



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

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Dundigal, Hyderabad - 500 043, Telangana

ELECTRONICS AND COMMUNICATION ENGINEERING

QUESTION BANK

Course Name	: Antennas and Wave Propagation (AWP)
Course Code	: A50418
Class	: III - B. Tech
Branch	: ECE
Year	: 2017 – 18
Course Coordinator	: Mrs. A. Usha Rani, Associate Professor
Course Faculty	: Mrs. A. Usha Rani, Associate Professor. Mr. G. Nagendra Prasad, Associate Professor. Mr. J. Siva Rama Krishna, Assistant Professor. Mr. K. Ravi, Assistant Professor.

OBJECTIVES

This course has the basics of antenna basics and types, concept of wireless communication through the various Medias. The main objectives of antennas and wave propagation are:

- To understand the basic terminology and concept of antennas.
- To attain knowledge on the basic parameters those are considered in the antenna design process and the analysis while designing that
- To analyze electric and magnetic field emission from various basic antennas mathematical formulation of the analysis
- To have knowledge on antenna operation and types as well as their usage in real time field.
- To aware of the wave spectrum and respective band based antenna usage and also to know the propagation of the waves at different frequencies through layers in the existing layered free space environment structure.

S.No	QUESTION	Blooms taxonomy level	Course Outcome
UNIT-I ANTENNA FUNDAMENTALS SHORT ANSWER QUESTIONS			
1	Define an antenna?	Remember	1
2	Describe the meant by radiation pattern?	Remember	1
3	Define Radiation intensity?	Analyze	1
4	Define Beam efficiency?	Remember	1
5	Define Directivity?	Analyze	1
6	Describe the different types of aperture?	Remember	1
9	Define different types of aperture?	Understand	1,2
10	Define Aperture efficiency?	Remember	1
11	Describe the meant by effective height?	Analyze	1,2
12	Describe the field zones?	Understand	1
13	Define antenna efficiency?	Understand	1

14	Describe the radiation resistance?	Analyze	1,2
15	Describe the meant by antenna beam width?	Analyze	2
16	Describe the meant by reciprocity Theorem?	Analyze	2
17	Describe the meant by isotropic radiator?	Understand	2
18	Define gain?	Understand	2
19	Define self impedance?	Understand	1
20	Define mutual impedance?	Understand	1
21	Describe the FRIIS transmission formula and explain its significance?	Analyze	2
22	Explain effective aperture area with its types in detail?	Understand	2
23	Define axial ratio?	Understand	2
24	Define radian and ste radian?	Understand	1
25	Describe the meant by Beam Area?	Understand	1
LONG ANSWER QUESTIONS			
1	Explain the retarded vector potential in detail?	Understand	1
2	Derive an expression for the power radiated by the current element and calculate the radiation resistance?	Analyze	1
3	Derive an expression for the far field component of a half wave dipole of an antenna?	Analyze	2
4	Derive the total power radiated by half wave dipole?	Remember	2
5	Show that the radiation resistance of a half wave dipole is 73Ohms?	Understand	3
6	Derive an expression for the electric field and magnetic field due to a current element at a distance point in free space?	Remember	2
7	Derive an expression for the gain of half wave dipole?	Understand	2
8	Derive FRIIS transmission formula and explain its significance?	Understand	1
9	Derive an expression for power radiated by an isotropic antenna?	Understand	1
10	Derive the relation between directivity and beam solid angle?	Remember	1
11	Derive the relationship between radiation resistance and efficiency?	Remember	2
12	Derive an expression for field intensity at a distant point?	Understand	2
13	Derive the field components of loop antenna?	Understand	1
14	Write short notes on: (a) Fields of an oscillating dipole?	Understand	1
15	Derive the expression of distance where Near and Far fields are separated?	Remember	1
16	Explain the Principle of Operation of loop antenna?	Remember	1
ANALYTICAL QUESTIONS			
1	The radial component of the radiated power density of an antenna is given by $W_{rad} = W_{rar} = \frac{r A_0 \sin \theta}{r^2} \quad (W/m^2)$, then determine the total radiated power?	Analyze	2
2	The radial component of the radiated power density of an infinitesimal linear dipole of length $l \ll \lambda$ is given by: $W_{av} = W_{rar} = \frac{r A_0 \sin \theta}{r^2} \quad (W/m^2)$, then find the maximum directivity of an antenna?	Evaluate	3
3	Show That the Directivity of An Small Current Element is 1.5.	Evaluate	2
4	A Transmitting Antenna Having An Effective Height of 61.4 meters, takes a current of 5Amp (rms) at a Wavelength of 625meters.Find R_r , P_r ,Antenna Efficiency for Total Antenna Resistance of 50ohms.	Remember	2
5	A Thin Dipole Antenna is $\lambda/15$ long.If its loss Resistance is 1.5Ω.Find R_r and the Efficiency.	Evaluate	2
6	A Transmitting Antenna Having An Effective Height of 100 meters has a current at the base 100A at the Frequency of 300KHz, Calculate the Field Strength at a distance of 100km, R_r , P_r .	Remember	2
7	An Antenna having a Gain of 6db over a Reference Antenna, is Radiating 700Watts. Calculate the Power that Reference Antenna must Radiate in Order to be Equally Effective in the most Preferred Direction.	Evaluate	2
8	An Antenna has a Radiation Resistance of 72Ω, a loss Resistance of 8Ω and a Power Gain of 12db,Determine the Antenna Efficiency and Directivity.	Evaluate	3

