

--	--	--	--	--	--	--	--	--	--

NEW SCHEME

Fourth Semester B.E Degree Examination, July 2006

EE / EC / TE / IT / ML / BM

Field Theory

Time: 3 hrs.]

[Max. Marks: 100

*Note: 1. Answer any FIVE full questions.
2. Assume any missing data.*

1.
 - a. State and explain coulomb's law in the vector form. Mention the units of each term involved. (06 Marks)
 - b. Explain the terms i) Electric field intensity and ii) Electric potential. Also bring out the relation between them. (06 Marks)
 - c. Point charges of 50nc each are located at A(1, 0, 0), B(-1, 0, 0), C(0, 1, 0) and D(0, -1, 0)m. Find the total force on the charge at A. Also find the electric field intensity at A. (08 Marks)

2.
 - a. Explain the concept of work and potential as applied to an electric field and hence obtain an expression for the potential difference between two points in an electric field produced by a point charge. (06 Marks)
 - b. Find electric field intensity at P(0, -h, 0)m due to a line charge of finite length along Z axis between A(0, 0, Z₁)m and B(0, 0, Z₂)m. (06 Marks)
 - c. A line charge of total charge 1μc is placed between A(0, 0, 1) and B(0, 0, 2)m. Find electric field intensity at (i) P₁(0, 0, 0)m and (ii) P₂(0, 1, 1)m. (08 Marks)

3.
 - a. Starting from Gauss's law, arrive at Poisson's equation and Laplace equation. Write Laplace equation in explicit form in
 - i) Cartesian co-ordinate system and
 - ii) Cylindrical co-ordinate system. (06 Marks)
 - b. Obtain an expression for the electric field intensity due to an infinite line charge along z axis having a uniform charge of P₁ c/m. using Gauss's law. (06 Marks)
 - c. Using Laplace equation, find an expression for the electric potential at any point in an infinitely long co-axial cable with inner radius a_m and outer radius b_m. (08 Marks)

4.
 - a. Discuss the boundary conditions at the interface between two dielectrics of different permittivities. (06 Marks)
 - b. Find the stored energy in a system of four identical charges of 4nc at the corners of a square of side 1m. What is the stored energy if only two charges are placed at the corners of the square. (06 Marks)
 - c. Find the potential and volume charge density at P(0.5, 1.5, 1)m in free space given the potential field as under
 - i) $V = 2x^2 - y^2 - z^2$ volt
 - ii) $V = 6\rho\phi z$ volt. (08 Marks)

5.
 - a. State and explain Biot Savart's law. Using this, find the magnetic field intensity in the vicinity of an infinitely long, straight, filamentary current I Ampere along Z-axis. (10 Marks)
 - b. State and discuss Ampere's circuital law. Write also in point form. Determine \vec{H} for a solid cylindrical conductor of radius a where current I is uniformly distributed over the cross section. (10 Marks)

Contd...2

- 6 a. Discuss the boundary conditions at the interface between two media of different permeabilities. (06 Marks)
- b. State and explain Faraday's law of electromagnetic induction. Write also in point form. (06 Marks)
- c. Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of length 60cm and of diameter 6cm, given that medium is air. Derive the expression used. (08 Marks)
- 7 a. Starting from Maxwell's equations derive the wave equation for sinusoidal waves in a good dielectric medium. (08 Marks)
- b. Derive the wave equation for a wave in conducting medium and hence explain the terms 'Skin depth'. (06 Marks)
- c. State and prove Poynting's theorem. (06 Marks)
- 8 Write short notes on:
- a) Energy density in an electrostatic field
 - b) Continuity equation
 - c) Force between two differential current elements,
 - d) Vector magnetic potential. (20 Marks)
