

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), November 2017

B. Tech in Electronics and Communication Engineering, Semester VII

Roll No.....

Antenna and Wave Propagation ECE 701

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
I.	An antenna having a gain of 10 dB radiates 3 W powers in free space. The electric field intensity at a distance of 1 km from the antenna is given by ($\eta_0 = 120\pi$) (a) 30 m V/m (b) $30\sqrt{2}$ m V/m (c) 15 m V/m (d) $15\sqrt{2}$ m V/m	
II.	A loop antenna is preferred for use as receiving antenna rather than the transmitting one because (a) High efficiency (b) High gain (c) low efficiency (d) none of these	
III.	Folded dipole antenna function at (a) Only at odd harmonics (b) Only at even harmonics (c) both of these (d) None of these	
IV.	The maximum radiation for an end fire array occur (a) at particular to the line of array (b) along the line of array (c) 45° to the line of array (d) In both perpendicular and along the axis of array	
V.	Which of the following is not a $\lambda/2$ dipole antenna (a) yagi-uda antenna (b) Rhombic antenna (c) Parabolic antenna (d) horn antenna	
VI.	At 20 GHz, the gain of a parabolic dish antenna of 1 meter diameter and 70% efficiency is (a) 15 dB (b) 25 dB (c) 35 dB (d) 45 dB	
VII.	Which of these is true for a parabolic reflector antenna? (a) High gain and high beam width (b) High gain and low beam width (c) Low directivity and circularly polarized (d) None of these	

- VIII. The electric field intensity at a distance of 10 km from an antenna having a directive gain of 10 dB and radiating a total power of 60 kw is
 (a) 0.6 V/m (b) 1.2 V/m
 (c) 0.36 V/m (d) 13.3 $\mu\text{W}/\text{m}^2$
- IX. Directivity of Antenna is determined by
 (a) Gain (c) Radiation Pattern
 (b) Impedance pattern (d) efficiency
- X. An antenna having a directivity of 2 at a frequency of 300 MHz will have a maximum effective aperture
 (a) $1/80 \pi \text{ m}^2$ (b) $1/4 \pi \text{ m}^2$
 (c) $1/2 \pi \text{ m}^2$ (d) $1/\pi \text{ m}^2$

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- I. Maximum Usable Frequency (MUF)
- II. Reciprocity theorem
- III. Skip distance
- IV. Antenna efficiency

Q.3A How the directivity of an antenna defined and what is the relation between directivity and gain of an antenna. 05

Q.3B Explain with suitable diagrams the working of log periodic antenna. What are the practical applications of these antennas? 05

Q.4A Obtain expression of (i) Direction of pattern maxima (ii) direction of pattern minima, for end fire array consisting of n isotropic sources of equal amplitude and spacing. 05

Q.4B Describe the cassegrain method of feeding a parabolic reflector antenna and its advantages. 05

Q.5A A parabolic reflector have a power gain of 1000 at $\lambda = 10 \text{ cm}$ and is fed by a non-directional antenna. Estimate its beamwidth between half power point (HPBW) and between first null (BWFN) w.r.t half wave dipole. Assume even illumination. 05

Q.5B Find out the beamwidth between first nulls and power of a 2 m paraboloid reflector operating at 6000 MHz. 05

Q.6A Take a typical case for $n=4$, $d = \lambda/2$ and $\alpha = 0^\circ$ (end fire array). Plot the field pattern with all components. 05

Q.6B Find the terminal resistance of complementary slot for a cylindrical dipole antenna with length of diameter ratio of 28 and length of 0.925λ having terminal impedance of $(710 + j.0) \Omega$. 05

OR

Q.6B A cylindrical antenna with a length to diameter ratio of 100 is resonant when the length is about 0.475λ . The terminal impedance is resistance and equal to about 67Ω . Find out the dimensions and terminal impedance of the complementary slot antenna of 10 cms wavelength. 05

Q.7A	Explain the principle of pattern multiplication and find the pattern of a four element half wave dipole antenna array with spacing of $\lambda/2$ each.	05
Q.7B	What do mean by tilting of wave and tilt angle/ how does tilt angle affect the field strength received at a finite distance from the transmitter.	05
OR		
Q.7B	What is meant by binomial array? Show that such a distribution gives no secondary lobe.	05
Q.8	Describe how critical frequencies for ionospheric propagation are measured. Explain how the wave propagation of a down coming wave after reflection from the ionosphere changes and how does it affects reception.	10
Q.9A	Describe how the radiation pattern and gain of a given antenna can be measured experimentally.	10
Q.9B	A radio communication link is to be established via ionosphere. Take maximum virtual height to be 100 km at the midpoint of the path. Assume critical frequency to be 2×10^6 Hz and distance between stations to be 600 km. Find Optimum Working Frequency (OWF).	10
OR		
Q.9B	Two aircraft are flying at altitudes of 300 m and 5000 m respectively. What is the maximum possible distance along the surface of the earth over which they can have effective point to point microwave communication? Radius of earth = 6.37×10^6 meters	10