

D 30901

(Pages : 2)

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 $+\sigma$ C per unit area, the second has a charge of $-\sigma$ 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.

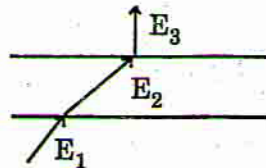


Fig. 1.

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 :
 $+ 5 \times 10^{-8} \text{c}$ at (0, 0) m, $- 6 \times 10^{-8} \text{c}$ at (0, 4) m and $+ 4 \times 10^{-8} \text{c}$ 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 $Q_1 = 25 \text{ nC}$ be located at $P_1 (4, -2, 7)$ and a charge $Q_2 = 60 \text{ nC}$ be at $P_2 (-3, 4, -2)$. Assume both the charges are in free space.
 (i) Find E at $P_3 (1, 2, 3)$
 (ii) At what point on the y -axis is $E_x = 0$?

13. (a) Two circular coils are located in free space at the $z = 0 \text{ m}$ plane and $z = 5 \text{ m}$ 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 $\epsilon_r = 2.26$ 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)