QP Code: 18EC0412 **R18**

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QUESTION BANK (DESCRIPTIVE)

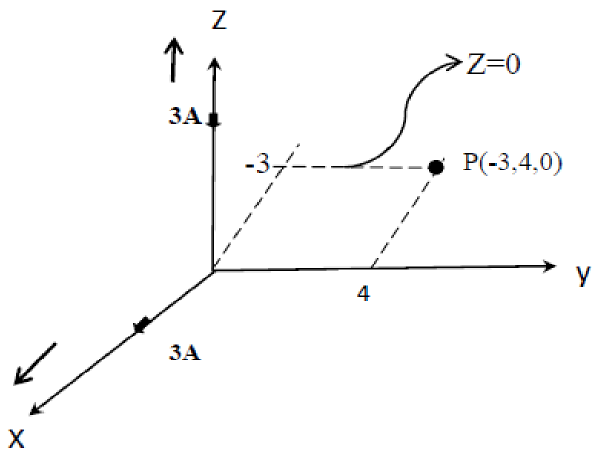
Subject with Code: Electromagnetic Theory and Transmission Line (18EC0412)

Course & Branch: B.Tech – ECE **Year &Sem:** III-B.Tech& I-Sem **Regulation:** R18

UNIT –I
ELECTROSTATIC FIELDS

1	**a**	Define Coulomb's law.	[L1][CO1]	**[2M]**
	b	Define Electric field intensity.	[L1][CO1&2]	**[2M]**
	c	Define Gauss's law.	[L1][CO1]	**[2M]**
	d	List various charge distributions.	[L1][CO1]	**[2M]**
	e	List Maxwell's equations for electrostatic fields.	[L1][CO1&2]	**[2M]**
2	**a**	Define Coulomb's law and derive the force F that exists between two unlike charges.	[L1][CO1&2]	**[5M]**
	b	Three Point Charges Q_1=1 mc, Q_2=2 mc and Q_3=-3 mc are respectively located at (0,0,4), (-2,6,1) and (3, -4, -8). Calculate the electric force and electric field on Q_1 due to Q_2 and Q_3.	[L3][CO1&2]	**[5M]**
3	**a**	Find the electric field at a point P located with a distance of r from an infinite sheet with uniform surface charge density of ρ_s C/m^2.	[L1][CO1&2]	**[6M]**
	b	A Point Charge of 20ηc is Located at the Origin. Determine the Magnitude and Direction of the electric field intensity at the Point (1,3, -4).	[L3][CO1&2]	**[4M]**
4	**a**	Define Gauss's Law. Apply Gauss's law to evaluate Electric Flux density for a uniformly charged Sphere.	[L1][CO1,2&3]	**[7M]**
	b	What are the advantages and applications of Gauss law?	[L1][CO1&2]	**[3M]**
5	**a**	Apply Gauss Law to evaluate the electric flux density at a point P due to the point charge located at the origin.	[L3][CO1,2&3]	**[5M]**
	b	A Point Charge 100 pC is located at (4,1, -3) while the x-axis carries charge 2ηC/m. If the Plane z=3 is also carries charge 5ηC/$m^{2,}$ find E at (1,1,1).	[L3][CO1&2]	**[5M]**
6	**a**	Evaluate the two Maxwell's equations for electrostatic fields and state them.	[L5][CO1,2&3]	**[8M]**
	b	List Maxwell equations for electrostatic fields in integral form.	[L1][CO1,2&3]	**[2M]**
7	**a**	Classify Maxwell equations for electrostatic fields in both differential and integral form.	[L4][CO1,2&3]	**[5M]**
	b	Two point charges, Q_A = +8 μC and Q_B = -5 μC, are separated by a distance r = 10 cm. What is the magnitude of the electric force between them?	[L3][CO1&2]	**[5M]**
8	**a**	Define the Electric Flux Density. Determine the Electric flux density at a point P due to infinite line of uniform Charge density ρ_L C/m.	[L1][CO1&2]	**[7M]**
	b	Point Charges Q_1=4μc, Q_2=-5μc and Q_3=2 μc are located at (0,0,1).(-6,8,0) and (0,4,-3) respectively find D at the origin.	[L3][CO1&2]	**[3M]**
9	**a**	Define Eclectic Potential. Find the electric potential for a point charge is located at origin.	[L1][CO1&2]	**[7M]**
	b	Determine the Relationship between E and V.	[L5][CO1&2]	**[3M]**
10		Explain the following with expression. A) Coloumb's law. b) Electric field intensity. c) Gauss law.	[L2][CO1,2&3]	**[10M]**
11	**a**	Deduce the electric field at a distance r due to an infinitely long straight line of charge with a uniform charge density of ρ_L *C/m*.	[L4] [CO1&2]	**[7M]**
	b	A charge of 5×10^{-8} C is distributed uniformly on the surface of a sphere of radius 1 cm. It is sphere of radius 6 cm. Calculate the electric flux.	[L3] [CO1&2]	**[3M]**

