C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 54403

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2024

Fourth Semester

Electronics and Communication Engineering

15UEC403–ELECTROMAGNETIC FIELDS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. Find the dot product of the vectors CO1- R
$\overline{A} = 2\overline{a_x} - 3\overline{a_y} + \overline{a_z}$ and $\overline{B} = 3\overline{a_x} + \overline{a_y} + 2\overline{a_z}$

(a) 5 (b) 30 (c) 40 (d) 56

2. The Biot-savart's law is a general modification of CO2- R

(a) Kirchhoff's law (b) Lenz's law (c) Ampere's law (d) Ampere's law

3. For boundary between conductor and free space the field intensity inside a conductor is_ CO3- R

(a) 1 (b) infinity (c) zero (d) constant

4. The law that the induced e.m.f. and current always oppose the cause producing them is due to CO4- R

(a) Faraday (b) Lenz (c) Newton (d) Coulomb

5. The unit of attenuation constant is _____. CO5- R

(a) Nepers (b) meter (c) Nepers/meter (d) none of the above

PART – B (5 x 3= 15 Marks)

6. Find the distance between the point P(5m,3π/2.0m) and Q(7m.π/2,10m) which are in cylindrical coordinate system. CO1- App

7. For a current distribution in free space, CO2- App
$\vec{A} = (2x^2y+yz)\,\hat{a}_x + (xy^2 - xz^3)\,\hat{a}_y - (6xyz-2x^2y^2)\,\hat{a}_z$ (Wb/m).
Calculate magnetic flux density.

8. State properties of conductor and dielectric materials. CO3- U

9. Derive point form of Ampere's Circuital law. CO4- U

10. List any two properties of uniform plane waves. CO5- U

PART – C (5 x 16= 80 Marks)

11. (a) Obtain the expression for the volume of a sphere of radius R from the differential volume. CO1- App (16)

Or

(b) Determine the electric field intensity at P (-0.2, 0,-2.3) due to a point charge of +5nC at Q (0.2, 0.1,-2.5) in air. All dimensions are in meter. CO1- App (16)

12. (a) Using Biot Savart Law, Formulate the $\vec{H}$ due to infinitely long straight conductor. CO2- App (16)

Or

(b) Derive the expression for magnetic field intensity and flux density of coaxial cable using Ampere's circuital law and also prove the Ampere's circuital law. CO2- App (16)

13. (a) Find the capacitance of a parallel plate capacitor having 2 layers of dielectrics in between them with a surface area of 1 m^2. The first layer has a relative permittivity of 5 and thickness of 1mm where as the second layer has relative permittivity of 10 with a thickness of 4mm. CO3- U (16)

Or

(b) Find the expression for magnetic field intensity, H due to a circular loop of radius 'a' carrying a current of I amperes at any point on the central axis of the loop CO3- U (16)

14. (a) A capacitor with air as the dielectric medium has a plate area of 1cm ^{2} with a plate separation of 0.1mm.Find the displacement current and displacement current density for an applied voltage of 100 sin (3.14 * 10 ^{6}) t. CO4- U (16)

Or

(b) Derive the expression of Maxwell equation in integral form and differential form. CO4- U (16)

15. (a) Derive the wave equation starting from the Maxwell‟s equation for free space. CO5- U (16)

Or

(b) Describe skin depth and arrive at a solution for a copper sheet having $\sigma = 5.8 \times 10^7$ siemens/m and $\mu_r = 1$. Find the skin depth at the frequency of 100 Hz. CO5- U (16)

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