PART C — (1 × 15 = 15 marks)

16. (a) A single phase, two wire transmission line circuit comprises two parallel conductors *A* and *B*, 1 cm diameter and spaced 1 m apart. The conductors carry current of +100 A and -100 A respectively. Determine the $\vec{H}$ at the surface of each conductor and also in the space exactly midway between *A* and *B*.

Or

(b) A Condenser consists of two parallel plates each having an area of 0.15 m^2 and seperated by a layer of 5 mm thick sheet of ebonite. Again a sheet of ebonite 1.8 mm thick is introduced between the plates and their distance is increased to 6.1 mm in order to keep the capacitance intact. Determine the capacitance of the condenser with ebonite in position and spacing of 5mm between the plates.

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Question Paper Code : 52946

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Third Semester

Electrical and Electronics Engineering

EE 6302 — ELECTROMAGNETIC THEORY

(Regulation 2014)

(Common to PTEE 6302 — Electro magnetic Theory for B.E. Part Time – For Second Semester –Electrical and Electronics Engineering – Regulation 2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Prove that curl grad $\varphi = 0$ where φ is scalar field.

2. Given the points $A(x=2, y=3, z=-1)$ and $B(r=4\ \theta=25°, \varphi=120°)$ find the distance from *A* to *B*.

3. An electric field is given by $\vec{E} = 10^2(\vec{i} + 3\vec{j} + 2\vec{k})$V/m. Show that no work done in moving a test charge from the origin to $r = \overrightarrow{0.06i} - 0.04\ \vec{j} + 0.03\vec{k}$.

4. The electric field between two concentric cylindrical conductors at $r = 0.01$ m and $r = 0.05$ m is given by $\vec{E} = \left(\frac{10^6}{r}\vec{a}_r\right)$V/m. Find the energy stored in 1.0 m length of conductor. Assume free space.

5. State the two conditions in choosing the closed Ampérian path as in Gauss's law.

6. What is the maximum torque on a square loop of 100 turns in a field of flux density 'B' tesla. The loop has 10 cm side and carries a current of 3 amp. What is the magnetic moment of the loop?

7. A straight conductor of length 40cm moves perpendicularly to its axis at avelocity of 50 m/sec in a uniform magnetic field of flux density 1.2 Tesla. Evaluate the e.m.f induced in the conductor if the direction of motion is normal to the field.

8. Write modified form of Ampere's circular law.

9. Write one dimensional wave equation.

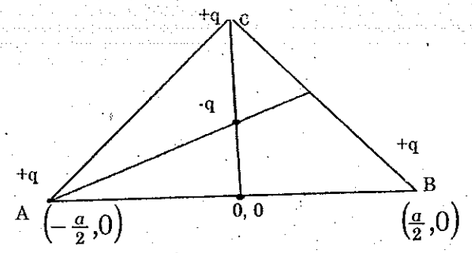
10. What is transverse electromagnetic wave?

PART B — (5 × 13 = 65 marks)

11. (a) Given that $\vec{D} = \left(\frac{5r^2}{4}\right)\vec{a}_r$ in spherical co-ordinates. Verify divergence for the volume enclosed between $r = 1$ and $r = 2$. (13)

Or

(b) (i) Find the value of point charge placed at the centre of an equilateral triangle which holds the three point charges '+q' at the corners of triangle in equilibrium. (7)



(ii) Determine the electric field intensity $\vec{E}$ at a point 2a along the axis perpendicular to the plane of a circular wire charged uniformly at C\m which has a radius 'a'. (6)

12. (a) (i) $\overline{E} = \left(\frac{-6y}{x^2}\right)\vec{I}_x + \left(\frac{6}{x}\right)\vec{I}_y + 5\vec{I}_z V/m$, Find the potential difference V_{AB}, given $A(-7, 2, 1)$ and $B(4, 2, 1)$. (8)

(ii) Explain law of conservation of charge. (5)

Or

(b) (i) Derive the expression for capacitance of parallel plate capacitor with necessary diagram. (7)

(ii) Derive the expression for capacitance of co-axial capacitor with necessary diagram. (6)

13. (a) (i) Derive the expression for magnetic field intensity $\vec{H}$ at the centre of a circular wire carrying current' i' in the counter clock wise direction. Assume wire is in XY plane and radius is 'a'. (7)

(ii) Prove that scalar magnetic potential is a multivalued function of φ, the given co-axial line conductor, in the region $a < \rho < b$. (6)

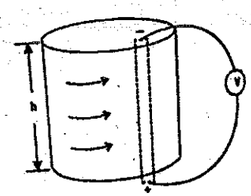
Or

(b) Determine the mutual inductance between an infinitely long straight conductor along Y-axis and a rectangular single turn coil situated in XY-plane with its corner located at point $(a, 0), (a + d, 0), (a, h), (a, d + h)$.

14. (a) Show that the displacement current in the dielectric of a parallel plate capacitor is equal to the conduction current in the leads.

Or

(b) (i) A conducting cylinder of radius 5 cm and height 20 cm rotates at 600 rev/s in a radial field B= 0.5 tesla. Sliding contacts at the top and bottom connect to voltmeter as shown below. Find the induced voltage. (7)



(ii) The conduction current flowing through a wire with conductivity $\sigma = 3 \times 10^7$ s/m and relative permittivity =1 is given by $= 3\sin\omega t(mA)$. If $\omega = 10^8$ rad/sec, Find the displacement current. (6)

15. (a) Analyze the following cases:

(i) Plane waves in lossless dielectrics (4)

(ii) Plane waves in free space (4)

(iii) Plane waves in good conductors. (5)

Or

(b) In a non magnetic medium $\overline{E} = 4\sin(2\pi \times 10^7 t - 0.8x)\vec{a}_z V/m$ Find

(i) ε_r, η. (10)

(ii) The time average power carried by the wave. (3)