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PES UNIVERSITY

PES University, Bangalore

(Established under Karnataka Act No. 16 of 2013)

UE14EC205

END SEMESTER ASSESSMENT (ESA-SUMMER) B.TECH III SEMESTER- JULY 2016

UE14EC205- ELECTROMAGNETIC FIELD THEORY

Time: 3 Hrs | Answer All Questions | Max Marks: 100

1.	a)	A vector field is given by the expression $\boldsymbol{F} = \frac{1}{r}\boldsymbol{a}_r$ in the spherical co-ordinates. Determine in Cartesian form at a point x=1,y=1 and z=1.	4m
	b)	Obtain an expression for electric field intensity due to an infinite line charge along z=axis having a uniform charge density ρ_L C/m.	7m
	c)	State and explain Coulomb's law in vector form. Mention the units for each term involved.	5m
	d)	The electric flux density is given as $\boldsymbol{D} = \frac{r}{4}\boldsymbol{a}_r$nC/m^2 in free space. Calculate (i) the electric field intensity of a sphere at r=0.25m (ii)total charge within a sphere of r=0.25m (iii) total flux leaving the sphere.	4m
2.	a)	Derive Continuity equation and define relaxation time.	5m
	b)	Derive the boundary conditions at the interface between two dielectrics of different permittivities.	6m
	c)	Find the capacitance of a capacitor consisting of 2 parallel plates of 30cmx30cm surface area, separated by 5mm in air. What is the total energy stored in the capacitor when charged to a potential difference of 500V?	4m
	d)	Given the potential field $V = \frac{50Sin\theta}{r^2}$ V in free space, determine whether V satisfies Laplace's equation.	5m
3.	a)	State Biot-Savarts Law and derive an expression to determine field due to straight current – carrying filamentary conductor of finite length AB.	6m
	b)	Given a field $\boldsymbol{H} = \rho^2 sin^2\phi\boldsymbol{a}_\rho + \rho^2 cos^2\phi\boldsymbol{a}_\phi + 2z^2\boldsymbol{a}_z$ A/m. Evaluate both sides of Stokes theorem for the path formed by the intersection of the cylinder ρ=2 and plane z=1 and for the surface defined by$\rho = 2,\ 1 \le z \le 3\ and\ z = 3, 0 \le \rho \le 2$.	8m
	c)	If $\boldsymbol{A} = 10\rho^{1.5}\boldsymbol{a}_z$Wb/m in free space, find (i) **H** (ii) **J**and (iii) Show that $\oint \boldsymbol{H}.dl = I$ for a circular path with $\rho = 1$.	6m
4.	a)	Derive an expression for force due to a moving charged particle in electric field and magnetic field.	4m
	b)	Derive the magnetic boundary conditions at the interface between two different magnetic materials.	6m
	c)	List generalized form of Maxwell's Equations in differential form for time varying fields.	4m
	d)	In free space $\boldsymbol{E} = 20\cos(\omega t - 50x)\boldsymbol{a}_y$V/m. Calculate the displacement current density $\mathbf{J_d}$ and Magnetic field intensity **H**.	6m
5.	a)	A uniform plane wave propagating in a medium has $\boldsymbol{E} = 2e^{-\alpha z}\sin(10^8 t - \beta z)\boldsymbol{a}_y$V/m. If the medium is characterized by $\varepsilon_r = 1\ ; \mu_r = 20\ and\ \sigma = 3S/m$,find $\alpha, \beta\ and\ \boldsymbol{H}$.	6m
	b)	Prove and explain Poynting Theorem using Maxwell's equations.	6m
	c)	Define Skin depth and obtain its relation with attenuation constant. Also define Skin effect.	4m
	d)	A plane wave travelling in air is normally incident on a block of paraffin with $\varepsilon_r = 2.2$. Find the reflection co-efficient and transmission co-efficient.	4m