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B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Third Semester

(Regulation 2004)

Electrical and Electronics Engineering

EE 1201 — ELECTROMAGNETIC THEORY

(Common to B.E. (Part-Time) Second Semester Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

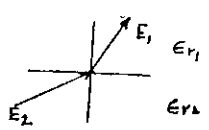
PART A — (10 × 2 = 20 marks)

1. Mention the criteria for choosing an appropriate coordinate system for solving a field problem easily. Explain with an example.

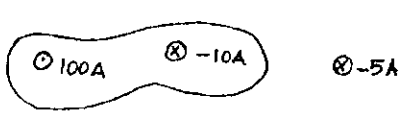
2. Define Stoke's theorem. Give an example where the theorem can be used.

3. Give examples for uniform and non-uniform electric fields.

4. Comment on the values of the relative permittivity $\varepsilon 1$ and $\varepsilon 2$ for the field at the charge free interface of two dielectric media.



5. For the configuration shown calculate the value of $\oint \mathbf{H}.d\mathbf{l}$.



6. What should be the direction of currents (of same magnitude) in two identical coaxial cylindrical coils to have maximum magnitude of **B** at a point on the axis?

7. Calculate the induced emf at t = 10 sec when the flux through each turn of a 200 turn coil is t (t – 1) mWb.

8. Mention the parameters that limit the circuit approach for solving an electrical problem.

9. When **E** and **H** are polarized in x and –z directions respectively, give the direction of the electromagnetic wave propagation.

10. How a dielectric medium can be identified as lossless and lossy for a given frequency?

PART B — ($5 \times 16 = 80$ marks)

11. (a) State Divergence theorem. Given $D = 10y^3/3\ a_y\ C/m^2$, evaluate both the sides of the Divergence theorem for the volume of a cube 2m on each edge centered at the origin and with the edges parallel to the axes.

Or

(b) Explain the working principle of any two practical applications of electrostatic fields and magnetostatic fields. (4 + 4 + 4 + 4)

12. (a) (i) Derive an expression for electric field intensity E due to an uniformly charged infinitely long straight line with constant charge density in C/m. (10)

(ii) A line charge of 20nC/m is located at x= 2m and y = –4m. Calculate the Field **E** at (–2, –1, 4)m. (6)

Or

(b) (i) Derive the boundary conditions at the charge interface of two dielectric media.

(ii) With **E1** 2 ax —3 ay + 5 az V/m at the charge free interface, calculate **D2**, $\theta 1$ and $\theta 2$ with $\varepsilon 1 = 2$ and $\varepsilon 2 = 5$. (8 + 8)

13. (a) (i) Determine **H** for a solid cylindrical conductor of radius 'a' with uniform current density.

(ii) A thin cylindrical conductor of radius 'a' infinite in length carries a current I. Find H at all points. (8 + 8)

Or

(b) (i) Derive the equivalent magnetic circuit of a C core with an air gap. Define the circuit parameters used.

(ii) A cast iron C core has a mean length of 0.44 m with square cross section 0.02 × 0.02 m. The air gap length is 2mm and the coil has 400 turns. Find the current required to establish an air gap of 0.141 mWb., $\mu_r = 328$. (8 + 8)

14. (a) What are the different ways of emf generation? Explain with the governing equations and suitable practical examples.

Or

(b) Derive the relationship between the field and circuit approach using a RLC series circuit.

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15. (a) Derive the EM wave equation in frequency domain. Derive the expression for intrinsic impedance and propagation constants for free space, dielectric and conductor.

Or

(b) (i) Define and derive Poynting vector. Mention its practical significance.

(ii) In free space $E(z,t) = 50 \cos (wt - bz)$ ax V/m. Find the average power crossing a circular area of radius 2.5m in the z_ constant plane. (8 + 8)
