Register Number:……..

KUMARAGURU
college of technology
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B.E. DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

Third Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

U18EET3002: Electromagnetic Fields

COURSE OUTCOMES

CO 1 Apply vector calculus in understanding electromagnetic theory and recognize different co-ordinate systems to describe various geometries as a function of space and time.
CO 2 Understand the fundamental laws governing electric and magnetic fields and determine the force exerted on charged particles and current elements.
CO 3 Apply the basic laws of electromagnetism to evaluate different physical quantities and energy storage devices, in a variety of simple configurations.
CO 4 Describe the significance of Maxwell's Equations in electromagnetism and interpret them both in point and integral form.
CO 5 Examine the phenomena of electromagnetic wave propagation in different media and realize simple electromagnetic concepts using software tools.

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

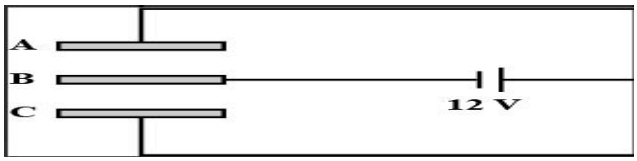
Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	Mention any two major sources of Electromagnetic Fields.	CO1	[K1]
2.	State coulomb's law and its limitation.	CO2	[K1]
3.	What is an equipotential surface?	CO3	[K1]
4.	State stoke's theorem.	CO1	[K1]
5.	Define Lorentz law of force.	CO2	[K1]
6.	Draw the magnetic flux pattern around a long straight current carrying conductor.	CO3	[K1]
7.	Write the expression for ohm's law in point form.	CO4	[K1]
8.	Write an continuity equation of current.	CO4	[K1]
9.	Distinguish between transformer emf and motional emf.	CO5	[K1]
10.	Mention any two practical examples of Electromagnetic wave propagating in free space.	CO5	[K1]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.	a)	Prove divergence theorem, for the field $\overline{D} = 2xy\,\overline{a_x} + x^2\,\overline{a_y}$ and the rectangular	(14)	CO1	[K3]

parallelepiped formed by the planes x=0, x=1; y=0, y=2; z=0, z=3;

	b)	Find Curl of the given vector field $F = (x^2 - y)i + 4zj + x^2k$.	(2)	CO1	[K2]
12.	a)	Find the force on a 40 μC charge at (0, 0, 4) m if four like charges of 10 μC are located in free space at (-3, 0, 0), (3, 0, 0), (0,-3,0), (0,3,0) and in a Cartesian coordinate system. All distances are in meters.	(10)	CO2	[K3]
	b)	"Gauss's Law can be used to solve complex electrostatic problems by simplifying the evaluation of electric field". Justify this statement by applying Gauss's Law for the above case of infinite sheet of charge.	(6)	CO2	[K2]
13.	(a)	With suitable diagram, Derive the magnetostatic boundary conditions of the normal and tangential components of magnetic field at the interface of two different magnetic media with different permeability's.	(10)	CO3	[K1]
	(b)	Three plates A, B and C each of area $50cm^2$ have separation 3 mm between A and B and 3 mm between B and C. Determine the energy stored when the plates are fully charged. 	(6)	CO3	[K3]
14.	(a)	State Biot-savart law and use it to obtain the magnetic field strength due to an infinitely thin long wire carrying current at a distance R. Also, find the magnetic flux density.	(10)	CO3	[K2]
	(b)	Given that $V = 10 \sin\theta \cos\varphi / r^2$. Find the Electric flux Density at $(2, \pi/2, 0)$.	(6)	CO3	[K3]
15.	a)	With necessary explanation, write the Maxwell's equation in differential and integral forms.	(8)	CO4	[K2]
	b)	Two wires carrying current in the same direction of 5000 A and 10000 A are placed with their axes 5 cm apart in free space. Calculate the force between them in N/m length. Also mention the type of force.	(8)	CO4	[K2]
16.	a)	Develop a mathematical equation for an electromagnetic wave propagating in free space.	(8)	CO5	[K2]
	b)	Define Poynting vector. With suitable equations prove Poynting theorem.	(8)	CO5	[K2]

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