UNIT –II
MAGNETOSTATIC FIELDS

1	**a**	Define Biot-Savart's law.	[L1][CO1&2]	**[2M]**
	b	Define Magnetic flux density.	[L1][CO1&2]	**[2M]**
	c	Define Ampere's Circuit law.	[L1][CO1,2&3]	**[2M]**
	d	Define Magnetic Flux.	[L1][CO2]	**[2M]**
	e	What is meant by Magnetostatic fields?	[L1][CO2]	**[2M]**
2	**a**	Explain Biot-Savart's Law.	[L2][CO1&2]	**[5M]**
	b	A Positive Y-axis (Semi Infinite Line with respect to the Origin) Carries a Filamentary Current of 2 A in the -ay Direction. Assume it is part of a large circuit. Find H at (i) A (2,3,0). (ii)B (3,12, -4).	[L3][CO1&2]	**[5M]**
3	**a**	Explain Ampere's Circuit Law.	[L2][CO1,2&3]	**[5M]**
	b	Determine the Magnetic Field Intensity due to a infinite sheet current.	[L5][CO1&2]	**[5M]**
4	**a**	Determine Maxwell's Equations for Magnetostatic Field.	[L5][CO1,2&3]	**[5M]**
	b	Determine the Magnetic Flux Density due to Infinite Sheet of Current.	[L5][CO1&2]	**[5M]**
5	**a**	Discuss about Magnetic Vector and Scalar Potentials.	[L6][CO1&2]	**[5M]**
	b	Given Magnetic Vector Potential A= $-\rho/4\ a_z$ wb/m, Calculate the total magnetic flux crossing the $\Phi=\pi/2, 1\leq\rho\leq 2$m, $0\leq z\leq 5$m.	[L3][CO1&2]	**[5M]**
6	**a**	Explain about magnetic scalar and vector potential for Magneto-statics.	[L2][CO1&2]	**[5M]**
	b	An infinitely filamentary wire carries a current of 2A in the +z direction. Calculate B at (-3,4,7).	[L3][CO1&2]	**[5M]**
7	**a**	Determine the Magnetic Field Density due to Infinite line Current by applying Ampere's Circuit law.	[L5][CO1&2]	**[6M]**
	b	List differential and integral form of Maxwell's equation for static EM filed.	[L1][CO2&3]	**[4M]**
8	**a**	Find the Magnetic field Intensity Due to a Straight current carrying filamentary conductor of finite length.	[L1][CO1&2]	**[5M]**
	b	Find H at (-3,4,0) due to the Current Filament Shown in the Figure. 	[L1][CO1,2&3]	**[5M]**
9		Find **H** for a straight current carrying conductor using Biot Savart's law and Ampere's Circuit law.	[L1][CO1&2]	**[10M]**
10		Explain any two applications of Ampere's Circuit law.	[L2][CO1,2&3]	**[10M]**
11	**a**	A Current Distribution gives rise to the vector potential $A= X^2Ya_x+Y^2Xa_y+XYZa_z$ web/m. Calculate B.	[L3] [CO1&2]	**[5M]**
	b	Explain about Non-Existence of Magnetic Mono pole.	[L2] [CO2]	**[5M]**

UNIT –III
MAXWELL'S EQUATIONS (TIME VARYING FIELDS)

