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Question Paper Code : 80130

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

Third Semester

Electrical and Electronics Engineering

EE 8391 — ELECTROMAGNETIC THEORY

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the condition for the vector F to be solenoidal.
2. What are the sources of electric field and magnetic field?
3. Why water has much greater dielectric constant than mica?
4. What are the significant physical differences between Poisson's and Laplace's equations?
5. State Gauss law for magnetic field.
6. State the conservative property of electric field.
7. What is the effect of permittivity on the force between two charges?
8. What is main effect of eddy current?
9. Mention the properties of uniform plane wave.
10. Define Poynting vector.

PART B — (5 × 13 = 65 marks)

11. (a) Express vector $\overline{B}$ in cartesian and cylindrical coordinate systems. Given $\overline{B} = \frac{10}{r}\overline{a}_r + r\cos\theta\,\overline{a}_\theta + \overline{a}_\varphi$ then find $\overline{B}$ at (–3, 4, 0) and (5, $\pi/2$,–2).

Or

(b) A charge of 1 C is at (2, 0, 0). What charge must be placed at (–2, 0, 0) which will make y component of total $\overline{E}$ zero at the point (1, 2, 2)?

12. (a) Consider an infinite line charge with density ρ_L C/m, along z-axis. Obtain the work done if a point charge Q is moved from r = a to r = b along a radial path.

Or

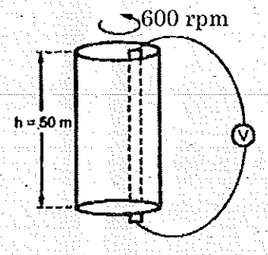
(b) $V = x - y + xy + zV$, find $\overline{E}$ at (1, 2, 4) and the electrostatic energy stored in a cube of side 2 m centered at the origin.

13. (a) A 'z' directed current distribution is given by, $\overline{J} = (r^2 + ur)$ for $r \le a$. Find $\overline{B}$ at any point $r \le a$ using Ampere's circuital law.

Or

(b) A circular loop of radius r and current I lies in z = 0 plane. Find the torque which results if the current is in $\overline{a}\,\phi$ and there is a uniform field $\overline{B} = \frac{B_0}{\sqrt{2}}(\overline{a}_x + \overline{a}_z)T$.

14. (a) A conducting cylinder of radius 7 cm and height 50 cm rotates at 600 rpm in a radial field $\overline{B} = 0.10\,\overline{a}_r\,T$. Sliding contacts at the top and bottom are used to connect a voltmeter as shown in the figure. Calculate induced voltage.



Or

(b) A parallel plate capacitor with plate area of $5\,cm^2$ and plate separation of 3 mm has voltage 50 sin 103t V applied to its plates. Calculate displacement current assuming $\varepsilon = 2\varepsilon_0$.

15. (a) Explain in detail the behavior of plane waves in lossless medium.

Or

(b) Starting from Maxwells equations derive the expression for Poynting vector and explain its significance.

PART C — (1 × 15 = 15 marks)

16. (a) Find the capacitance of conducting sphere of 2 cm in diameter, covered with a layer of polyethelene with $\epsilon_r = 2.26$ and 3 cm thick.

Or

(b) The region between two concentric right circular cylinders contains a uniform charge density ρ. Solve the Poisson's equation for the potential in the region.