UNIT -2 VHF, UHF AND MICROWAVE ANTENNAS - I SHORT ANSWER QUESTIONS			
1	Describe the the Special feature of folded dipole antennas?	Remember	4
2	Describe the Advantages of folded dipole?	Understand	4
3	Describe the Application of folded dipole?	Remember	5
4	Compare half wave dipole & folded dipole?	Remember	5
5	Describe the a normal mode of helix antenna	Remember	5
6	Describe the a axial mode of helix antenna	Remember	6
7	Discriminate the axial mode with Normal Mode	Understand	6
8	Describe the parameters to be considered for the design of a helical antenna	Apply	6
9	List the applications of helical antenna?	Understand	6
10	Describe the mean by basic yagi antenna?	Apply	6
11	Describe the characteristics of Yagi uda antenna?	Understand	6
12	Describe the mean by horn	Understand	5
13	Describe the different types of horn antennas used in practical applications	Understand	5
14	Describe the mean by fermat's principle	Remember	4
15	Describe the advantages horn antennas	Remember	4
LONG ANSWER QUESTIONS			
1	Explain the special features of various types of Horn antennas	Evaluate	4
2	With a suitable diagram, discuss the construction and operation of a Yagi-Uda antenna?	Analyze	4
3	Explain in detail the working principle of Helical antenna in Normal mode	Evaluate	5
4	Explain the principle of operation and applications of folded dipoles?	Evaluate	6
5	Draw The Helical Antenna With Neat Geometry.	Evaluate	5
6	Explain in detail the working principle of Helical antenna in Axial mode	Evaluate	5
7	Explain About the Design Considerations Of Pyramidal Horn Antenna.	Analyze	6
8	Explain the Working Principle of Horn Antenna.	Analyze	4
9	Derive the Voltage and Current Relations in Parasitic Elements.	Analyze	4
10	Classify the Types of Horn Antennas with neat Geometry	Analyze	6
ANALYTICAL QUESTIONS			
1	Design Basic Yagi Uda antenna at a frequency of 30MHz	Evaluate	5
2	Design 5 element Yagi – Uda antenna at a frequency of 300MHz	Evaluate	5
3	Calculate in db the directivity of 20 turn helix, having $\alpha = 12^\circ$, circumference equal to one wave length	Analyze	5
4	Calculate the power gain of optimum horn antenna approximately with a square aperture of 10λ on one side	Analyze	4
5	Find out the Length L, Width W, and half flare angles θ_E & θ_H of a Pyramidal horn antenna for Which the Mouth Height $h=10\lambda$. The Horn is fed by a rectangular wave guide with TE_{10} mode.	Analyze	4
6	A 16 Turn Helical Beam Antenna has a Circumference of λ , and turn spacing of $\lambda/4$. Find HPBW, Axial Ratio, Gain, Power Pattern.	Analyze	4
UNIT-3 VHF, UHF AND MICROWAVE ANTENNAS - II SHORT ANSWER QUESTIONS			
1	Describe the features of Patch antennas	Remember	8
2	Describe the different types of reflector antennas	Remember	8

