

SUBJECT CODE:- 290
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E.(EEP/EE/EEE) Examination Nov/Dec 2015
Electromagnetic Fields
(Revised)

[Time: Three Hours]

[Max. Marks: 80]

“Please check whether you have got the right question paper.”

N.B

- i) Q. no 1 and Q. No. 6 are compulsory.
- ii) Attempt any two questions from Q. No 2 to Q. no 5
- iii) Attempt any two questions from Q. no 7 to Q. no 10
- iv) Assume suitable data wherever necessary.

Section A

- Q.1 Attempt any five 10
- i) Define scalar and vector field. Give its two examples.
 - ii) Define electric flux and electric flux density. Write relation between E and D
 - iii) What is electric dipole and dipole moment state its unit.
 - iv) Given two points A(2,3,-1) and B (4,25⁰,120⁰) find spherical coordinates of A and cartesian coordinates of B.
 - v) Show that $A = 4ax-2ay-az$ and $B = ax+4ay-4az$ are perpendicular.
 - vi) Define the potential. Distinguish between potential and potential difference.
 - vii) The point charges $Q_1=30 \text{ nc}$, $Q_2=150\text{nc}$. And $Q_3=-70\text{nc}$, are enclosed by a surface S what net flux crosses surface S.
 - viii) State gauss law. What do you mean by guassion surface.
- Q.2 05
- a) Find the angle between $A=5.8 ay+1.55az$ and $B= - 6.93 ay+4.0az$ using both dot product and cross product
 - b) Transfer the following vector to cylindrical co-ordinate. $F=10ax - 8ay + 6az$ at point P(10,-8,6) 06
 - c) State Coulomb's law and deduce the vector form of force between two point charges. 04
- Q.3 07
- a) Derive the expression of Electric field intensity due to infinite long & line charge of placed along z-axis. 07
 - b) A line charge of $2\pi \text{nc}/m$ lies along y-axis while surface charge densities of 0.1 and -0.1 nc/m^2 exists on plane $z=3$ and $z=-4$ respectively find E at (1, -7, 2). 08
- Q.4 06
- a) State and explain divergence theorem 06
 - b) Given $D = \frac{5r^2}{4} ar \text{ c}/m^2$ in spherical co-ordinate. Evaluate both the sides of divergence theorem for the volume of sphere enclosed by $r=4$. 09
- Q.5 07
- a) Derive the expression for potential and elective field at any point P in free space due to electric dipole. 07
 - b) Given the potential field $V = x^2yz + 20y^2$ volts in free space find at point P(1,2,3) 08
 - i) V
 - ii) \vec{E}
 - iii) $\frac{dV}{dN}$
 - iv) D
 - v) Ev

SECTION-B

- Q.6 Attempt any five 10
- i) State continuously equation of current in integral and differential form
 - ii) State the properties of perfect metallic conductor
 - iii) Define magnetic field intensity and state its unit
 - iv) Define vector magnetic potential and state its unit
 - v) Compare self and mutual inductance
 - vi) State Uniqueness theorem.
 - vii) What is the significance of displacement current
 - viii) Justify the expression $\nabla \cdot B = 0$
- Q.7 a) Derive the boundary condition of the normal and tangential components of electric field at the interface of two different dielectric material 08
- b) The vector current density is given by $J = \left(\frac{4}{r^2}\right) \cos\theta \bar{a}_r + 20e^{-2r} \sin\theta \bar{a}_\theta - r \sin\theta \cos\phi \bar{a}_\phi (A/m^2)$ find the total current passing through the spherical cap $r=3, 0 \leq \theta \leq 20^\circ, 0 \leq \phi \leq 2\pi$ in \bar{a}_r direction. 07
- Q.8 a) Derive an expression for magnetic field intensity due to infinite long current carrying filament at any point P in free space 08
- b) Calculate value of vector current density in cylindrical co-ordinate at point $P(1.5, 90^\circ, 0.5)$ if $H = \frac{2}{\rho} \cos(0.2\phi) \bar{a}_\phi$ 07
- Q.9 a) State and explain stokes theorem 05
- b) Working in cylindrical co-ordinate with the field $A = 2\rho^2(Z + 1) \sin^2\phi \bar{a}_\phi$, evaluate both sides of stokes theorem for the portion of cylindrical surface define by $\rho = 2, \frac{\pi}{4} \leq \phi \leq \frac{\pi}{2}, 1 \leq z \leq 1.5$ and for its perioneter. Let $\bar{ds} = ds \bar{a}_\rho$. 10
- Q.10 Attempt any three 15
- a) State Maxwell's equation in differential form
 - b) State and explain Amperes circuital law
 - c) Magnetic boundary conditions
 - d) Scalar magnetic potential
 - e) Polarization in dielectric