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PES

P.E.S. Institute of Technology, Bangalore.

(Autonomous Institute under VTU, Belgaum)

11EC205

(Lateral Entry-EC)

Semester End Exam(S.E.E.), B.E., 3rd Semester – January 2013

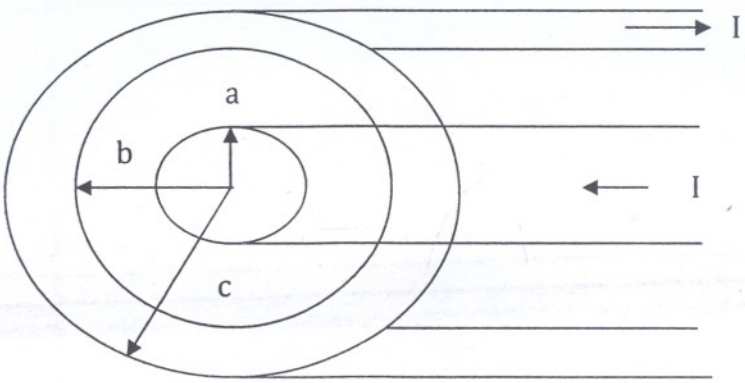
(For Lateral Entry Students)

Electromagnetic Field Theory.

Time: 3Hrs | Answer all questions | Max. Marks : 100

1.	a.	Using Coulomb's law derive the expression for the field due to an infinite line of charge.	08
	b.	Using Gauss's law find the electric field intensity due to an infinite sheet of charge with uniform charge distribution, ρ_s (C/m^2)	05
	c.	If electric field intensity $\vec{E} = y\boldsymbol{a_x} + x\boldsymbol{a_y} + 2\boldsymbol{a_z}$(V/m). Prove that the work done in carrying 2C from B(1,0,1) to A(0.8,0.6,1) along shorter arc of the circle $x^2 + y^2 = 1, z = 1$ and along the straight line path from B to A are same.	07

2.	a.	State the principle of conservation of charge and derive an expression for equation of continuity.	05
	b.	Discuss the boundary conditions at the interface between two dielectric of different permittivities.	07
	c.	Given the potential field $v = (50\ sin\theta/r^2)$ volts in free space using Poisson's equation determine the total charge stored inside the spherical shell $1 < r < 2$.	08

3.	a.	State Biot-Savart law. Apply this law to determine the magnetic flux density $\vec{B}$ on the axis of a circular loop, carrying a current I.	07
	b.	Using Ampere's circuital law determine the magnetic field intensity $\vec{H}$ in an infinitely long coaxial transmission line carrying a uniformly distributed total current I in the center conductor and –I in the outer conductor as shown in the figure. 	07
	c.	Given the vector magnetic potential $\vec{A} = 10\rho^{1.5}\boldsymbol{a_z}$ Wb/m in free space. Find i. Magnetic field intensity $\vec{H}$. ii. Current density $\vec{J}$.	06

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4.	a.	A charged particle of mass 2Kg and 1C starts at the origin with velocity $\vec{u} = 3\boldsymbol{a}_y$m/s and travels in a region of uniform magnetic field $\vec{B} = 10\boldsymbol{a}_z$ Wb/m^2. At t = 4s, determine, i. The velocity and acceleration of the particle. ii. The magnetic force on it. iii. Its kinetic energy and location.	10
	b.	Define self inductance and derive an expression for energy stored in a magnetic field.	10

5	a.	Starting from Maxwell's equations, derive the equation for a uniform plane wave travelling in free space.	08
	b.	Describe and derive an expression for depth of penetration.	04
	c.	State and prove Poynting's theorem.	08