3	Describe the mean by spill over?	Remember	8
4	Define F/D ratio?	Understand	8
5	List Out the advantages of strip antennas	Understand	8
6	Describe the characteristic of micro strip antennas	Understand	8
7	Describe the limitations of strip antennas	Understand	8
8	Describe the features of micro strip antennas	Understand	8
9	Describe the advantages of parabolic reflector antenna	Understand	8
10	Describe the use of stocked MSA	Understand	8
11	Describe the drawbacks of parabolic reflector antenna	Remember	8
12	Describe the mean by tuning in MSA	Understand	8
13	Describe the drawbacks of corner and flat sheet antennas	Understand	8
14	Write the formula for centre frequency of patch antenna	Understand	8
15	Listout the Feed Methods of Patch Antenna	Understand	8
16	Write the Performance Parameters of Micro Strip antennas?	Understand	8
17	Discuss the effect of Substrate on the radiation of Patch antenna	Understand	8
18	List out all the Microwave Antennas	Understand	8
19	Write Design Considerations of Low profile Antennas	Understand	8
20	List the Applications of reflector antennas	Apply	8
MID-II			
1	List the types of Horn antennas?	Remember	8
2	Compare the reflector and lens antennas?	Understand	8
3	Describe the drawbacks of lens antenna?		
4	Mention different types of Lens antennas	Analyze	8
5	Sketch the Paraboloidal Reflector antenna along with its radiation pattern.	Understand	8
6	What is the principle of Horn antenna.	Understand	8
7	Reproduce the expression for flare angle of Horn antenna.	Remember	8
8	List the applications of Horn antenna.	Remember	8
9	Recall the expression for Axial length of Horn antenna.	Remember	8
10	Define capture area ?	Remember	8
11	Discriminate Delay lens with Metal plate lens.	Understand	8
12	Explain Fermat's principle.	Understand	8
13	State the drawbacks of lens antenna?	Remember	8
14	List the various types of feed system for a parabolic reflector	Remember	8
15	Recall the applications of Parabolic dish antenna	Remember	8
16	Give examples of secondary antennas.	Remember	8
17	State the advantages of Zoning?	Understand	8
18	Relate thickness and frequency of Lens antenna.	Understand	8
19	For a DTH antenna, the diameter is D_a . Relate the directivity with diameter.	Remember	8
20	Reproduce the figure of Cassegrain feed.	Remember	8
LONG ANSWER QUESTIONS			
1	Describe the features of micro strip antennas?	Evaluate	8
2	Describe the advantages and limitations of strip antennas?	Understand	8
3	Describe the feed methods of rectangular strip antennas?	Remember	8
4	Explain the characteristics of micro strip antennas?	Understand	8
5	Explain the impact of different parameters on characteristics of micro strip antennas?	Understand	8
6	Explain advantages and disadvantages of corner and flat sheet reflectors?	Understand	8
7	Explain feed methods of parabolic reflector in detail?	Analyze	8
8	Explain the principle of operation of basic lens antenna?	Analyze	8
9	Describe types lens antennas? Explain?	Analyze	8
10	Describe the advantage, disadvantages and applications of lens antenna?	Analyze	8

ANALYTICAL QUESTIONS			
1	A parabolic reflector antenna with diameter 20 m, is designed to operate at frequency of 6GHz and illumination efficiency of 0.54. Calculate antenna gain?	Apply	7,8
2	Calculate the angular aperture for a parabolic reflector antenna for which aperture number is (i) 0.25 (ii) 0.50 (iii) 0.60. Given the diameter of the reflector mouth is 10m; calculate the position of the focal point with reference the reflector mouth in each case?	Remember	7,8
3	Estimate the diameter of a parabolic reflector required to produce a beam of 5° width at 1.2GHz. How would you make this reflector?	Understand	7,8
4	Design an optimum horn antenna with mouth height $h=20\lambda$ and path difference $\delta = 0.20\lambda$. Find L and θ .	Apply	7,8
5	Calculate the directivity and power gain of an optimum horn antenna with a square of 10λ on a side.	Apply	7,8
6	Find out the length, width & flare angles of θ_E & θ_H of pyramidal horn antenna for which the mouth height is 10λ .	Apply	7,8
7	A parabolic dish antenna provides a gain of 75dB at a frequency of 15GHz. Calculate the capture area, HPBW and FNBW.	Apply	7
8	Find beam width between first nulls and half power beam width for 2m diameter paraboloid reflector which is operating at 5 GHz.	Remember	7
UNIT-IV			
ANTENNA ARRAYS& MEASUREMENTS			
SHORT ANSWER QUESTIONS			
1	Describe the point source.	Remember	9
2	Describe the meant by array.	Understand	9
3	Describe the meant by uniform linear array.	Remember	9
4	List out the types of array	Understand	9
5	Describe the Broad side array	Understand	10
6	Describe the End fire array	Understand	10
7	Describe the collinear array	Understand	10
8	Describe the parasitic array	Remember	10
9	Describe the Sources of Error in brief	Remember	10
10	Draw the IEEE Standard Co-Ordinate Systems.	Remember	10
11	Differentiate broad side and End fire array	Understand	11
12	Describe the need for the Binomial array	Remember	11
13	Define power pattern?	Remember	11
14	Describe the need for Antenna Measurement	Remember	11
15		Understand	11
LONG ANSWER QUESTIONS			
1	Write short notes on various forms of arrays i. Broad side array ii. End fire array ii. Collinear array iv. Parasitic array?	Apply	10
2	Explain the Radiation Pattern Measurement with Neat Sketch.	Analyze	11
3	Explain the Gain Measurement by 3-Antenna Method with Neat Sketch.	Remember	11
4	Explain the Sources of Error while doing the Measurement.	Remember	11
5	Explain the Directivity Measurement with Neat Sketch.	Evaluate	11
6	Write detail notes on Binomial arrays	Evaluate	11
7	Explain the principle of Pattern multiplication?	Apply	11
8	Derive the expression for the far field pattern of an array of 2 – isotropic point sources i) Equal amplitude and phase ii) Equal amplitude and opposite phase?	Apply	11
9	Explain the Gain Measurement by Comparison Method with Neat Sketch.	Remember	10
10	Generalize the Concept of Dolph Tchebyscheffs Array.	Remember	10

