ROLL NO.

## Code: AE63 Subject: ELECTROMAGNETICS & RADIATION SYSTEMS

# AMIETE – ET (NEW SCHEME)

Time: 3 Hours

# **JUNE 2012**

Max. Marks: 100

 $(2 \times 10)$ 

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:

a. Force between two point charges  $q_1$  and  $q_2$  situated at point A and B respectively separated by a distance d can be expressed as

(A) 
$$F_A = \frac{Kq_1q_2}{d^2} i_{BA}$$
 (B)  $F_A = \frac{Kq_1q_2}{d}$   
(C)  $F_A = \frac{Kq_1q_2}{d^2}$  (D)  $F_A = \frac{Kq_1q_2}{d} i_{BA}$ 

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

(A) Laplacian equation	( <b>B</b> ) Kirchoff's node equation
(C) Poisson's equation	( <b>D</b> ) Continuity equation for discrete
	currents

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

(A) J= <i>o</i> E	$(\mathbf{B}) \mathbf{J} = \boldsymbol{\sigma}^2 \mathbf{E}$
(C) $J = \frac{E}{\sigma}$	( <b>D</b> ) $J = \frac{E^2}{\sigma}$

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

(A) $120\pi$ ohm	( <b>B</b> ) <b>π</b> ohm
( <b>C</b> ) 73 ohm	( <b>D</b> ) 73 <b>m</b> ohm

e. An electric field of 50 V/m has the charge of 0.3  $\mu$  C, what is the force on that charge.

(A) 15 µ N	<b>(B)</b> 12.5 µ N
(C) 18 µ N	( <b>D</b> ) 10.5 µ N

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f. The attenuation in a wave guide near the cut-off frequency is

(A) High	<b>(B)</b> Low
(C) Zero	<b>(D)</b> Negative

g. Select the Equation which is not Maxwell's

$(\mathbf{A})  \nabla \mathbf{B} = 0$	$(\mathbf{B}) \nabla \mathbf{D} = \rho$
(C) $\nabla E = -B$	<b>(D)</b> $\nabla \times \mathbf{H} = \mathbf{J} + \dot{\mathbf{D}}$

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

(A)	HF	( <b>B</b> ) VHF
(C)	UHF	( <b>D</b> ) VLF

i. Indicate the antenna that is not wideband

(A) Discone	( <b>B</b> ) Folded dipole
(C) Helical	( <b>D</b> ) Marconi

j. Cassegrain feed is used with a parabolic reflector to

- (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 convenient point.

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

Q.2	a.	State and explain Coulomb Law and derive electric field intensity discrete charges.	/ for n (10)
	b.	Find the force on a unit (+ve) charge at p on x-axis (2, 0), due to $1 \times 10^{-9}$ origin and $-2 \times 10^{-9}$ C at (1, 0).	0 <sup>-9</sup> C at (6)
Q.3	a.	Explain the concept of current density and derive Continuity equation.	(6)
	b.	In a certain region the electric scalar potential is given by $V = x^2 + 3y^2 + 9z$	
		Find the value of electric field at point P $(1,-2,1)$ .	(10)
Q.4	a.	State and derive the Uniqueness theorem.	(10)
	b.	Derive Laplace's equation in rectangular co-ordinates.	(6)
Q.5	a.	State and prove Biot-Savart Law.	(8)
	b.	State and prove Stoke's theorem.	(8)

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Q.6	a.	<ul> <li>Explain the concept of force on a moving charge and derive the Lorentz for equation. (1)</li> <li>A solenoid of 20 cm long and 1 cm diameter has 100 turn winding. If this placed in uniform magnetic field of strength 2Wb/m<sup>2</sup> and current of 10 at flows through it, calculate the maximum torque on solenoid. (4)</li> </ul>		
	b.			
Q.7	a.	Derive the continuity equation for time varying fields. (8)	)	
	b.	Write Maxwell's equations in point and in integral form. (8)	)	
Q.8	a.	Define the following:(i) Critical Frequency(ii) Virtual height(iii) MUF(iv) Skip distance	)	
	b.	Electromagnetic waves are said to be transverses; what does this mean? (6)	)	
	c.	Determine the length of antenna operating at a frequency of 800 KHz. Tak velocity factor as 0.95. (2)	te )	
Q.9	a.	With reference to the Antenna, define the following terms.(i) Directive gain(ii) Directivity and power gain(iii) Antenna losses(iv) Polarization(v) Phased Array(10)	)	
	b.	What is parabola? With sketches, show why its geometry makes it a suitable	e	

b. What is parabola? With sketches, show why its geometry makes it a suitable basis for antenna reflectors? (6)