Code: AE63 **Subject: ELECTROMAGNETICS & RADIATION SYSTEMS**

AMIETE – ET

Time: 3 Hours | **DECEMBER 2014** | 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. Which of the following is true for vector field p to be solenoidal

(A) $\oint_s \rho.ds = 0$ (B) $\oint_s \rho.d\ell = 0$

(C) $\nabla \times \rho = 0$ (D) $\nabla \times \rho \neq 0$

b. The magnetic vector potential A does not obey the equation

(A) $B = \nabla \times A$ (B) $H = -\nabla A$

(C) $\nabla^2 A = -\mu_0 J$ (D) $A = \oint \dfrac{\mu_0 I\, dL}{4\pi R}$

c. The skin depth is proportional to

(A) frequency   (B) permeability

(C) $\dfrac{1}{\sqrt{\sigma}}$ (D) $\sqrt{\sigma}$

d. The divergence of $D = e^{-x} \sin y\, a_x - e^{-x} \cos y\, a_y + 2z\, a_2$ at origin is

(A) 1   (B) 2
(C) e^{-x} (D) e^{+x}

e. The work done in taking a unit charge around any closed path is

(A) zero   (B) one
(C) finite   (D) infinite

f. The energy band gap in metallic conductors at 0 K is

(A) Large   (B) Small
(C) Zero   (D) Medium

g. The capacitance of a parallel plate capacitor having a mica dielectric $\in_r = 6$, a plate area of 6.45×10^{-3} m^2 and separation of 2.54×10^{-4} m is

(A) 0.349 nF   (B) 1.349 nF
(C) 2.349 nF   (D) 3.349 nF

h. The equation $f = q(E + V \times B)$ is

(A) Ampere's law   (B) Continuity equation
(C) Lorentz's equation   (D) Hall's equation

i. The frequencies in UHF range normally propagate by means of

(A) Ground wave   (B) Sky wave
(C) Surface wave   (D) Space wave

j. The standard reference antenna for directive gain is

(A) infinitesimal dipole   (B) isotropic antenna
(C) elementary doublet   (D) half wave dipole

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

Q.2 a. State and prove divergence theorem.   **(10)**

b. Find the electric field intensity at (0, 0, 4) due to a charge of 2nC distributed uniformly on the line $0 \le x \le 3$.   **(6)**

Q.3 a. Derive the continuity equation and give its physical interpretation.   **(8)**

b. A charge distribution with spherical symmetry has volume charge density

$$\rho_V = \begin{cases} \rho_0 & 0 \le r \le a \\ 0 & r > a \end{cases}$$

calculate (i) electrical field intensity and (ii) total energy stored.   **(8)**

Q.4 a. Draw the profiles for (i) the charge density (ii) the electric field intensity (iii) the potential of pn-junction as function of distanced from the centre of the junction.   **(8)**

b. A coaxial cable consists of an inner conductor of radius 'a' and outer conductor of radius 'b'. The space between the conductor is filled with the dielectric of permittivity '$\in$'. Determine the capacitance of cable per unit length.

(8)

Q.5 a. What is vector magnetic potential? Derive its expression.   **(8)**

b. What is curl operator? Explain stokes theorem.   **(8)**

Q.6   a. What are magnetic circuits? Compare it with electrical circuits.   **(8)**

b. Calculate the values for χ_m, M and H for ferrite material operating in a linear mode with B = 0.05 T and $\mu_r = 50$.   **(8)**

Q.7   a. Explain Faradays' law for time varying fields.   **(8)**

b. Explain the concept of displacement current.   **(8)**

Q.8   a. Explain the reflection and refraction of electromagnetic waves by a conducting medium.   **(8)**

b. Explain the following: **(4+4)**
   (i) Ground wave propagation
   (ii) Directional Antennas

Q.9   Write short notes on :   **(4+4+4+4)**
   (i)   Antenna resistance
   (ii)   Grounded Antennas
   (iii) Antenna couplers
   (iv)   Lens Antenna