

2125  
B.E. (Electrical and Electronics Engineering)  
Fifth Semester  
PC-EE-503: Electromagnetic Fields Theory

Time allowed: 3 Hours

Max. Marks: 50

*NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit.*

x-x-x

I. Attempt the following:-

- a) How are the unit vectors defined in three coordinate systems?
- b) If two vectors are  $\vec{A} = 4\vec{a}_y + 10\vec{a}_z$  and  $\vec{B} = 2\vec{a}_x + 3\vec{a}_y$ , find the projection of  $\vec{A}$  on  $\vec{B}$ .
- c) What is the inductance per unit length of coaxial conductor?
- d) State the difference between Laplace and Poisson's equations.
- e) State the difference between conduction current density and displacement current density. (5x2)

**UNIT - I**

II. a) State and prove Stokes theorem.

b) Derive the expression of electric field due to a line charge. (5,5)

III. a) Derive the expression for capacitance of conducting spheres.

b) Convert the vector  $\vec{A} = 2\vec{a}_x + 3\vec{a}_z$  from Cartesian to spherical coordinate system. (5,5)

IV. a) Define current density. Derive the continuity equation for steady current

b) Find E at the origin due to a point charge of 50 nC located at (-4, 5, 3) m in Cartesian coordinates. (5,5)

**UNIT - II**

V. a) Define magnetic flux density. Derive the expression for self inductance of toroid of circular cross section.

b) What are the various magnetic boundary conditions? (5,5)

P.T.O.

(2)

- VI. a) Find out the Maxwell's equations for free space and for harmonically varying fields.  
b) A certain material has  $\sigma = 0$  and  $\epsilon_r = 1$  if  $\vec{H} = 4 \sin(10^6 t - 0.01z) \vec{a}_y$  A/m. Use Maxwell's equations to find  $\mu_r$ . (5,5)
- VII. a) Write down the modified form of Ampere's circuital law. Further, derive the expression for wave equation in conducting media.  
b) Derive Poynting theorem and explain its significance. (5,5)

x-x-x