1	**a**	Define Faraday's law.	[L1][CO2&3]	**[2M]**
	b	Define In consistency of Ampere's law.	[L1][CO2&3]	**[2M]**
	c	Define Motional EMF.	[L1][CO2&3]	**[2M]**
	d	Define Transformer EMF.	[L1][CO2&3]	**[2M]**
	e	Define Displacement current.	[L1][CO2&3]	**[2M]**
2	**a**	Explain Faraday's laws in Electromagnetic induction.	[L2][CO1&2]	**[6M]**
	b	Prove that the Displacement Current Density $J_D = \frac{\partial D}{\partial t}$.	[L5][CO1,2&3]	**[4M]**
3	**a**	Determine the Transformer EMF for the time varying fields.	[L5][CO1,2&3]	**[7M]**
	b	Define Faraday's law?	[L1][CO1,2&3]	**[3M]**
4	**a**	Explain Faraday's law of electromagnetic induction and derive the Expression for Induced EMF.	[L2][CO1,2&3]	**[5M]**
	b	Explain the motional EMF and derive the expression for the maxwell equation.	[L2][CO1,2&3]	**[5M]**
5	**a**	Determine the Expressions for inconsistency of Ampere's law.	[L5][CO1,2&3]	**[8M]**
	b	Why ampere's Law is In-consistent.	[L1][CO2&3]	**[2M]**
6	**a**	Discuss Maxwell's equation in both differential and integral in final form	[L6][CO1,2&3]	**[6M]**
	b	An antenna radiates in free space and H= 50 cos(1000t-5y) A/m. Calculate ω and β.	[L3][CO2&3]	**[4M]**
7	**a**	In free space, E= 20 cos(ωt-50x) ay V/m. Calculate Jd, **H**.	[L3][CO2&3]	**[6M]**
	b	Translate the Maxwell's equations into word statement.	[L2][CO1,2&3]	**[4M]**
8	**a**	Prove that one of the Maxwell's equation is $\nabla\times E = -dB/dt$	[L5][CO1,2&3]	**[6M]**
	b	In free space, H= 10 sin(ωt-100x) ay A/m. Calculate Jd, **E.**	[L3][CO2&3]	**[4M]**
9	**a**	Prove that one of the Maxwell's equation is $\nabla\times H = J_d + J$.	[L5][CO1,2&3]	**[7M]**
	b	An antenna radiates in free space and E= 80 cos(500t-8z) ax V/m. Calculate ω and β.	[L3][CO2&3]	**[3M]**
10		Explain and determine the EMF for the Followings. i) Motional EMF. (ii)Transformer EMF.	[L2][CO2&3]	**[10M]**
11		Explain the following i) Faraday's law ii) Inconsistency of Ampere's law	[L2] [CO2&3]	**[10M]**

UNIT –IV
EM WAVE PROPAGATION

1	**a**	Define Poynting theorem.	[L1][CO3&4]	**[2M]**
	b	Define Polarization.	[L1][CO3&4]	**[2M]**
	c	Define Poynting vector.	[L1][CO3&4]	**[2M]**
	d	Define Propagation constant.	[L1][CO3&4]	**[2M]**
	e	List wave equation for E and H in free space?	[L1][CO3&4]	**[2M]**
2		Discuss about pointing theorem and Poynting vector.	[L6][CO4&5]	**[10M]**
3	**a**	Explain and derive the characteristics of wave propagation in free space.	[L2][CO3,4&5]	**[6M]**
	b	Given that E=$40\cos(10^8t-3x)\,a_y v/m$, Determine the direction of wave propagation, velocity of the wave, wave length.	[L3][CO4&5]	**[4M]**
4		Electric field in free space is given by E=$50\cos(10^8t+\beta x)\,a_y v/m$ a). Find the direction of wave propagation. b). Calculate β and the time it takes to travel a distance of λ. c). Sketch the wave at t=0,T/4 and T/2.	[L3][CO4&5]	**[10M]**
5	**a**	Determine the expression for intrinsic impendence and propagation constant in a good conductor.	[L5][CO4&5]	**[6M]**
	b	In a Nonmagnetic medium E=$4\sin(2\pi X10^7t-0.8x)\,a_z v/m$, findε_r,η.	[L3][CO4&5]	**[4M]**
6	**a**	Evaluate the wave characteristics of a uniform plane wave in free space.	[L5][CO4&5]	**[6M]**
	b	In free space ($z\le 0$), a plane wave with H = 10 cos (10^8t - βz) $\hat{a}_x$ mA/m is incident normally on a lossless medium (ε=2ε_0,μ=8μ_0) in region z > 0. Determine the reflected wave and the transmitted wave.	[L3] [CO4&5]	**[4M]**
7	**a**	Evaluate the wave equation in lossy dielectric medium for sinusoidal time variations.	[L5][CO3,4&5]	**[5M]**
	b	In lossless medium $\eta=40\pi, \mu_r=1$, H=2 cos (ωt - z) $\hat{a}_x$+5sin (ωt - z) $\hat{a}_y$.Find ε_r, ω, E for the medium.	[L3][CO4&5]	**[5M]**
8	**a**	Evaluate the expressions for attenuation constant and phase shift constant of lossy dielectric medium.	[L5][CO4&5]	**[5M]**
	b	A plane wave propagating through medium with $\varepsilon_r=8, \mu_r=2$has the electric field intensity E = 0.5 e^{-jz3}sin (10^8t- βz) $\hat{a}_x$ V/m. Determine wave velocity, wave impedance and magnetic field intensity.	[L3][CO4&5]	**[5M]**
9		Evaluate the expressions for reflection coefficient and transmission coefficient by a normal incident wave for a dielectric medium.	[L5][CO4&5]	**[10M]**
10		Explain the followings with an expression. i) Linear polarization ii) Circular polarization iii) Elliptical polarization	[L2][CO4&5]	**[10M]**
11		In a medium, E = 14$e^{-0.05x}$sin (2 X 10^8 t - 2x) $\hat{a}_z$ V/m Determine the followings: i) The propagation constant ii) The wavelength iii) The speed of the wave iv) Sketch the wave at t=0,T/4 & T/2	[L3] [CO4&5]	**[10M]**

