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**Question Paper Code: U3304**

B.E./B.Tech. DEGREE EXAMINATION, NOV 2025

Third Semester

Electrical and Electronics Engineering

21UEE304 - ELECTRO MAGNETIC FIELDS

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. State Gauss Divergence theorem CO1-U
2. What is the relation between vector potential and field strength CO1-U
3. Define Electric Field Intensity CO1-U
4. What is the difference between electric flux density and Current density CO1-U
5. Identify the energy storing element which stores the energy in magnetic field. CO1-U
6. Identify the passive component which is used to store energy in magnetic field and write the formula for energy storage CO2-App
7. For time varying field write the Maxwell equation which is derived from ampere circuital law CO2-App
8. Define conduction current density CO1-U
9. Write general wave equations in terms of Electric field CO1-U
10. Write general wave equations in terms of Magnetic field CO1-U

PART – B (5 x 16= 80 Marks)

11. (a) (i) State and prove stokes theorem with neat example. CO2-App (16)  
(ii) Given point P(-2,6,3) Express P in the Cartesian, cylindrical and spherical systems.

Or

- (b) (i) State and prove Divergence theorem with neat example. CO2-App (16)  
(ii) Show that the vector  $H = (y^2 - z^2 + 3yz - 2x) a_x + (3xz + 2xy) a_y + (3xy - 2xz + 2z) a_z$  is both irrotational and solenoidal.

12. (a) Two small identical conducting sphere have charges of  $2nc$  and  $-1nc$  respectively. When they are separated by  $4cm$  apart, find the magnitude of the force between them. If they are brought into contacts and then again separated by  $4cm$ , find the force between them. CO2-App (16)
- Or
- (b) Apply Coulomb's law to determine the electric field intensity due to infinite line of uniform charged wire. CO2-App (16)
13. (a) At an interface separating two different magnetic materials show that the tangential component of magnetic field intensity is continuous across the boundary, whereas the normal component of magnetic field intensity is discontinuous at the boundary. CO2-App (16)
- Or
- (b) Derive the expressions for magnetic field intensity due to toroidal coil and circular coil CO2-App (16)
14. (a) State and explain Faraday's law of electromagnetic induction and derive the expressions for statically and dynamically induced emf. CO1-U (16)
- Or
- (b) Contrast electricity and magnetism by comparing their laws and parameters and constants CO1-U (16)
15. (a) Derive the electromagnetic wave equation and propagation constant and intrinsic impedance CO2-App (16)
- Or
- (b) Prove that the intrinsic impedance offered by free space is  $120\pi\Omega$  CO2-App (16)