Code No: R1921024 **R19** SET - 1

II B. Tech I Semester Regular Examinations, March - 2021
ELECTRO MAGNETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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1	a)	If coulomb's force , $F=(2a_x+a_y+a_z)N$, is acting on a charge of 10 C, find the electric field intensity , its magnitude and direction	[8M]
	b)	Derive the E-field due to infinite charge sheet?	[7M]
		Or	
2	a)	Define electric field in terms of point charge and also in terms of potential, mention salient features of electric field intensity	[8M]
	b)	Semi infinite conducting planes $\phi = 0$ and $\phi = \Pi/6$ are separated by an infinitesimal insulating gap. If $V (\phi = 0) = 0$ and $V(\phi = \Pi/6) = 100$ V, calculate V and E in the region between the planes.	[7M]
3	a)	Discuss about behavior of conductors in an electric field.	[8M]
	b)	Derive the expression for energy density in electrostatic field	[7M]
		Or	
4	a)	Derive the boundary conditions between the perfect dielectrics of permittivities $\varepsilon_1$and ε_2.	[8M]
	b)	Two extensive homogeneous dielectrics meet on plane z=0.For z>0, ε_{r1} =4 and for z<0 ε_{r2} =3.A uniform electric field $E_1 = (5a_x - 2a_y + 3a_z)$ KV/m exists for $Z \geq 0$. Find (i) $_{E2}$ for $Z \leq 0$ (ii) The angles E_1 and E_2 make with the interface.	[7M]
5	a)	Determine the force between two linear parallel conductors carrying currents in opposite directions.	[8M]
	b)	Obtain the expression for torque on a current loop placed in a magnetic field.	[7M]
		Or	
6	a)	Determine the magnetic field intensity, H at the center of a square current Element. The length of each side is 2 m and the current, I=1.0 Amp.	[8M]
	b)	Derive the Maxwell's equation in point form and integral form using Ampere's Circuit law?	[7M]
7	a)	Derive an expression for mutual inductance using Newmann's formulae.	[8M]
	b)	A rectangular coil is composed of 150 turns of a filamentary conductor. Find the mutual inductance in free space between this coil and an infinite straight filament on the z axis if the four corners of the coil are located at (i) (0,1,0), (0,3,0), (0,3,1), and (0,1,1) (ii) (1,1,0), (1,3,0), (1,3,1), and (1,1,1)	[7M]
		Or	
8	a)	Derive the expression for energy stored in a magnetic field?	[8M]
	b)	Current in a coil is increased from zero to 15 amps at a uniform rate in 6 seconds. It is found that this coil develops self induced emf of 150 volts whereas an emf of 25 volt is produced in a neighboring coil. Compute self-inductance of the first coil and the mutual inductance between the two coils.	[7M]
9	a)	State and explain Maxwell's equations in differential and integral form?	[8M]
	b)	Write short notes on statically induced e.m.f and dynamically induced e.m.f?	[7M]
		Or	
10	a)	State and explain faraday's laws of electromagnetic induction?	[8M]
	b)	Explain (i) Conduction Current. (ii) Displacement current.	[7M]

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Code No: R1921024 **R19** SET - 2

