

AMITE - ET (NEW SCHEME)

Time: 3 Hours

JUNE 2012

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

- a. Force between two point charges q_1 and q_2 situated at point A and B respectively separated by a distance d can be expressed as

(A) $F_A = \frac{Kq_1q_2}{d^2} i_{BA}$

(B) $F_A = \frac{Kq_1q_2}{d}$

(C) $F_A = \frac{Kq_1q_2}{d^2}$

(D) $F_A = \frac{Kq_1q_2}{d} i_{BA}$

- b. The equation $\Delta J = 0$ is called

(A) Laplacian equation

(B) Kirchoff's node equation

(C) Poisson's equation

(D) Continuity equation for discrete currents

- c. Ohm's law relates the current density J with field intensity E as

(A) $J = \sigma E$

(B) $J = \sigma^2 E$

(C) $J = \frac{E}{\sigma}$

(D) $J = \frac{E^2}{\sigma}$

- d. Intrinsic or Characteristic impedance of free space has a value of

(A) 120π ohm

(B) π ohm

(C) 73 ohm

(D) 73π ohm

- e. An electric field of 50 V/m has the charge of $0.3 \mu C$, what is the force on that charge.

(A) $15 \mu N$

(B) $12.5 \mu N$

(C) $18 \mu N$

(D) $10.5 \mu N$

f. The attenuation in a wave guide near the cut-off frequency is

- (A) High (B) Low
(C) Zero (D) Negative

g. Select the Equation which is not Maxwell's

- (A) $\nabla \cdot \mathbf{B} = 0$ (B) $\nabla \cdot \mathbf{D} = \rho$
(C) $\nabla \cdot \mathbf{E} = -B$ (D) $\nabla \times \mathbf{H} = \mathbf{J} + \dot{\mathbf{D}}$

h. Troposphere scatter is used with frequencies in the following range.

- (A) HF (B) VHF
(C) UHF (D) VLF

i. Indicate the antenna that is not wideband

- (A) Discone (B) Folded dipole
(C) Helical (D) Marconi

j. Cassegrain feed is used with a parabolic reflector to

- (A) increase the gain of system
(B) increase bandwidth
(C) reduce the size of main reflector
(D) allow the feed to be placed at a convenient point.

**Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.**

- Q.2** a. State and explain Coulomb Law and derive electric field intensity for n discrete charges. (10)
b. Find the force on a unit (+ve) charge at p on x-axis (2, 0), due to $1 \times 10^{-9}\text{C}$ at origin and $-2 \times 10^{-9}\text{C}$ at (1, 0). (6)
- Q.3** a. Explain the concept of current density and derive Continuity equation. (6)
b. In a certain region the electric scalar potential is given by
 $V = x^2 + 3y^2 + 9z$
Find the value of electric field at point P (1, -2, 1). (10)
- Q.4** a. State and derive the Uniqueness theorem. (10)
b. Derive Laplace's equation in rectangular co-ordinates. (6)
- Q.5** a. State and prove Biot-Savart Law. (8)
b. State and prove Stoke's theorem. (8)

- Q.6** a. Explain the concept of force on a moving charge and derive the Lorentz force equation. (10)
- b. A solenoid of 20 cm long and 1 cm diameter has 100 turn winding. If this is placed in uniform magnetic field of strength 2Wb/m^2 and current of 10 amp flows through it, calculate the maximum torque on solenoid. (6)
- Q.7** a. Derive the continuity equation for time varying fields. (8)
- b. Write Maxwell's equations in point and in integral form. (8)
- Q.8** a. Define the following:
- | | |
|------------------------|---------------------|
| (i) Critical Frequency | (ii) Virtual height |
| (iii) MUF | (iv) Skip distance |
- (8)
- b. Electromagnetic waves are said to be transverses; what does this mean? (6)
- c. Determine the length of antenna operating at a frequency of 800 KHz. Take velocity factor as 0.95. (2)
- Q.9** a. With reference to the Antenna, define the following terms.
- | | |
|----------------------|---------------------------------|
| (i) Directive gain | (ii) Directivity and power gain |
| (iii) Antenna losses | (iv) Polarization |
| (v) Phased Array | |
- (10)
- b. What is parabola? With sketches, show why its geometry makes it a suitable basis for antenna reflectors? (6)