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UNIT –V
TRANSMISSION LINES

1	**a**	What are the secondary constants of a line?	[L1][CO6]	**[2M]**
	b	What is characteristic impedance?	[L1][CO6]	**[2M]**
	c	Define transmission line.	[L1][CO6]	**[2M]**
	d	What is the relationship between characteristic impedance and propagation constant?	[L1][CO6]	**[2M]**
	e	What are the primary constants of a transmissionline?	[L1][CO6]	**[2M]**
2	**a**	Evaluate the equation for voltage and current at any point in a transmission line.	[L5][CO6]	**[6M]**
	b	Discuss about Transmission line Parameters.	[L6][CO6]	**[4M]**
3	**a**	Evaluate the equation for Characteristic Impedance of a Transmission line.	[L5][CO6]	**[5M]**
	b	A telephone line has the following parameters: R =30 Ω/km, G =0 L = 100mH/km, C = 20μF/m. At 1kHz, calculate the characteristic impedance, propagation constant and velocity of the signal.	[L3][CO6]	**[5M]**
4	**a**	Explain about Microstrip Transmission Line.	[L2][CO6]	**[5M]**
	b	A distortion less line has Z_0=60 Ω Attenuation constant = 20 mNp/m and u=0.6c (c is velocity of light) Find the primary parameters of the transmission line(R L C G and λ) at 100MHz.	[L3][CO6]	**[5M]**
5	**a**	Evaluate the equation for Input Impedance of the transmission line.	[L5][CO6]	**[5M]**
	b	A Certain transmission line 2m long operating at $\omega = 10^6$ rad/s has α=8bd/m, β=1 rad/m, and Z_0=60+j40Ω. If the line is connected to a source of 10angle(0^0) V, Z_g = 40Ω and terminated by a load of 20+j50Ω, determine the input impedance.	[L3][CO6]	**[5M]**
6	**a**	Relate SWR and reflection coefficient.	[L2][CO6]	**[5M]**
	b	Explain the applications of transmission lines.	[L2] [CO6]	**[5M]**
7	**a**	Discuss about Transients on Transmission Lines.	[L6][CO6]	**[5M]**
	b	A low loss transmission line of 100 Ω characteristics impedance is connected to a load of 200 Ω. Calculate the voltage reflection coefficient and the standing wave ratio.	[L3][CO6]	**[5M]**
8		A 50Ω lossless transmission line is terminated on a load impedance of ZL =(25 + j 50)Ω. Use the smith chart to find. i) Voltage reflection coefficient. ii) VSWR. iii) input impedance of the line, given that the line is 3.3λ long.	[L3][CO6]	**[10M]**
9	**a**	Explain about the smith chart for finding the SWR and Reflection co-efficient.	[L2][CO6]	**[7M]**
	b	List out the applications of smith chart?	[L1][CO6]	**[3M]**
10		A 30 m long lossless transmission line with Z_0 = 50Ω operating at 2 MHz is terminated with a load Z_L = 60 + j 40Ω. If u = 0.6 C on the line, find the reflection coefficient, the standing wave ratio S and the input impedance.	[L3][CO6]	**[10M]**
11		A lossless transmission line with Z_0=50 Ω is 30m long and operates at 3MHz. The line is terminated with a load ZL= 70 +j50Ω, If u=0.6c on the line. Compute reflection coefficient, standing wave ratio and Input impedance, load impedance, SWR and complex reflection coefficient (i) without using smith chart (ii) Using smith chart	[L3][CO6]	**[10M]**

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