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Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
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1	a)	Derive an expression for the Electric field intensity due to a finite length line charge along the Z-axis at an arbitrary point Q(x,y,z)	[8M]
	b)	An infinite length of uniform line charge has ρ_L= 10 pC/m and it lies along the Z-axis. Determine electric field E at (4,3,3)	[7M]
		Or	
2	a)	Derive Poisson's and Laplace's equations from the fundamentals.	[8M]
	b)	Let a point charge Q_1 =25 nC be located at P_1 (4,-2, 7) and a charge Q_2 = 60 nC be at P_2(-3, 4,-2). If $\varepsilon = \varepsilon_0$, find **E** at P_3(1, 2, 3): At what point on the y axis is $E_x = 0$?	[7M]
3	a)	Explain polarization in dielectrics?	
	b)	A parallel plate capacitor has plate area 200 cm^2 and plate separation of 3 mm. The charge density is 1μC/m^2 and air is the dielectric. Find (i) the capacitance of the capacitor (ii) Voltage between the plates (iii) the force with which the plates attract each other	[8M]
		Or	[7M]
4	a)	An electric dipole located at the origin in free space has a moment **p** = $3\mathbf{a_x} - 2\mathbf{a_y} + \mathbf{a_z}$ nC.m. (i) Find V at P_A (2, 3, 4). (ii) Find V at $r = 2.5$, $\theta = 30°$, $\phi = 40°$	[8M]
	b)	Define electric dipole. Derive the expression for electric field due to electric dipole.	[7M]
5	a)	Sate and explain point form of ampere's circuital law?	[8M]
	b)	Determine H at P2 (0.4, 0.3, 0) in the field of an 8A filamentary current directed inward from infinity to the origin on the positive x- axis and then outward to infinity along the y-axis.	[7M]
		Or	
6	a)	State and explain biot-savart's law?	[8M]
	b)	Planes z=0 and z=4 carry current K= - $10a_x$ A/m and K=$10a_x$ A/m respectively. Determine H at (i) (1,1,1) and (ii) (0,-3,10).	[7M]
7	a)	Derive the expression for self inductance of a coaxial cable of inner radius 'a' and outer radius 'b'.	[8M]
	b)	Determine the inductance of a solenoid of 2500 turns wound uniformly over a length of 0.25m on a cylindrical paper tube, 4 cm in diameter and the medium is air	[7M]
		Or	
8	a)	Explain the concept of self and mutual inductances.	[8M]
	b)	Derive the expression for energy stored in a magnetic field?	[7M]

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9 a) Derive the Maxwell's four equations for time varying fields [8M]

b) In a material for which σ = 5.0 s/m and $\in r$ = 1, the electric field intensity is E = 250 Sin1010t (V/m). Find the conduction and displacement current densities and the frequency at which they have equal magnitudes. [7M]

Or

10 a) A parallel plate capacitor with plate area of 4 cm^2 and plate separation of 2mm has a voltage 400 Sin 10^3t volts applied to its plates. Calculate the displacement current, assuming $\varepsilon = 2\varepsilon_0$. [8M]

b) Explain the concept of displacement current and obtain an expression for the Displacement current density. [7M]

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Code No: R1921024 **R19** SET - 3

II B. Tech I Semester Regular Examinations, March - 2021
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Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
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1	a)	State Guass law. Explain any two applications of Guass law in detail.	[8M]
	b)	A circular ring of charge with radius 5m lied in z = 0 plane with centre at origin. If the line charge density is 10 nC/m. Find E at the point (0, 0, 6) m	[7M]
		Or	
2	a)	Prove that the electric field intensity is the negative gradient of potential.	[8M]
	b)	A square plate described by -2≤x≤2, -2≤y≤2, z=0 carries a charge 12|y| mC/m^2. Find the total charge on the plate and the electric field intensity at (0,0,10)	[7M]
3	a)	Derive an expression for capacitance of a parallel plate capacitor containing two dielectrics with the dielectric interface parallel to the conducting plates	[8M]
	b)	A homogeneous dielectric (ε_r =2.5) fills region 1 (x< 0) while region 2 (x> 0) is free space. (i)If $\mathbf{D}_1 = 12a_x - 10a_y + 4a_z$ nC/m^2, find D_2 and θ_2. (ii)If E_2 = 12V/m and θ_2 = 60°, find E_1 and θ_1.	[7M]
		Or	
4	a)	Derive the expression for capacitance of a spherical capacitor.	[8M]
	b)	Conducting spherical shells with radii a = 10 cm and b = 30 cm are maintained at a potential difference of 100 V such that V(r = b) = 0 and V(r = a) = 100 V. Determine V and E in the region between the shells. If ε_r = 2.5 in the region, determine the total charge induced on the shells and the capacitance of the capacitor.	[7M]
5	a)	Derive an expression for magnetic flux density at any point on the axis of a plane circular current loop.	[8M]
	b)	Two long parallel conductors carrying currents 100 A and 150 A respectively. If the conductors are separated by 20 mm. Find the force/meter length of each conductor, if the current flow is in opposite direction?	[7M]
		Or	
6	a)	Prove that the force on a closed filamentary circuit in a uniform magnetic field is zero.	[8M]
	b)	A conducting filamentary triangle joins A (3,1,1), B (5,4,2) and C (1,2,4). The segment AB carries a current of 0.2 A in the a_{AB} direction. In the presence of magnetic field $B = 0.2a_x - 0.1a_y + 0.3a_z$ T. (i) Find the force on segment BC (ii) Find the torque on the loop about an origin at A.	[7M]
7	a)	Derive the expressions for the self inductances of a toroid.	[8M]
	b)	A very long solenoid with 2 X 2 cm cross section has an iron core (μ_r = 1000) and 4000 turns/meter. If it carries a current of 500 mA, find (i) Its self-inductance per meter (ii) The energy per meter stored in its field.	[7M]
		Or	
8	a)	Derive the expression for energy stored and density in a magnetic field.	[8M]
	b)	Derive the expressions for the self inductances of a solenoid?	[7M]

