

Code: AE63 Subject: ELECTROMAGNETICS & RADIATION SYSTEMS

AMIETE - ET (NEW 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. Gauss's law is stated as

- (A) Flux out of surface = current flowing
 (B) $\nabla \cdot \mathbf{B} = 0$
 (C) $\nabla \cdot \mathbf{E} = -j\omega\mu\mathbf{H}$
 (D) Flux out of surface = charge enclosed

b. Laplace equation is

- (A) $\nabla^2 V = \frac{-\rho}{\epsilon}$ (B) $\nabla^2 V = 0$
 (C) $\nabla^2 \vec{D} = \rho$ (D) None of above

c. Joule's law can be expressed as

- (A) $dV = \vec{E}d\ell$ (B) $\frac{d\rho}{dV} = \vec{E}dV$
 (C) $\frac{d\rho}{dV} = \vec{E}\vec{J}$ (D) $d\rho = \int \vec{E}dV$

d. Ampere's circuital law is given by

- (A) $\int \vec{B} \cdot d\vec{s} = \mu_0 I$ (B) $\int \vec{B} \cdot d\vec{a} = \frac{\mu_0}{2} I$
 (C) $\int \vec{B} \cdot d\vec{s} = \mu_0 I$ (D) $\int \vec{B} \cdot d\vec{s} = \mu_0 J$

Code: AE63 Subject: ELECTROMAGNETICS & RADIATION SYSTEMS

e. Differential form of Faraday's law is

(A) $\text{curl} \vec{E} = -\frac{\partial \vec{H}}{\partial t}$

(B) $\text{curl} \vec{H} = \frac{\partial \vec{E}}{\partial t}$

(C) $\text{curl} \vec{E} = -\frac{\partial \vec{B}}{\partial t}$

(D) $\text{curl} \vec{E} = -\int ds$

f. Displacement current is given by

(A) $\frac{\partial \vec{B}}{\partial t}$

(B) $\frac{\partial \vec{E}}{\partial t}$

(C) $\frac{\partial \vec{H}}{\partial t}$

(D) $\frac{\partial \vec{D}}{\partial t}$

g. For a time varying electromagnetic field, the rate of energy flow per unit area is

(A) $|\vec{E}| \cdot |\vec{H}| \cos \theta$

(B) $|\vec{E}| \cdot |\vec{H}| \sin \theta$

(C) $[|\vec{E}| + |\vec{H}|] \sin \theta$

(D) $[|\vec{E}| - |\vec{H}|] \cos \theta$

h. Maximum usable frequency is

(A) $\text{MUF} = f_C \sec \theta$

(B) $\text{MUF} = f_C \cos \theta$

(C) $\text{MUF} = f_C \sin \theta$

(D) $\text{MUF} = f_C \tan \theta$

i. The gain of an antenna

(A) varies inversely as wavelength

(B) varies inversely as square of wavelength

(C) varies directly as wavelength

(D) none of these

j. The polarisation required in ground wave propagation is

(A) horizontal

(B) vertical

(C) circular

(D) elliptical

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

Q.2 a. Find expression for Electric field due to surface charge on sheet. (8)

b. State Gauss's Law. Write its applications. (8)

Code: AE63 Subject: ELECTROMAGNETICS & RADIATION SYS

- Q.3** a. Deduce expression for potential of a point due to electric field of a point charge and show that the potential field in the presence of a number of point charges is sum of the individual potential field arising from each charge. (8)
- b. Given the potential $V = 100(x^2 - y^2)$ and a point $P(2, -1, 3)$ that is stipulated to lie on a conductor to free space boundary. Find
 (i) V (ii) E
 (iii) D (iv) ρ_s at P (8)
- Q.4** a. Write Laplace equation in cylindrical coordinate system and determine the potential distribution between two coaxial cylinders of radius r_1 & r_2 with a dielectric ϵ between them. (8)
- b. Use Poisson's equation to find V in the region between two concentric right circular cylinders containing a uniform charge density ρ . (8)
- Q.5** a. State Biot-Savart law and express it in terms of distributed sources such as current density J and surface current density K . (8)
- b. What is curl? How the point form of Ampere's circuital law is obtained using curl? (8)
- Q.6** a. Explain the following:
 (i) Magnetic dipole moment and magnetization. (8)
 (ii) Hysteresis loop. (8)
- b. Find force on the loop carrying current of 2mA as shown in Fig.1. (8)

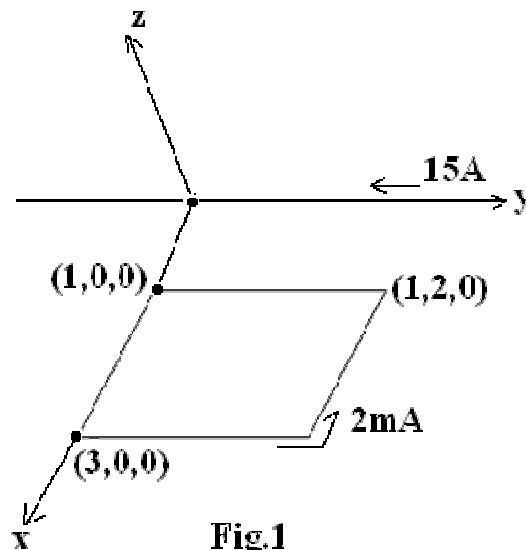


Fig.1

Code: AE63 Subject: ELECTROMAGNETICS & RADIATION SYSTEMS

- Q.7** a. Find the amplitude of displacement current density and obtain Maxwell's equation as $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$ (8)
- b. What is retarded potential? Obtain relation between electric potential and vector magnetic potential as $\mathbf{E} = -\nabla V - \frac{\partial \mathbf{A}}{\partial t}$. (8)
- Q.8** a. Briefly describe the following terms related to sky-wave propagation
(i) Virtual height (ii) Critical frequency
(iii) Skip distance (iv) Fading (8)
- b. What are the various factors used for selection of the feed point of a dipole antenna? How do current feed and voltage feed differ? (8)
- Q.9** a. Explain the function of the following:
(i) Selection of antenna couplers.
(ii) Impedance matching between devices. (8)
- b. Write working principle and applications for the following:
(i) Helical Antenna
(ii) Folded Dipole Antenna. (8)