

D 30901

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Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
OCTOBER 2012

Electrical and Electronics Engineering

EE 09 304/PTEE 09 303—ELECTROMAGNETIC FIELD THEORY

(2009 Admissions)

Time : Three Hours

Maximum : 70 Marks

Part A

Answer all questions.

1. State Gauss's law.
2. Define Inductance.
3. What is meant by displacement current ?
4. Define uniform plane electromagnetic wave.
5. Define phase velocity.

(5 × 2 = 10 marks)

Part B

Answer any four questions.

6. Express the vector field $G = 8 \sin \phi \bar{a}_\phi$ in :
 - (a) Rectangular components.
 - (b) Cylindrical components.
7. Two infinite plane sheets are separated by a distance 'd'. The first has a charge of +σ C per unit area, the second has a charge of -σ C per unit area. Find the electric field intensity at any point between them.
8. Fig. 1 shows a planar dielectric slab with free space on either side. Assuming a constant field E_2 within the slab, Express E_3 in terms of E_1 . Prove your answer.

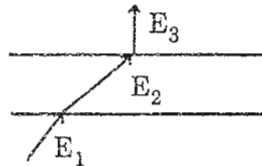


Fig. 1.

9. A parallel plate capacitor with area 0.3 m^2 and separation 5.5 mm contains three dielectrics with interfaces normal to E and D as follows :

$\epsilon_1 = 3.0, d_1 = 1.0 \text{ mm} ; \epsilon_2 = 3.0, d_2 = 2.0 \text{ mm} ; \epsilon_3 = 6.0, d_3 = 2.5 \text{ mm}$. Find the capacitance.

Turn over

10. Discuss Pointing Theorem.
11. Derive Maxwell's equation from Ampere's law.

(4 × 5 = 20 marks)

Part C

Answer all questions.

12. (a) Three point charges in free space are located as follows :
+ 5 × 10⁻⁸c at (0, 0) m, - 6 × 10⁻⁸c at (0, 4) m and + 4 × 10⁻⁸c at (0, 4) m
(i) Find the electric field intensity and electric flux density at (3, 4) m.
(ii) What is the total electric flux over a sphere of 5 m radius with centre at (0, 0).
Or
- (b) Let a point charge Q₁ = 25 nC be located at P₁ (4, -2, 7) and a charge Q₂ = 60 nC be at P₂ (-3, 4, -2). Assume both the charges are in free space.
(i) Find E at P₃ (1, 2, 3)
(ii) At what point on the y-axis is E_x = 0 ?
13. (a) Two circular coils are located in free space at the z = 0 m plane and z = 5 m plane, centered about the axis. The first coil having a radius of 1 m carries a current of 10 A. The second coil having a radius of 0.5 m carries a current 20 A. (both the coil currents one in anti clockwise direction) Calculate the magnetic field intensity at (0, 0, 2.5). Derive the formula used.
Or
- (b) A shielded power cable has a polyethylene insulation for which ε_r = 2.26 and the dielectric strength is 18.1 MV/m. What is the upper limit of voltage on the inner conductor with respect to the shield when the inner conductor has a radius of 1 cm and the inner side of the concentric shield is at radius of 8 cm ?
14. (a) Derive the wave equation for a conducting medium.
Or
- (b) Explain various types of wave polarization.
15. (a) Write short notes on :
(i) Standing wave ratio.
(ii) Impedance matching.
Or
- (b) State and explain law of reflection and law of refraction.

(4 × 10 = 40 marks)