ROLL NO. _____

Code: AE14 **Subject: ELECTROMAGNETICS AND RADIATION**

AMIETE – ET (OLD SCHEME)

Time: 3 Hours **DECEMBER 2011** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **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. Which one of the following is a scalar quantity

(A) Electric field strength **(B)** Electric potential
(C) Electric displacement density **(D)** Force

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

(A) Laplacian equation **(B)** Kirchoff's law
(C) Poisson's equation **(D)** Continuity equation for discrete currents

c. An electric field of 50 V/m have the charges of 0.3 μC, what is the force on that charge

(A) 15 μ N **(B)** 12.5 μ N
(C) 18 μ N **(D)** 10.5 μ N

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

(A) $J = \sigma E$ **(B)** $J = \sigma^2 E$
(C) $J = E/\sigma$ **(D)** $J = E^2/\sigma$

e. For normal incidence the angle of incidence is

(A) 90° **(B)** 180°
(C) 0° **(D)** 45°

f. The direction of propagation of electromagnetic wave, is given by

(A) vector E **(B)** vector H
(C) vector (E×H) **(D)** E.H

g. Point charges Q_1 1nC and Q_2 2nC are at a distant apart. Which of the following statement is incorrect?

(A) The force on Q_1 is repulsive.
(B) The force on Q_2 is the same in magnitude as that on Q_1
(C) As the distance between them decreases, the force on Q_1 increases linearly.
(D) The force on Q_2 is along the line joining them.

h. Which is not an example of convention current?

(A) A moving charged belt
(B) Electronic movement in a vacuum tube
(C) An electron beam in a television tube.
(D) Electric current flowing in a copper wire

i. For a lossy transmission line, the characteristics impedance does not depend on

(A) The operation frequency of line.
(B) The load terminating the line.
(C) The conductivity of conductors.
(D) The conductivity of dielectric separating conductors.

j. Indicate the antenna that is not wideband

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

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

Q.2 a. State and explain coulomb law and explain the electric field intensity at a point. **(8)**

b. State and explain Gauss's law with appropriate equations. Derive the Maxwell's equation. **(8)**

Q.3 a. What is capacitance? Derive the expression of capacitance in a parallel plate capacitor. **(8)**

b. Explain the phenomena of reflection and refraction for a uniform wave in conductor with oblique incidence. **(8)**

Q.4 a. State and prove Biot – Savart's law for the magnetic flux density. **(8)**

b. Derive the continuity equation. **(8)**

Q.5 a. Write the Maxwell's equations in differential and integral form for time varying fields. Also mention the related laws. **(12)**

b. Explain the concept of displacement current in magnetic field due to time varying field. **(4)**

Q.6 a. Calculate the input impedance at anti-resonance of a full-wave cylindrical dipole antenna (dia 2 cm). Frequency is 150 MHz. Assume $R_a = 210\,\text{ohm}$. **(12)**

b. Define the surface impedance w.r.t a good conductor. **(4)**

Q.7 a. What do you mean by standing wave? Derive the expression for reflection co-efficient and SWR. **(8)**

b. Derive the Transmission line equation for transmission line with distributive reactive & non linear resistive elements. **(8)**

Q.8 a. A 6 GHz signal is to be propagated in the dominant mode in a rectangular wave guide. If its group velocity is to be 90% of the free space velocity of light, what must be the breath of the waveguide if it is correctly matched? **(6)**

b. Derive the expression for critical frequency for any ionosphere layer and how it is dependent on the maximum ionization density for any given layer. **(10)**

Q.9 a. Derive the equation of effective area for Hertzian dipole. **(10)**

b. Explain the quarter wave transformer technique for Impedance matching. **(6)**