

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

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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

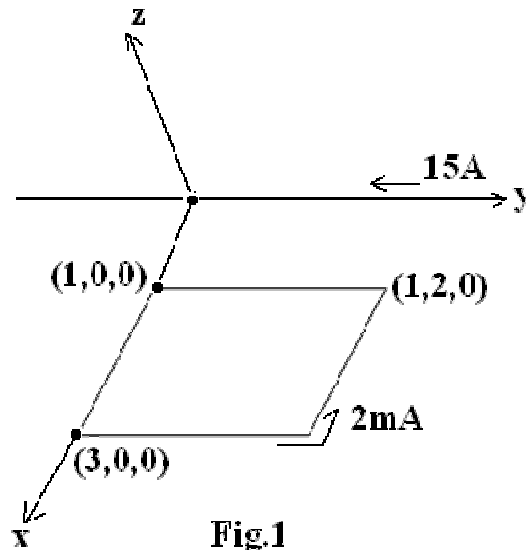
- (A) horizontal                                      (B) vertical  
 (C) circular    (D) elliptical

**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)

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- 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)  $\rho_s$  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  $\epsilon$  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  $\rho$ . (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**

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- 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)