Course Code: 20EC0415 **R20**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY :: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code: EMTL (20EC0415) **Course & Branch**: B.Tech. – ECE

Year &Sem: III-B.Tech & I-Sem **Regulation:** R20

UNIT –I
ELECTROSTATIC FIELDS

1	**a)**	Define Coulomb's law and derive the force **F** that exists between two unlike charges.	[L3][CO1]	**[06M]**
	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]	**[06M]**
2	**a)**	Define Electric field intensity and write the properties electric flux	[L1][CO1]	**[06M]**
	b)	A Point charge of 20nC is located at the origin. Determine the magnitude and direction of the electric field intensity at point (1,3,-4).	[L3][CO2]	**[06M]**
3		Explain the following types of charge distributions. i) Line charge distribution. ii) Surface charge distribution. iii) Volume charge distribution.	[L2][CO2]	**[12M]**
4	**a)**	Deduce the electric field Intensity at a distance p due to an infinitely long straight line.	[L4] [CO3]	**[08M]**
	b)	A point charge Q= 30 nC is located at the origin in Cartesian co-ordinates. Find the electric flux density **D** at (1,3,-4).	[L3] [CO3]	**[04M]**
5	**a)**	Deduce the electric field Intensity due to Surface charge	[L4] [CO3]	**[06M]**
	b)	Deduce the electric field Intensity due to volume charge	[L4] [CO3]	**[06M]**
6	**a)**	Explain the following i) Electric Flux density ii) Gauss Law.	[L2][CO2]	**[08M]**
	b)	What are the advantages and applications of Gauss law?	[L1][CO2]	**[04M]**
7	**a)**	Apply Gauss Law to evaluate the electric flux density at a point P due to the point charge located at the origin.	[L3][CO2]	**[06M]**
	b)	A charge of $5x10^{-8}$C is distributed uniformly on the surface of a sphere of radius 1cm. It is a sphere of radius 6 cm. Determine electric flux density	[L3][CO2]	**[06M]**
8	**a)**	Determine the Electric flux density at a point P due to infinite line charge of uniform Charge density ρ_L C/m using Gauss law.	[L3][CO2]	**[06M]**
	b)	Determine the Electric flux density at a point P due to infinite sheet of Charge using Gauss law.	[L3][CO2]	**[06M]**
9		Determine the Electric flux density due to uniformly charged Sphere using Gauss law.	[L3][CO2]	**[12M]**
10	**a)**	Define Electric Potential. Find the electric potential for a point charge is located at origin and Write Maxwell's second equation for electrostatic field	[L3][CO2]	**[08M]**
	b)	Determine the Relationship between **E** and V.	[L3][CO2]	**[04M]**

UNIT –II
MAGNETOSTATIC FIELDS

1	**a)**	Explain Biot-Savart's Law.	[L2][CO1]	**[06M]**
	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][CO2]	**[06M]**
2		Find the Magnetic field Intensity Due to a Straight current carrying filamentary conductor of finite length.	[L3][CO3]	**[12M]**
3	**a)**	Explain Ampere's Circuit Law.	[L2][CO1]	**[06M]**
	b)	Determine the Magnetic Field Density due to Infinite line Current by applying Ampere's Circuit law.	[L3][CO3]	**[06M]**
4		Explain any two applications of Ampere's Circuit law.	[L2][CO3]	**[12M]**
5	**a)**	Determine the Magnetic Field Intensity due to a infinite sheet current.	[L3][CO2]	**[06M]**
	b)	Define magnetic flux density and explain 3^{rd} maxwells equation	[L2][CO2]	**[06M]**
6	**a)**	An infinitely filamentary wire carries a current of 2A in the +z direction. Calculate **B** at (-3,4,7).	[L3][CO3]	**[06M]**
	b)	Define magnetic flux and explain its properties.	[L2] [CO2]	**[06M]**
7	**a)**	Explain about Non-Existence of Magnetic Mono pole.	[L2] [CO2]	**[06M]**
	b)	Determine Maxwell's Equations for static EM Fields.	[L3][CO2]	**[06M]**
8		List differential and integral form of Maxwell's equation for static EM filed.	[L1][CO2]	**[12M]**
9	**a)**	Discuss about Magnetic Vector and Scalar Potentials.	[L2][CO1]	**[06M]**
	b)	Given Magnetic Vector Potential $\mathbf{A} = -\rho/4\ \mathbf{a_z}$ wb/m, Calculate the total magnetic flux crossing the $\Phi=\pi/2, 1\leq\rho\leq2m1, 0\leq z\leq5m$.	[L3][CO3]	**[06M]**
10		A Current Distribution gives rise to the vector potential $\mathbf{A} = X^2Y\mathbf{a_x}+Y^2X\mathbf{a_y}+XYZ\mathbf{a_z}$ web/m. Calculate **B**.	[L3] [CO2]	**[12M]**

