ANTENNA AND RADIATING SYSTEMS
(ECEN 5101)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) A standard reference antenna for the measurement of directive gain is
(a) an elementary dipole (b) a half wave dipole
(c) a horn antenna (d) an isotropic radiator

(ii) Radiation pattern from helical antenna is
(a) horizontally polarized (b) vertically polarized
(c) circularly polarized (d) randomly polarized

(iii) The current distribution in half-wave dipole is
(a) sinusoidal (b) constant
(c) triangular (d) parabolic

(iv) The radiation pattern of normal mode helix is
(a) isotropic
(b) of figure eight shaped rotated about its axis
(c) directional along its axis
(d) none of these

(v) The effective length of a vertical radiator is
(a) increased by capacitive hat
(b) increased by loading with lumped inductance
(c) increased by supplying more power
(d) increased by resistance loading

(vi) The effects of EMI can be reduced by
(a) Suppressing emission
(b) Reducing the efficiency of coupling path
(c) Reducing the susceptibility of receptor
(d) All of these

(vii) The ability of an electronic system to function properly in its intended electromagnetic environment and should not be a source of pollution to that electromagnetic environment is known as
(a) Susceptibility (b) Interference
(c) Emission (d) Electromagnetic Compatibility

(viii) Null-to-Null band width is
(a) equal to 3 dB band width (b) greater than 3 dB band width
(c) less than 3 dB band width (d) not related to 3 dB band width

(ix) Name the ionization layer that exists during day time and vanishes at night due to highest combination rate
(a) Appleton Region (b) D Region
(c) Normal E Region (d) Sporadic E Region

(x) Loop antenna is
(a) isotropic radiator (b) directional radiator
(c) omni-directional radiator (d) point source.

Group- B

2. (a) Discuss different nature of near field zone of any antenna. [(CO1, (Remember/LOCQ)]
(b) An antenna whose radiation resistance is 300Ω operates at a frequency of 1 GHz and with a Current of 3 amperes. Find the radiated power. [(CO1, (Apply/IOCQ)]
(c) Explain the radiation mechanism of an antenna. [(CO1, (Understand/LOCQ)]

4 + 4 + 4 = 12

3. (a) A helical antenna has diameter 0.3 λ, 12 turns and turn spacing S = 0.25 λ. If the antenna is operating at 3 GHz, calculate the (a) directivity (b) axial ratio (c) HPBW and (d) FNBW. [(CO2) (Apply/IOCQ)]
(b) Design a three element Yagi-Uda antenna to operate at a frequency of 172 MHz. [CO2, (Create/HOCQ)]

5 + 7 = 12

Group - C

4. (a) 'A bike or mixer under running condition disturbs a TV Receiver function'. Develop a strategy to solve this interference scenario. [(CO4)(Evaluate/HOCQ)]
(b) If an array of isotropic radiators is operated at a frequency of 6 GHz and is required to produce a broadside beam, find Null-to-Null beam width if the array length is 10 m. Also find the directivity. [CO2, (Analyze/IOCQ)]
(c) How to measure radiation pattern of an antenna? [(CO3)(Remember/LOCQ)]

3 + 4 + 5 = 12

5. (a) A circular loop antenna has a diameter of 1.5λ. Find its directivity and radiation resistance. [CO2,(Analyze/IOCQ)]
   (b) An array consists of 10 isotropic radiators with an inter-element spacing of 0.5 λ. Estimate the progressive phase shift so that the beam points at $\phi = 60°$. In addition, evaluate the FNBW of the array. [(CO2) (Evaluate/HOCQ)]

5 + 7 = 12

Group - D

6. (a) Design a horn antenna with gain 9.54 dB and directivity 11.76 dB at frequency 6GHz. [CO2, (Create/HOCQ)]
   (b) A paraboloid reflector has radiation characteristics whose half power beam width is 5^0. Find out its Null-to-Null beam width and power gain. [CO2, (Analyze/IOCQ)]
   (c) Discuss the features of uniform linear array. [CO2,(Understand)LOCQ)]

6 + 3 + 3 = 12

7. (a) Apply Friis Transmission formula to develop link design in Satellite Communication. [(CO5)(Apply/HOCQ)]
   (b) What is fading? Describe different types of fading. Briefly explain the methods that can be used to reduce fading. [(CO5) (Remember & Understand/IOCQ)]

5 + 7 = 12

Group - E

8. (a) In a communication link two identical antennas at 20 GHz are used for propagation of 80 dB. If the transmitted power is 2 W, find the received power, if the range of the link is 60 km. [(CO5, CO6)(Analyze/IOCQ)]
   (b) Explain the effect of earth radius on ground wave propagation? [(CO5)(Understand/LOCQ)]
   (c) What do you mean by line-of-sight communication? Analyse effects of geographical topology on such communication. [(CO6)(Analyse/IOCQ)]

4 + 4 + 4 = 12

9. (a) Explain the term Maximum usable frequency in radio wave communication. What is the significance of MUF in ensuring QoS in Radio Links? [(CO6) (Apply/IOCQ)]
   (b) A pulsed RADAR operating at 9 GHz has an antenna gain 30 dB, transmitter power 2.5 kW, and minimum detectable signal -100 dBm. The target is a cabin cruiser that has an RCS 10 m^2. Derive appropriate analytical expressions to describe the scenario and use the same to find the maximum RADAR range. [(CO6)(Evaluate/HOCQ)]

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	28.1 %	41.7 %	30.2 %

Course Outcome (CO):

After the completion of the course students will be able to

1. Antenna – Radiation, VSWR, aperture and their importance.
2. Types of antennae and antenna arrays including microstrip antenna.
3. Testing principles of antennae.
4. EMI and EMC and associated hazards.
5. Different propagation phenomena.
6. QoS of radio links and their analysis

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission Link
ECE	https://classroom.google.com/c/NDEwMjY0NzI4NTUz/a/MjI3OTI5NzQzODI2/details