

Subject: Math: IV-VI(ix)/IX-XI(ix) M.A/M.Sc: Part- II / Composite, 1st -A/2011
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University of Sargodha

M.A/M.Sc Part-II / Composite, 1st -A/2011

Math: IV-VI(ix)/IX-XI(ix) Electromagnetic Theory

Maximum Marks: 40

Fictitious #: _____

Time Allowed: 45 Min.

Objective Part

Signature of CSO: _____

Note: Cutting, Erasing, overwriting and use of Lead Pencil are strictly prohibited. Only first attempt will be considered.

Q.1 (a) Fill in the blanks:

(5)

- (i) A _____ is an imaginary line (or curve) drawn in such a way that its direction at any point is the direction of the electric field at that point.
- (ii) The _____ gives the local energy flow per unit time per unit area.
- (iii) The transverse dispersion relation determines the magnitude of the _____ in terms of given frequency and given material constant.
- (iv) $\mathbf{J} = g\mathbf{E}$ is called _____, where $\mathbf{J}$ is current density, $\mathbf{E}$ is the electric field and g is conductivity.
- (v) The Lorentz force is $\mathbf{F} =$ _____.

(b) Choose the best answer.

(5)

- (a) Sparking occurs when a load is switched off because the circuit has high
 - (i) Inductance
 - (ii) capacitance
 - (iii) resistance
 - (iv) none of the above
- (b) According to Lenz's law, the direction of induced emf and hence current
 - (i) may be found by the right-hand rule
 - (ii) is always determined by the rate of cutting flux
 - (iii) always opposes the cause producing it
 - (iv) depends on whether the coil is wound with a right or left-hand spiral
- (c) When electromagnetic waves are reflected at an angle from a wall, their wavelength along the wall is
 - (i) the same as in free space
 - (ii) the same as the wavelength perpendicular to the wall
 - (iii) shortened because the Doppler effect
 - (iv) greater than in the actual direction of propagation
- (d) One volt equals :
 - (i) one joule
 - (ii) one joule / coulomb
 - (iii) one coulomb / joule
 - (iv) none of the above

(e) Pointing vector signifies:

- (i) current density vector producing electrostatic field
- (ii) power density vector producing electromagnetic field
- (iii) current density vector producing electromagnetic field
- (v) power density vector producing electrostatic field

(c) State whether the statement is true or false.

(10)

(i) $\nabla \cdot \nabla \times \mathbf{F} = 0$.

(ii) $\nabla(\phi\psi) = \phi\nabla\psi + \psi\nabla\phi$.

(iii) In MKS system the unit of electric potential is volt.

(iv) In MKS system the unit of constant k in Coulomb's law is Nm^2/C^2 .

(v) MKS system is also called Giorgi system of units.

(vi) The algebraic sum of currents flowing towards a branch point is zero.

(vii) The rate of change of field energy equals power dissipation per unit volume at each point.

(viii) The total sum of electric lines of force leaving the given surface normally is called electric flux.

(ix) Displacement current is nothing but the current flowing through capacitor.

(x) The normal component of magnetic flux density B is continuous across the boundary.

(d) Give short answers:

(20)

(i) Alfven waves

(iv) Capacitor

(vii) Surface current

(ii) Meissner effect

(v) Normal dispersion

(viii) Wave number

(iii) Wave frequency

(vi) Surface charge density

(ix) Power density

(x) Power factor

- i. _____
- ii. _____
- iii. _____
- iv. _____
- v. _____
- vi. _____
- vii. _____
- viii. _____
- ix. _____
- x. _____

University of Sargodha

M.A/M.Sc Part- II/Composite, 1st -A/2011

Math: IV-VI(ix)/IX-XI(ix) Electromagnetic Theory

Maximum Marks: 60

Time Allowed: 2:15 Hours

Subjective Part

Note: Attempt any three questions. All questions carry equal marks.

- Q.2 (a) A spherical charge distribution of Radius "R" has volume charge density, $\rho = \frac{a}{r}$, where "r" is the distance from the center of the distribution, find only the total charge for this spherical charge distribution. (10)
(b) State and prove the Gauss's theorem. Explain why it is called the divergence theorem. (5)
(c) Justify that the net Electric field within a conductor is always zero. (5)
- Q.3 (a) By taking start from writing the coulomb law for discrete charge distribution, write the expression for Electric Field for discrete charge. (5)
(b) If two equals and opposites charge are separated by small distance, field at the center of the charges will dipole field? If your answer is "yes" or "no", in both cases justify your answer by giving the reason. (5)
(c) State and prove the Gauss's law for dielectric. (10)
- Q.4 (a) Define uniform plane wave propagation. (3)
(b) Discuss its properties. (5)
(c) A uniform plane electromagnetic wave propagating in air is given by
$$E = ix \cos [wt - (2\pi/\lambda)y]$$
Derive by using the Maxwell's equations, the expression for the vector magnetic field. (12)
- Q.5 (a) Find the capacitance of parallel plates capacitors when a dielectric material placed between the plates. (10)
(b) Write Maxwell's equation in free space for the time varying fields both in differential and integral form. Why these equations are not completely symmetrical? (10)
- Q.6 (a) Derive Laplace's equation for electrostatic field. Write down this equation in spherical coordinates and obtain a general solution for the same. (10)
(b) Find the volume charge density inside a sphere of radius a. Given electric field intensity $E_r = Ar^4$ $r < a$, $E_r = Ar^2$ $r > a$. (10)