Course Code: 20EC0415 **R20**

UNIT –III

MAXWELL'S EQUATIONS (TIME VARYING FIELDS)

1		Define Faraday's law and Explain Faraday's laws in Electromagnetic induction.	[L2][CO1]	**[12M]**
2	**a)**	Determine the Transformer EMF for the time varying fields.	[L3][CO4]	**[06M]**
	b)	Explain the motional EMF and derive the expression for the maxwell equation.	[L3][CO4]	**[06M]**
3		Explain and determine the EMF for the Followings. i) Motional EMF. (ii)Transformer EMF.	[L3][CO2]	**[12M]**
4	**a)**	Derive the expression for Stationary Loop in Time Varying **B** field	[L3][CO2]	**[06M]**
	b)	Derive the expression for Moving Loop in Static **B** field	[L3][CO2]	**[06M]**
5	**a)**	Deduce the Expression for Moving loop in Time varying Fields	[L3][CO2]	**[06M]**
	b)	Define Displacement Current with expression	[L2][CO2]	**[06M]**
6	**a)**	Determine the Expressions for inconsistency of Ampere's law.	[L3][CO3]	**[08M]**
	b)	Why ampere's Law is In-consistent.	[L4][CO2]	**[04M]**
7	**a)**	Discuss Maxwell's equation in both differential and integral in final form	[L2][CO2]	**[08M]**
	b)	An antenna radiates in free space and $\mathbf{H}$= 50 Cos(1000t-5y)a_x A/m. Calculate ω and β.	[L3][CO3]	**[04M]**
8	**a)**	In free space, $\mathbf{E}$= 20 cos(ωt-50x)$\mathbf{a_y}$ V/m. Calculate $\mathbf{J_d}$, $\mathbf{H}$.	[L3][CO4]	**[08M]**
	b)	Write the Maxwell's equations into word statement.	[L1][CO4]	**[04M]**
9	**a)**	Prove that the Maxwell's equation is $\nabla\times\mathbf{E} = -d\mathbf{B}/dt$	[L5][CO4]	**[08M]**
	b)	In free space, H= 10 sin(ωt-100x)$\mathbf{a_y}$ A/m. Calculate **E**	[L3][CO4]	**[04M]**
10	**a)**	Prove that one of the Maxwell's equations is $\nabla\times\mathbf{H} = \mathbf{J_d}+\mathbf{J}$.	[L5][CO4]	**[08M]**
	b)	An antenna radiates in free space and $\mathbf{E}$= 80 cos(500t-8z)$\mathbf{a_x}$ V/m. Calculate ω and β.	[L3][CO2]	**[04M]**

