17EC36

Visvesvaraya Technological University, Belagavi

MODEL QUESTION PAPER

3rd Semester, B.E (CBCS 2017-18 Scheme) EC/TC

Course: 17EC36 - Engineering Electromagnetics, *Set no.1*

		MODULE – 1	
1.	a.	State and explain coulomb's law of force between two point charges in vector form. Also derive an expression for totalForce due to n number of point charges.	8
	b.	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 a charge at A and also find Electric Field Intensity.	7
	c.	Let $\vec{D} = 5r^2\vec{a}_r$ mc/m^{2}for r≤0.08m and $\vec{D} = \frac{0.205}{r^2}\vec{a}_r$ µc/m^2 for r >0.08m. Find ρ_v for i)r = 0.06m ii) r = 0.1m	5
		OR	
2.	a.	Derive an expression for Electric field intensity due to infinite line charge.	8
	b.	Define Electric Field Intensity and Electric Flux Density and also establish the relationship between them.	6
	c.	Calculate the divergence of vector D at the points specified using Cartesian and cylindrical coordinates: 1. $\vec{D} = \frac{1}{z^2}[10xyz.a_x + 5x^2z.a_y + (2z^3 - 5x^2y)a_z]$ c/m^2 at point P(2,3,5) 2. $\vec{D} = 5z^2.a_r + 10rz.a_z$ at p(3, 45^o,5)	6
		MODULE – 2	
3.	a.	State and Prove Gauss's Law.	6
	b.	What is Convection Current density ? Derive relationship between J and ρ_v . Also obtain Continuity of Current equation.	8
	c.	Given the current density J=10r2a$_r$-4rcos^{2}Φa$_\Phi$ mA/m^2: a)find the current density at P(r=3 ,Φ=300, Z=2 b)determine the total current flowing outward through the circular band r=3 ,0<Φ<2π , 2<Z <2.8	6
		OR	
4.	a.	Derive an expression for energy expended in moving a point charge in an electric field.	5
	b.	Given D=30e^{-r}a$_r$-2za$_z$ C/m^2,verify Divergence theorem for the volume enclosed by r=2 and z=5.	10

	c.	Calculate the work done in moving a 4C charge from B(1,0,0) to A (0,2,0) along the path y=2-2x, z=0 in the field E: i)$5a_x$V/m ii)$5xa_x$ V/m	5
MODULE – 3			
5.	a.	Using Gauss Law derive Poisson's and Laplace equation. Represent Laplacian in Cartesian, Cylindrical and Spherical co-ordinates.	7
	b.	Using laplace's equation, find capacitance per unit length of two concentric sphere with inner radius 'a'm and outer radius 'b'm with boundary conditions $V=V_0$ at r=a and V=0 at r=b,b>a.	10
	c.	Determine whether or not the following potential satisfy the Laplace's equation. $V=2x^2-4y^2+z^2$	3
OR			
6.	a.	State and prove Stroke's theorem.	
	b.	Derive an expression for magnetic field intensity due to straight conductor of finite length.	7
	c.	A circuit carrying a direct current of 5A form a regular hexagon inscribed in a circle of radius 1m. Calculate the magnetic flux density at the centre of current hexagon. Assume medium to be free space.	6
MODULE – 4			
7.	a.	Briefly explain force between differential current elements.	8 Marks
	b.	A conductor 4m long lies along the y axis with a current of 10 amps in the a_y direction.Find the force on the conductor if the field is B=0.005a Tesla.	5
	c.	Discuss the boundary conditions at the interface between two media of different permeabilities.	7
OR			
8.	a.	Obtain an expression for Lorentz force equation.	5
	b.	Define Magnetization and Magnetic susceptibility.Derive relationship between Magnetic susceptibility and relative permeability.	7
	c.	Two differential current elements $I_1\Delta L_1=3x10^{-6}a_y$ A-m at A(1,0,0) and $I_2\Delta L_2=3x10^{-6}(-0.5a_x+0.4a_y+0.3a_z)$A-m at B(2,2,2,) are located in free space.Find the vector force exerted on i) $I_2\Delta L_2$ by $I_1\Delta L_1$ ii) $I_1\Delta L_1$by $I_2\Delta L_2$	8
MODULE – 5			
9.	a.	Derive an expression for displacement current density using Ampere's circuital Law.	7 Marks
	b.	State and Explain Poynting's theorem.	8 Marks
	c.	Within a certain region, $\varepsilon = 10^{-11}$ F/m and $\mu = 10{-}5$ H/m. If, $B_x = 2\times10^{-4}\cos 10^5 t \sin 10^{-3}$ y T, use $\nabla\times\mathbf{H} = \varepsilon\frac{\partial E}{\partial t}$to find **E**.	5 Marks
OR			
10.	a.	List Maxwell's equation in point and integral form.	4 Marks
	b.	For an Electromagnetic wave propagating in free space prove that $\frac{E}{H}=\eta$.	10 Marks
	c.	A 160 M Hz plane wave penetrates through aluminium of conductivity 10^5 ℧/m, $\varepsilon_r=\mu_r=1$. Calculate the skin depth and also depth at which the wave amplitude decreases to 13.5% of its initial value.	06 Marks