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

Question Paper Code: 31443

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

Fourth Semester

Electronics and Communication Engineering

01UEC403 – ELECTROMAGNETIC FIELDS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. State Divergence theorem.
2. Transform the vector $\vec{B}$= y$\vec{a}_x$-x$\vec{a}_y$+z$\vec{a}_z$ into cylindrical coordinates.
3. Define Biot-Savart law.
4. A loop with magnetic dipole moment $8x10^{-3}\ \vec{a}_z\ Am^2$, lies in a uniform magnetic field $\vec{B}$= $0.2\vec{a}_x+0.4\vec{a}_z\ wb/m^2$. Compute the torque.
5. State the difference between Poisson's equation and Laplace's equation.
6. Draw B-H curve for classifying magnetic materials.
7. Write down the Maxwell's equation derived from Faraday's law.
8. If $\vec{E} = E_m \cos(\omega t - \beta z)\ \vec{a}_x\ V/m$ is the electric field propagating in free space. Calculate the Poynting vector.
9. What is meant by skin depth?
10. The dielectric constant of pure water is 80. Determine the Brewster angle for parallel polarization.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) Find the EF intensity at *A* point *P* located at (*0, 0, h*) *m* due to change of surface charge density σ C/m^2 uniformly distributed over the circular disc $r \leq a,\ z = 0m$. (10)

(ii) Determine the divergence and curl of the given field $\vec{F} = 30\vec{a}_x - 2xy\vec{a}_y + 5xz^2\vec{a}_z$ at (1, 1, -0.2) and hence state the nature of the field. (6)

Or

(b) (i) Derive an expression for the electric field intensity at any point due to a uniformly charged sheet with density ρ_s *c/m²*. (8)

(ii) Define divergence, curl and gradient in cylindrical and spherical system with mathematical expressions. (8)

12. (a) (i) Derive an expression for magnetic field intensity on the axis of a circular loop of radius '*a*' carrying current *I*. (8)

(ii) Obtain the expression for vector magnetic potential. (8)

Or

(b) Derive the expression for magnetic field intensity and magnetic flux density due to finite and infinite line charges. (16)

13. (a) (i) Derive the expression for inductance of a toroidal coil carrying current. (8)

(ii) A solenoid is 50*cm* long, 2*cm* in diameter and contains 1500 turns. The cylindrical core has a diameter of 2*cm* and a relative permeability of 75.This coil is co-axial with a second solenoid, also 50*cm* long, but 3*cm* diameter and 1200 turns. Calculate *L* for the inner solenoid and *L* for the outer solenoid. (8)

Or

(b) Derive the boundary conditions of the normal and tangential components of EF at the interface of two media with different dielectrics. (16)

14. (a) (i) Generalize Ampere's law for time varying fields. (8)

(ii) List the Maxwell's equations in integral form and point form for free space condition. (8)

Or

(b) (i) State and prove poynting theorem. (8)

(ii) Derive the expression for total power flow in co-axial cable. (8)

15. (a) (i) From the Maxwell's equation, derive the electromagnetic wave equation in conducting medium for *E* and *H* fields. (8)

(ii) Calculate the attenuation constant and phase constant for the uniform plane wave with the frequency of 100*GHz* in a conducting medium for which $\mu_r=1$ and $\sigma=58\times10^6$ *S/m*. (8)

Or

(b) Discuss about the plane waves in free space and homogenous material. (16)