Discuss the design considerations of log periodic antenna.	**[L2][CO2]**	**[10M]**
8	**a)**	Explain about the construction and operation of helical antenna.	**[L2][CO2]**	**[5M]**
	b)	Explain design considerations of Monofilar Axial-mode Helical antenna.	**[L2][CO2]**	**[5M]**
9	**a)**	Discuss about the helical antenna of normal mode and its radiation pattern.	**[L2][CO2]**	**[6M]**
	b)	Calculate the directivity of 20 turn helix with $\alpha = 12^0$ and circumference equals to one wavelength.	**[L3][CO2]**	**[4M]**
10	**a)**	Discuss about the helical antenna of axial mode and its radiation pattern.	**[L2][CO2]**	**[5M]**
	b)	Explain about the horn antenna types & its characteristics.	**[L2][CO2]**	**[5M]**
11	**a)**	Discuss the design considerations of pyramidal horn antenna.	**[L2][CO2]**	**[6M]**
	b)	Calculate the directivity of pyramidal horn antenna with an aperture. If size 12x12cm operating with 3.2cm wavelength.	**[L3][CO2]**	**[4M]**

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UNIT –III
MICROWAVE ANTENNAS

1	**a)**	Define rectangular patch antenna?	**[L1][CO3]**	**[2M]**
	b)	List two advantages of microstrip antennas.	**[L1][CO3]**	**[2M]**
	c)	Define corner reflector antenna?	**[L1][CO3]**	**[2M]**
	d)	Name a feed method for parabolic reflectors.	**[L1][CO3]**	**[2M]**
	e)	List types of lens antennas?	**[L1][CO3]**	**[2M]**
2	**a)**	Explain about micro strip antennas and its types with neat diagrams.	**[L2][CO3]**	**[6M]**
	b)	Give the advantages and limitations of micro strip antennas.	**[L1][CO3]**	**[4M]**
3	**a)**	Discuss the construction of rectangular patch antenna	**[L2][CO3]**	**[7M]**
	b)	What are the applications of Microstrip antenna?	**[L1][CO3]**	**[3M]**
4		Discuss the characteristics of Microstrip Antenna.	**[L2][CO3]**	**[10M]**
5	**a)**	Design a rectangular microstrip patch antenna to resonate at 2.4 GHz using substrate ($\varepsilon_n \approx 2.2$) of height 1.6 mm.	**[L4][CO3]**	**[5M]**
	b)	Explain the types of reflector antennas.	**[L2][CO3]**	**[5M]**
6	**a)**	Draw and explain the principle of parabolic reflector.	**[L3][CO3]**	**[5M]**
	b)	Explain the principle of operation of a flat (plane) sheet reflector antenna.	**[L2][CO3]**	**[5M]**
7	**a)**	A parabolic dish with D = 1.2 m**,** η = 65% operates at f = 10 GHz**.** i). Calculate the gain in dBi**.** ii). Estimate the HPBW (degrees) and effective aperture Ae**.**	**[L3][CO3]**	**[5M]**
	b)	Describe the differences between a flat sheet reflector and a corner reflector.	**[L4][CO3]**	**[5M]**
8	**a)**	Explain the different feed methods to parabolic reflectors.	**[L2]CO3]**	**[6M]**
	b)	A parabolic dish provides a power gain of 50 dB at 10 GHz with 70% efficiency. Find out i) HPBW ii) BWFN	**[L3][CO3]**	**[4M]**
9	**a)**	Explain the design and operation of a Cassegrain reflector antenna.	**[L2][CO3]**	**[7M]**
	b)	Write the advantages of using the Cassegrain feed method.	**[L1][CO3]**	**[3M]**
10	**a)**	Explain the Geometry of the non metallic dielectric lens antenna.	**[L2][CO3]**	**[5M]**
	b)	Describe zoning and manufacturing tolerances in lens design.	**[L4][CO3]**	**[5M]**
11	**a)**	Describe the characteristic of lens antenna with tolerance.	**[L2][CO3]**	**[6M]**
	b)	List the advantages and applications of the lens antenna.	**[L1][CO3]**	**[4M]**

