

K15F 0172

Reg. No. : .....

Name : .....



V Semester B.Tech. Degree (Reg./Sup./Imp. – Including Part Time)  
Examination, November 2015  
(2006 & Earlier Admn.)

PTEC 2K/EC 2K 502 : ELECTROMAGNETIC FIELD THEORY

Time : 3 Hours

Max. Marks : 100

**Instruction :** Answer all questions.

1. a) State and explain Gauss's law.  
b) Derive an expression for energy stored in an electric field.  
c) Compare scalar and magnetic potentials.  
d) Explain Faraday's laws of electromagnetic induction.  
e) Write down Maxwell's equations for freespace and explain their physical significance.  
f) What is polarization ? Explain the different types of polarization.  
g) What is total internal reflection and Brewster angle ?  
h) Write a short note on Smith chart. (8×5=40)
2. a) A ring of radius 10 cm is charged with  $10\mu\text{C}$ . Find the electric potential and field intensity at a point 10 cm away from the centre of the ring, lying perpendicular to the plane of the ring. 10  
b) Discuss about field polarisation in dielectrics. 5

OR

- c) A concentric spherical capacitor is formed by two concentric spheres of radii  $a$  and  $b$ . If the medium between the spherical shells has dielectric constant  $\epsilon_{r_1}$  from  $a$  to  $r$  and  $\epsilon_{r_2}$  from  $r$  to  $b$ , where  $r > a$ , find the capacitance. 7
- d) Derive the Laplace's and Poisson's equations. 8

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3. a) Two coils of 50 and 500 turns respectively are wound one over other on a closed iron circuit of section  $100 \text{ cm}^2$  having a mean length of 200 cm. Estimate the mutual inductance between them if the relative permeability of iron is 500. A current in the first coil grows steadily from 0 to 100 A in 1 ms. Find the emf induced in the other. 10
- b) Distinguish between motional and transformer emf. 5
- OR
- c) Compute the magnetic flux density at the centre of a circular current of 2A and radius 5 cm. Also calculate the equivalent magnetic dipole moment. 8
- d) Discuss about magnetic boundary conditions. 7
4. a) Obtain Maxwell's equations for free space and explain their significance. 10
- b) Derive wave equation for a wave propagating in conducting medium. 5
- OR
- c) Define and explain Poynting's vector and theorem. Explain their significance. 10
- d) Obtain current continuity equation. 5
5. a) From the transmission line equations, derive an expression for characteristic impedance. 6
- b) Define and explain phase velocity and group velocity. Derive an expression for group velocity. 9
- OR
- c) Analyse mathematically the situation when a wave falls : 15
- i) obliquely on a conductor and
  - ii) normally on a perfect dielectric.