ANALYTICAL QUESTIONS			
1	Design a 8 element Broadside array of isotropic sources of $\lambda/2$ spacing between elements. The patterns are to be optimum with a side lobe 26db down the main lobe maximum?	Analyze	11
2	Calculate the directivity of a broadside array of height 10λ and the length 20λ in db?	Analyze	11
3	Two identical point sources separated by a distance d, each source having a field pattern given by $E_o = E_1 \sin\theta$. If $d = \lambda/2$ and phase angle $\alpha = 0$ derive an expression for a total field pattern. Plot the pattern?	Understand	11
4	Design a 4 element broad side array of $\lambda/2$ spacing between elements. The pattern is to be optimum with a side lobe level 19.1db down the main lobe maximum?	Analyze	11
5	While Measuring the Gain Of Horn Antenna, the gain oscillator was set for 9GHz Frequency and the Attenuation inserted was found to be 908db. Calculate the gain of the horn. The distance between the two horn was 35cm.	Analyze	11
UNIT-V Wave propagation			
SHORT ANSWER QUESTIONS			
1	Define Ground wave?	Understand	13
2	Describe the types of Ground waves	Understand	13
3	Describe the Space Wave in detail	Understand	13
4	Describe Surface Wave in detail	Remember	12
5	Describe the Ray Path.	Understand	12
6	Explain Skip Distance?	Remember	12
7	Describe the Scattering Phenomena.	Understand	12
8	Define LUF?	Understand	12
9	Describe maximum Usable Frequency?	Remember	12
10	Describe The concept of Virtual Height.	Understand	12
11	Define Optimum frequency?	Understand	12
12	Explain the Structure of Atmosphere?	Remember	12
13	Explain the various layers of Ionosphere?	Understand	12
14	Explain Absorption	Understand	12
15	Draw the Structure of Ionosphere	Remember	12
LONG ANSWER QUESTIONS			
1	Describe and Distinguish between the terms – (i) Critical Frequency & MUF (ii) Virtual Height and Skip Distance.	Understand	13
2	Derive the Relation Between Skip Distance and MUF	Analyze	13
3	Explain the Effect of Earth's Curvature and Absorption	Analyze	13
4	Explain the Concept of Refraction and Reflection of Sky Waves by Ionosphere	Understand	13
5	Sketch and Explain the Field Strength Variation of Space wave with Distance and Antenna Height	Apply	13
6	Explain the duct propagation and M-Curves in detail?	Apply	13
7	Explain the Significance of E And F Layers of Ionosphere, And Account for the Multi Hop Propagation	Analyze	13
8	Derive the Curved Earth Reflections in Ground Wave Propagation	Remember	13
9	Derive the Plane Earth Reflections in Ground Wave Propagation	Understand	13
10	Describe the Following Terms in Detail (i) Critical Frequency (ii) Super Refraction	Remember	11
ANALYTICAL QUESTIONS			
1	Calculate the critical frequency for reflection at vertical incidence if the	Apply	13

	maximum value of electron density is $1.24 \times 10^{10} \text{ cm}^{-3}$?		
2	Calculate the critical frequency for the F1, F2 and E layers for which the maximum ionic densities are 2.3×10^{10} , 3.5×10^{10} and 1.7×10^{10} electrons per c.c respectively?	Evaluate	13
3	Assume that reflection takes place at a height of 400km and that the maximum density in the ionosphere corresponds to 0.9 refractive index at 10MHz. what will be the range (assume flat earth condition) for which the MUF is 10MHz?	Apply	13
4	A transmitter radiates 20W of power at a wavelength of 4 cm. calculate the power received by the antenna at a distance 100km if the gain of the transmitting and receiving antennas are equal and have a value of 30db?	Apply	13
5	Find the MUF and refractive index for a sky wave signal reflected by a layer at a height of 200 km, and having an electron density of 2.0×10^{11} per cubic meter, for a skip distance of 2500 km. Also calculate the corresponding angle of incidence	Apply	12

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