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UNIT –IV
ANTENNA ARRAYS & ANTENNA MEASUREMENTS

1	**a)**	Define an antenna array.	**[L1][CO4]**	**[2M]**
	b)	Define a broadside array?	**[L1][CO4]**	**[2M]**
	c)	What is pattern multiplication?	**[L1][CO4]**	**[2M]**
	d)	Identify one source of error in antenna measurements.	**[L1][CO5]**	**[2M]**
	e)	What is Antenna under Test (AUT)?	**[L2][CO5]**	**[2M]**
2	**a)**	What is antenna array and explain its types?	**[L2][CO4]**	**[8M]**
	b)	Define the point sources.	**[L1][CO4]**	**[2M]**
3	**a)**	What are the different cases of arrays of 2-point sources?	**[L1][CO4]**	**[3M]**
	b)	Derive the expression for far field pattern of an array of 2 isotropic point sources at equal amplitude & same phase.	**[L4][CO4]**	**[7M]**
4		Derive the expression for far field pattern of an array of two isotropic point sources at equal amplitude & opposite phase.	**[L4][CO4]**	**[10M]**
5	**a)**	Explain pattern multiplication with any one case	**[L2][CO4]**	**[5M]**
	b)	Explain n- element uniform linear array	**[L2][CO4]**	**[5M]**
6	**a)**	What is Broad side array and its radiation pattern.	**[L1][CO4]**	**[5M]**
	b)	What is End fire array and its radiation pattern.	**[L1][CO4]**	**[5M]**
7	**a)**	Explain End fire array with increase directivity and derive the directivity equation.	**[L2][CO4]**	**[7M]**
	b)	Explain the concept of non uniform amplitude distribution of BSA?	**[L2][CO4]**	**[3M]**
8	**a)**	Find the minimum spacing between the elements in a broad side array of 10 isotropic radiators to have directivity of 7db.	**[L3][CO4]**	**[5M]**
	b)	A broad side array operating at 10cm wavelength consists of 4 half wave dipole spaced 50 cm each element carries radio frequency current in the same phase and magnitude 0.25A. Calculate the radiated power, half power beam width of major lobe	**[L3][CO4]**	**[5M]**
9	**a)**	Explain sources of Error in Antenna measurement.	**[L2][CO5]**	**[5M]**
	b)	Explain the measurement of directivity.	**[L2][CO5]**	**[5M]**
10		Explain the radiation pattern measurement with fundamental procedure, arrangements and distance requirement.	**[L2][CO5]**	**[10M]**
11	**a)**	Explain Gain measurement by direct comparison method.	**[L2][CO5]**	**[5M]**
	b)	Explain the gain measurement using absolute method.	**[L2][CO5]**	**[5M]**

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UNIT –V
WAVE PROPAGATION

1	**a)**	What are the modes of propagation?	**[L1] [CO6]**	**[2M]**
	b)	Define skip distance.	**[L1] [CO6]**	**[2M]**
	c)	Mention different types of fading.	**[L1] [CO6]**	**[2M]**
	d)	Define wave tilt.	**[L1] [CO6]**	**[2M]**
	e)	Define optimum working frequency (OF).	**[L1] [CO6]**	**[2M]**
2	**a)**	Discuss about refraction, reflection and different modes of EM waves.	**[L2] [CO6]**	**[6M]**
	b)	Discuss about Ray path with neat sketch.	**[L2] [CO6]**	**[4M]**
3	**a)**	Explain the Structure of Ground wave propagation with neat sketch.	**[L2] [CO6]**	**[5M]**
	b)	Discuss Reflection and Refraction of space wave propagation.	**[L2] [CO6]**	**[5M]**
4	**a)**	Explain the concept in brief of Super refraction and M-curves.	**[L2] [CO6]**	**[4M]**
	b)	Explain about the duct propagation and Scattering phenomenon?	**[L2] [CO6]**	**[6M]**
5	**a)**	Discuss the effects of tropospheric propagation, fading and patch losses?	**[L2] [CO6]**	**[6M]**
	b)	Determine the maximum usable frequency for a critical frequency of 20 MHz and an angle of incidence of 350.	**[L3] [CO6]**	**[4M]**
6		Draw and explain the structure of Ionosphere with its typical electron density variation characteristics.	**[L3] [CO6]**	**[10M]**
7		Discuss Reflection and Refraction of sky wave propagation by Ionosphere.	**[L2] [CO6]**	**[10M]**
8	**a)**	Explain critical frequency and its expression.	**[L2] [CO6]**	**[6M]**
	b)	Explain Maximum usable frequency with its expression.	**[L2] [CO6]**	**[4M]**
9	**a)**	Write a short note on lowest usable frequency (LUF) and working frequency	**[L2] [CO6]**	**[5M]**
	b)	Explain Virtual height and its significance.	**[L2] [CO6]**	**[5M]**
10	**a)**	Explain Skip distance and derive its expression.	**[L2] [CO6]**	**[6M]**
	b)	Explain the relation between MUF and skip distance.	**[L5] [CO6]**	**[4M]**
11	**a)**	Give brief note on Multi hop propagation and energy loss in Ionosphere.	**[L2] [CO6]**	**[6M]**
	b)	For a flat earth assume that at 400 km reflection takes place. The maximum density of ionosphere corresponds to a refractive index of 0.9 at 10 MHz. Calculate range for which maximum usable frequency is 10 MHz.	**[L3] [CO6]**	**[4M]**