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9 a) State and explain faraday's laws of electromagnetic induction? [8M]
b) Write down the Maxwell's equations for time-varying fields and explain? [7M]

Or

10 a) State maxwell's equation in integral form and also explain its significance? [8M]
b) In free space $E = 20\cos(\omega t - 50x)a_y\, V/m$. Find (i) J_d (ii) H (iii)ω [7M]

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Code No: R1921024 **R19** SET - 4

II B. Tech I Semester Regular Examinations, March - 2021
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Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
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1 a) Using Gauss law, derive the expression for electric field intensity due to an infinite length of line charge? [8M]

b) Four 5 nC positive charges are located in the z=0 plane at the corners of a square 6 cm on a side. A fifth 5 nC positive charge is located at a point 8 cm distance from the other charges. Calculate the magnitude of the total force on this fifth charge for ε=ε0. [7M]

Or

2 a) Explain electric potential and its properties [8M]

b) A charge of -0.3 μC is located at A(25, -30, 15) (in cm) and a second charge of 0.5 μ C is at B(-10, 8, 12) cm . Find E at (a) the origin (b) P(15,20, 50) cm. [7M]

3 a) State and derive the conditions at the boundary between conductor-dielectric interface. [8M]

b) A spherical capacitor with a = 1.5 cm, b= 4 cm has an inhomogeneous dielectric of ε= 10 ε_o/r. Calculate the capacitance of the capacitor. [7M]

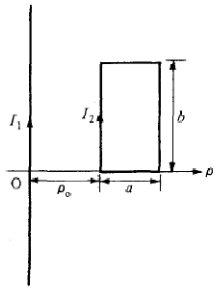
Or

4 a) Find the capacitance of two parallel plates 30cmX30cm separated by 6 mm in air. And also find the energy stored by the capacitor if it is charged to a potential difference of 600 volts [8M]

b) If a dielectric material of ε_r =4.0 is kept in an electric field E= $3.0a_x$ +$2.0a_y$ + a_z , V/m, find the polarization. [7M]

5 a) Derive an expression for force on a current element in a magnetic field. [8M]

b) A rectangular loop carrying current I_2 is placed parallel to an infinitely long filamentary wire carrying current I_1 as shown below. Show that the force experienced by the loop is given by $F = -\frac{\mu_0 I_1 I_2 b}{2\pi}[\frac{1}{\rho_0} - \frac{1}{\rho_0 + a}]\ a_\rho N$ [7M]



Or

6 a) State and explain ampere's circuital law? Using the above find H due to an infinitely long filamentary current I placed along the Z-axis? [8M]

b) Derive Ohm's law in point form and explain [7M]

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7	a)	Derive the expressions for the self inductances of a solenoid .	[8M]
	b)	A toroid with cross section of radius 2cm has a silicon steel core of mean length 28cm and an air gap of length 1mm. Assume the air-gap area is 10% greater than the adjacent core and finds the mmf required to establish an air-gap flux of1.5 m wb.	[7M]
		Or	
8	a)	Explain the concept self and mutual inductances	[8M]
	b)	Find the mutual inductance between two toroidal windings which are closely wound on iron core of relative permeability 900. The mean radius of the core is 5 cm and radius of its cross-section is 5cm. Each winding has also 800 turns.	[7M]
9	a)	Write Maxwell's equation for static fields. Explain how they are modified for time varying electric and magnetic fields	[8M]
	b)	State and explain faraday's laws of electromagnetic induction?	[7M]
		Or	
10	a)	State and explain Maxwell's fourth equation?	[8M]
	b)	Write short notes on statically induced e.m.f and dynamically induced e.m.f?	[7M]

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