Reg. No. | | | | | | | | | | | | |

Question Paper Code : 27194

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fourth Semester

Electronics and Communication Engineering

EC 6403 – ELECTROMAGNETIC FIELDS

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A – (10 × 2 = 20 marks)

1. Find the electric field intensity E at (111) if the potential is $V = xyz^2 + x^2yz + xy^2z(V)$.

2. State Gauss law and write its applications.

3. What are the boundary conditions for electric field at the perfect dielectric-conductor interface?

4. Find the energy stored in the $20pF$ parallel plate capacitor with plate separation of 2 cm. The magnitude of electric filed in the capacitor is 1000 V/m.

5. State Biot-Savart law.

6. Derive point form of Ampere's circuital law.

7. In a ferromagnetic material $(\mu = 4.5\mu_0)$, the magnetic flux density is $B = 10y\,a_x\ mWb/m^2$. Calculate the magnetization vector $(\mu_0 = 4\pi \times 10^{-7} H/m)$.

8. What is the energy stored in a magnetic field in terms of field quantities?

9. What are the Maxwell's equations for free space medium?

10. In a medium, the electric field intensity is $E = 10\sin(1000t - 10x)a_y V/m$. Calculate the displacement current density $(\varepsilon_r = 80, \varepsilon_0 = 8.854 \times 10^{-12} F/m)$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) State and explain Divergence theorem. (8)

(ii) Determine the electric flux density D at (1,0,2) if there is a point charge 10mC at (1,0,0) and a line charge of 50 mC/m along y axis. (8)

Or

(b) (i) Derive the expression for energy stored in an electrostatic field, in terms of field quantities. (10)

(ii) The two point charges $10\,\mu C$ and $2\,\mu C$ are located at (1,0,5) and (1,1,0) respectively. Find the potential at (1,0,1), assuming zero potential at infinity. (6)

12. (a) (i) Derive the expression for relaxation time by solving the continuity equation. (10)

(ii) Calculate the relaxation time of mica ($\sigma = 10^{-15} S/m, \varepsilon_r = 6$) and paper ($\sigma = 10^{-11} S/m, \varepsilon_r = 7$). (6)

Or

(b) (i) Derive the Poisson's equation. (6)

(ii) A spherical capacitor consists of an inner conducting sphere of radius 'a' and an outer conductor with spherical inner wall of radius is 'b'. The space between the conductors is filed with a dielectric of permittivity 'ε'. Determine the capacitance. (10)

13. (a) An infinitely long, straight conductor with a circular cross section of radius 'b' carries a steady current 'I'. Determine magnetic flux density both inside and outside the conductor. (16)

Or

(b) (i) Derive the expression for vector magnetic potential in terms of current density. (10)

(ii) For a current distribution in free space, $A = \left(2x^2y + yz\right) a_x + \left(xy^2 - xz^3\right) a_y - \left(6xyz - 2x^2y^2\right) a_z (Wb/m)$. Calculate magnetic flux density.

14. (a) (i) Explain about magnetization vector and derive the expression for relative permeability. (10)

(ii) State and explain Ampere's force law. (6)

Or

(b) Derive the boundary conditions of static magnetic field at the interface of two different magnetic medium. (16)

15. (a) Derive the Maxwell's equations both in integral form and differential form Ampere's law, faraday's law and Gauss' law. (16)

Or

(b) State and explain the poynting theorem and derive the expression for poynting vector. (16)
