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Reg. No. :

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

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   CO3- R
   inside a conductor is_

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

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

   (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)   CO1- App
   which are in cylindrical coordinate system.

7. For a current distribution in free space,   CO2- App
   $\vec{A} = (2x^2y+yz)$ â$_x$+ $(xy^2- xz^3)$ â$_y$-$(6xyz-2x^2 y^2)$ â$_z$ (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   CO1- App   (16)
        the differential volume.

                                    Or

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

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

                                    Or

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

13. (a) Find the capacitance of a parallel plate capacitor having 2 layers   CO3- U   (16)
        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.

                                    Or

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

14. (a) A capacitor with air as the dielectric medium has a plate area of   CO4- U   (16)
        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.

                                    Or

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(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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