Register Number:……..

KUMARAGURU
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B.E. DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Third Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

U18EET3002: Electromagnetic Fields

COURSE OUTCOMES

CO1: Apply vector calculus in understanding electromagnetic theory and recognize different co-ordinate systems to describe various geometries as a function of space and time.

CO2: Understand the fundamental laws governing electric and magnetic fields and determine the force exerted on charged particles and current elements.

CO3: Apply the basic laws of electromagnetism to evaluate different physical quantities and energy storage devices, in a variety of simple configurations.

CO4: Describe the significance of Maxwell's Equations in electromagnetism and interpret them both in point and integral form.

CO5: Examine the phenomena of electromagnetic wave propagation in different media and realize simple electromagnetic concepts using software tools.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

1.	List the formula to convert a point in spherical coordinate system into Cartesian coordinate system.	CO1	[K_2]
2.	State Divergence theorem.	CO1	[K_2]
3.	Define Coulomb's Law.	CO2	[K_2]
4.	Mention the formula for Electric Dipole.	CO2	[K_2]
5.	Enumerate the Ohm's law in point form.	CO3	[K_3]
6.	Give the boundary conditions of perfect dielectric materials.	CO3	[K_3]
7.	Explain Biot-savart law for magnetic field.	CO4	[K_2]
8.	Analyze the formula for magnetic field due to infinite and finite current filament.	CO4	[K_2]
9.	Describe Lorentz force equation.	CO5	[K_3]
10.	Compare the inductance due to solenoid and toroidal core.	CO5	[K_3]

Answer any FIVE Questions:- PART B (5 x 16 = 80 Marks) (Answer not more than 400 words)					
11.	a)	If a scalar $V = \frac{60\sin\theta}{r^2}$, find V and E= -grad(V) at P($3,60^0,25^0$).	8	CO1	[K_2]
	b)	Given that a vector $D = \frac{5r^2}{4} a_r C/m^2$, evaluate both the sides of divergence theorem for a surface enclosed by r=4cm and θ=π/4.	8	CO1	[K_2]
12.	a)	The potential distribution in an electric field is given by $V = 8x + 6y^2 - 3z^{\frac{1}{2}}$ volts. Determine the expression for electric field E. Find the magnitude and direction at(2,1,2)m.	8	CO2	[K_2]
	b)	Derive the expression for the potential and electric field at any point P due to an electric dipole.	8	CO2	[K_2]
13.	a)	Analyze the magnetic field intensity at the origin due to a current element $IdL = 3\pi(u_x + 2u_y + 3u_z)$micro.Amp.metre at the point P(3,4,5) in free space.	8	CO3	[K_3]
	b)	Enumerate the magnetic field intensity at the center of a square current carrying loop.	8	CO3	[K_3]
14.	a)	A solenoid of 25cm long and 1cm mean diameter of a coil turns uniformly distributed windings of 2000 turns. The solenoid is placed in uniform field of 2 tesla flux density. A current of 5A is passed through the winding. Determine the (1). Maximum force on the solenoid (2). Maximum torque on the solenoid and (3). Compute the magnetic moment on the solenoid.	8	CO4	[K_2]
	b)	A coil has a self-inductance of 1 henry and a resistance of 4 ohms. If it is connected to a 40 volt DC supply, estimate the energy stored in the magnetic field when the current has attained its final steady value.	8	CO4	[K_2]
15.	a)	A uniform plane wave is traveling at a velocity of $2.5x10^5$ m/sec having wavelength λ=0.25mm in a good conductor. Find the frequency of wave and the	8	CO5	[K_3]

		conductivity of a medium.			
	b)	Evaluate the attenuation constant and phase constant for a uniform plane wave with frequency of 10 GHz in a medium for which $\mu=\mu_0$, $\varepsilon_r = 2.3$ and $\sigma=2.56x10^{-4}$ mho/m.	8	CO5	[K_3]
16.	a)	Derive the magnetic boundary conditions between two magnetic materials.	8	CO4	[K_2]
	b)	Describe Poynting theorem and enumerate the expression for Poynting vector.	8	CO5	[K_3]

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