Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/(ECE-New)/SEM-6/EC-604A/2013

2013

ANTENNA THEORY & PROPAGATION

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) The intrinsic impedance of free space is

      a) 1 ohm b) 4 ohm

      c) 120 π ohm d) 0 ohm.

   ii) When the polarization of the receiving antenna is unknown, to ensure that it receives at least half the power (except in particular situation), the transmitted wave should be

      a) horizontally polarized

      b) vertically polarized

      c) circularly polarized

      d) elliptically polarized.

   iii) Microwaves antenna aperture efficiency depends on

      a) feed pattern b) antenna aperture

      c) surface losses d) low side lobe level.

iv) The antenna most commonly used for TV broadcasting in the UHF band is

a) turnstile antenna b) dipole antenna

c) yagi antenna d) rhombic antenna.

v) Fields are said to be circularly polarized if their magnitudes are

a) equal and they are in phase

b) equal and they differ in phase by ± 90°

c) unequal and they differ by ± 90°

d) not equal but they are in phase.

vi) The current distribution in half-wave dipole is

a) sinusoidal b) constant

c) triangular d) parabolic.

vii) The ground wave field strength is

a) inversely proportional to distance

b) inversely proportional to the square of distance

c) directly proportional to distance

d) directly proportional to the square of distance.

viii) Power and field patterns are related as

a) $P \propto E^2$ b) $P \propto E$

c) $P \propto E^{1/2}$ d) $P \propto 1/E$.

ix) Circularly polarized antenna is

a) dipole b) parabolic dish

c) yagi-uda d) helical.

x) Antenna commonly used for microwave links is

a) loop antenna b) log periodic antenna

c) paraboloidal dishes d) rhombic antenna.

xi) A half wave dipole used at a frequency of 300 MHz has a length of

a) 10 metres b) 3 metres

c) 1 metres d) 50 centimetres.

xii) A log periodic antenna is a

a) frequency independent antenna

b) frequency dependent antenna

c) directional antenna

d) none of these.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What is antenna gain ? How is it related with directive gain and power gain ?

3. Define Yagi-uda antenna and explain its operation.

4. Define the following terms :

i) Friss transmission formula

ii) Duality theorem.

5. What are the different modes of radio wave propagation ? What do you mean by fading ?

6. Derive the relation between effective area and gain of antenna. Define about noise temperature of antenna.

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) What are the vector potential and retarded vector potential ? 2 + 3

b) Define gain, directivity and efficiency of antenna. 2 + 2 + 2

c) The radiation resistance of an antenna is 80 Ω and loss resistance is 10 Ω. Determine efficiency, directivity if the power gain is 20. And also find out the beam solid angle. 1 + 2 + 1

8. Find the radiation resistance of a half wave dipole with uniform current distribution. Explain the design aspects of Yagi-uda antenna. 10 + 5

9. Explain special features of parabolic reflector antenna and discuss on different types of feed used with neat diagram. For *N*-element array show that the first minor lobe is 13·46 dB down from the major lobe. 5 + 4 + 6

10. a) Define MUF, critical frequency and virtual height. 2 + 2 + 3

b) At what frequency a wave must propagate for the *D* region to have an index of refraction 0·6 ? Given $N = 500$ electron / c.c. for *D* region. 3

c) In a communication link two identical antennas at 10 GHz are used for propagation of 40 dB. If the transmitted power is 1 W, find the received power, if the range of the link is 30 km. 5

11. Write short notes on any *three* of the following : 3 × 5

a) Duct propagation

b) Loop antenna

c) Sky wave propagation

d) Microstrip antenna

e) Skip distance.