UNIT –IV
EM WAVE PROPAGATION

1		Derive the general wave equation.	[L3][CO5]	**[12M]**
2	**a)**	Evaluate the wave equation in lossy dielectric medium for sinusoidal time variations.	[L4][CO5]	**[06M]**
	b)	In a Nonmagnetic medium **E**=$4\sin(2\pi X10^7 t - 0.8x)\, a_z v/m$, find $\boldsymbol{\varepsilon_r}$,η.	[L3][CO5]	**[06M]**
3		A plane wave propagating through medium with $\varepsilon_r = 8, \mu_r = 2$ has the electric field intensity **E** = 0.5 $\boldsymbol{e^{-jz3}}$ sin (10^8t- βz) $\hat{a}_x$ V/m. Determine wave velocity, wave impedance and magnetic field intensity.	[L3][CO5]	**[12M]**
4	**a)**	Evaluate the wave characteristics of plane wave in lossless dielectric medium.	[L4][CO5]	**[06M]**
	b)	In lossless medium η $= 40\pi, \mu_r = 1,$ **H**=2 cos (ωt - z) $\hat{\boldsymbol{a}}_x$+5sin (ωt - z) $\hat{\boldsymbol{a}}_y$.Find $\boldsymbol{\varepsilon_r}$, ω, **E** for the medium.	[L3][CO5]	**[06M]**
5	**a)**	Derive the characteristics of plane wave in free space.	[L3][CO5]	**[06M]**
	b)	Given that **E**=$40\cos(10^8 t - 3x)\, a_y v/m$, Determine the direction of wave propagation, velocity of the wave, wave length.	[L3][CO5]	**[06M]**
6	**a)**	Derive the expression for intrinsic impendence and propagation constant in a good conductor.	[L3][CO5]	**[06M]**
	b)	In a medium, **E** = $14\boldsymbol{e}^{-0.05x}$ 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	[L3][CO5]	**[06M]**
7		Discuss about power and Poynting vector.	[L2][CO5]	**[12M]**
8		Evaluate the expressions for reflection coefficient and transmission coefficient by a normal incident wave for a dielectric medium.	[L4][CO5]	**[12M]**
9		Derive the expressions for reflection coefficient and transmission coefficient for reflection of plane wave at oblique in parallel polarization	[L3][CO5]	**[12M]**
10		Derive the expressions for reflection coefficient and transmission coefficient for reflection of plane wave at oblique in perpendicular polarization	[L3][CO5]	**[12M]**

Course Code: 20EC0415 **R20**

UNIT –V

TRANSMISSION LINES

1	**a)**	Define Transmission line and Discuss about Transmission line Parameters.	[L2][CO6]	**[06M]**
	b)	With neat sketch explain about Primary and Secondary constants of transmission line.	[L3][CO6]	**[06M]**
2	**a)**	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]	**[06M]**
	b)	A telephone line has the following parameters: R=30Ω/km, G =0 L = 100mH/km, C = 20µF/m. At 1kHz, Find the characteristic impedance, propagation constant and velocity of the signal.	[L3][CO6]	**[06M]**
3		Deduce the equation for voltage and current at any point in a transmission line.	[L4][CO6]	**[12M]**
4		Determine the equation for Input Impedance of the transmission line.	[L3][CO6]	**[12M]**
5	**a)**	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 $10 \angle 0^0$ V, Z_g = 40Ω and terminated by a load of 20+j50Ω, determine the input impedance.	[L3][CO6]	**[06M]**
	b)	Explain about SWR and Power	[L2][CO6]	**[06M]**
6	**a)**	A low loss transmission line of 100 Ω characteristics impedance is connected to a load of 200 Ω. Compute the voltage reflection coefficient and the standing wave ratio.	[L3][CO6]	**[06M]**
	b)	Explain about S-Circle, r-Circle and x-Circle in smith chart.	[L2][CO6]	**[06M]**
7		A 50Ω lossless transmission line is terminated on a load impedance of Z_L = (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 0.3λ long.	[L3][CO6]	**[12M]**
8		A lossless transmission line with Z_0=50 Ω is 30m long and operates at 3MHz. The line is terminated with a load Z_L= 70 +j50Ω, If u=0.6c on the line. Compute reflection coefficient, standing wave ratio and Input impedance, load impedance, (i) without using smith chart (ii) Using smith chart	[L3][CO6]	**[12M]**
9		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. (i) without using smith chart (ii) Using smith chart	[L3][CO6]	**[12M]**
10	**a)**	List the applications of transmission lines.	[L1][CO6]	**[04M]**
	b)	Discuss about transient on transmission line	[L2][CO6]	**[04M]**
	c)	Discuss about Microstrip transmission lines	[L2][CO6]	**[04M]**

Prepared by

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