ROLL NO. _____

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

AMIETE – ET (OLD 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. The electric field on equipotential surface is

(A) unity
(B) always parallel to the surface
(C) always perpendicular to the surface
(D) zero

b. The equation $\overline{\nabla}\cdot\bar{J}=0$ 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) $\bar{J}=\sigma\overline{E}$ **(B)** $\bar{J}=\sigma^2\overline{E}$

(C) $\bar{J}=\dfrac{\overline{E}}{\sigma}$ **(D)** $\bar{J}=\dfrac{\left|\overline{E}\right|^2}{\sigma}$

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

(A) Zero **(B)** 120π ohms
(C) 73 ohm **(D)** 73π ohm

e. A electric field of 50 V/m have the charge of 0.3 μ C, 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

f. Waveguide act as a

(A) High pass filter **(B)** Low pass filter
(C) All pass filter **(D)** Band pass filter

g. Select the equator which is not Maxwell's equation

(A) $\nabla.B = 0$ **(B)** $\nabla.D = q$
(C) $\nabla.E = -B$ **(D)** $\nabla \times H = D + j$

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

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

i. Ideal value of VSWR of Transmission Line is

(A) 0 **(B)** 1
(C) ∞ **(D)** any value between 0 and 1

j. Cassegrain feed is used with a parabolic reflector

(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 convent point

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

Q.2 a. State and derive Possion's and Laplace's equation. **(6)**

b. Find the force on a unit (+ ve) charge at P on x-axis (2, 0) due to 1×10^{-9}C at origin and -2×10^{-9}C at (1, 0). **(6)**

c. Find capacitance of parallel plate capacitor. **(4)**

Q.3 a. State and explain the boundary condition in magnetostatics. **(8)**

b. Derive an expression for magnetic field due to an infinite plane sheet of uniform surface current density. **(8)**

Q.4 a. State and derive Ampere's circuit law. Also write its differential form. **(9)**

b. Determine the force per unit length between two infinitely long parallel conductors carrying current *I* in the opposite direction, this conductors being separated by a distance *'d'* as shown in the Fig.1. **(7)**

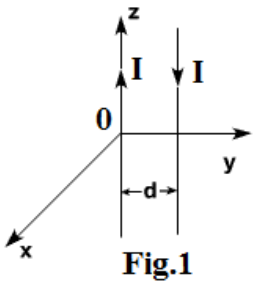

Fig.1

Q.5 a. Write and explain the Maxwell's equation in both differential and integral form for a time varying field. **(10)**

b. Considering a losses having $\mu = 2\mu_0$ and $\in = 5 \in_0$. If $\vec{H} = \cos(wt - 5y)\ \hat{a}_x\ A/m$, determine the frequency f and the electric field $\vec{E}$. **(6)**

Q.6 a. Explain Poynting Vector and Power Flow in Electromagnetic Fields. **(10)**

b. Define three types of Polarization of electromagnetic waves. **(6)**

Q.7 a. Derive the transmission line equation in terms of lumped parameters. **(8)**

b. Derive the expression for oscillation frequencies in rectangular cavity resonator. **(8)**

Q.8 a. Derive the equation of effective area for Hertzian dipole antenna. **(10)**

b. Consider an isotropic antenna radiating in free space. At a distance 100 m from the antenna, the electric field (E_0) is found to be 10 V/m. What is the total power radiated? **(6)**

Q.9 a. Derive the expression for critical frequency for sky wave propogation. **(8)**

b. Explain the single stub technique for Impedance matching. Also discuss its merits and demerits. **(8)**