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MANIPAL INSTITUTE OF TECHNOLOGY, MANIPAL
(A Constituent Institute of MAHE, Deemed University)

THIRD SEMESTER B.E. DEGREE MAKE-UP EXAMINATION
(REVISED CREDIT SYSTEM)

13 January 2007

ELECTRO MAGNETIC THEORY (ELE 207)

Time: 3 hours

Max.Marks: 50

Note: Answer any **FIVE** full questions.

- 1A) A square sheet defined by $-2m \leq x \leq 2m$, $-2m \leq y \leq 2m$ lies in the $z = -3m$ plane. The charge density on the sheet is $\rho_s = 2(x^2 + y^2 + 9)^{3/2}$ nano coulomb/m². Calculate the electrical field intensity at the origin. (04)
- 1B) Charge is distributed uniformly along a straight line of finite length $2L$. Show that for two external points near the mid point, such that r_1 and r_2 are small compared to the length, the potential V_{12} is the same as for an infinite line charge. (06)
- 2A) Given $V = 8x^2y^2 - 6xz^2$ volts. Find i) \vec{E} at $p(3,4,5)$
ii) Unit vector in the direction of \vec{E} iii) \vec{D} assuming free space. (03)
- 2B) Derive expression for the capacitance of a two wire transmission line (04)
- 2C) Explain boundary conditions between two dielectric media. (03)
- 3A) State and explain Biot-savart's law for static magnetic field (03)
- 3B) Develop expressions for the magnetic field intensity, both inside and outside a solid cylindrical conductor of radius 2cm, carrying a current of 100Amp with uniform current density (04)
- 3C) A conductor of length 2.5cm located at $Z=0$ $X=4cm$ carries a current of 12Amp in the $-ay$ direction find the uniform B in the region if the force on the conductor is $1.20 \times 10^{-2}N$ in the direction $(-ax+ay)/\sqrt{2}$ (03)
- 4A) Write a short notes on
a) Stoke's Theorem as applied to magnetic field
b) Magnetic vector potential (04)
- 4B) Determine the loop inductance of two wire transmission line with solid wires of radii a and b (06)
- 5A) Show that $J_{total} = J + J_d$ with the usual notations. Explain the current density terms. (03)
- 5B) A circular loop of radius 10 cm is located in $x-y$ plane in a magnetic field of flux density $B = 0.5 \cos 377t (3ay + 4az)$ Tesla. Using Faraday's law find the induced emf in the loop, if there are 10 turns in the loop. (03)
- 5C) Write short note on 1) transformer emf 2) skin depth (04)
- 6A) Derive expressions for propagation constant and intrinsic impedance of the medium when a uniform plane wave propagates through a perfect dielectric medium. (06)
- 6B) A plane wave is travelling in the x -direction in a lossless medium having permeability same as free space and permittivity 9 times that of free space. Find the phase velocity of the wave. If the electric field intensity has only y -component with an amplitude of 10 v/m, find the amplitude and direction of the magnetic field intensity. (04)