Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EE 302

Course Name: ELECTROMAGNETICS (EE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

1		Obtain gradient of the functions: a) $F = 5\rho^4 z^3 \sin\varphi$ b) $V = 10r^4 \sin\theta \cos\varphi$.	(5)
2		Obtain the expression of electric filed due to different charge bodies.	(5)
3		Find the magnetic flux crossing the portion of the conductor in the plane $\emptyset = \pi/4$ defined by $0.01 \leq \emptyset \leq 0.05\ m$ and $0 \leq Z \leq 2\ m$ for a current of 2 A	(5)
4		Explain about energy densities in electric and magnetic fields.	(5)
5		Explain about Poynting theorem.	(5)
6		Derive and Explain Uniform plane wave equation.	(5)
7		Define a) intrinsic impedance b) characteristic impedance.	(5)
8		Write down the expression of transmission line parameters.	(5)

PART B

Answer any two full questions, each carries10 marks.

9	a)	Explain about the cylindrical coordinate system.	(3)
	b)	Find the gradient of scalar function V=ρ^2 sin 2Ø in cylindrical coordinates and the directional derivative of the function in the direction of the vector $\vec{A}=\overrightarrow{a_\rho}+\overrightarrow{a_\emptyset}$ at the point (2, π/4, 0).	(7)
10	a)	Explain about the physical significance of divergence of vector quantity.	(4)
	b)	Derive the expression of electric field intensity due to sheet charge having surface charge density $\sigma_{s\ C/m^2}$	(6)
11	a)	Explain about the conservative field.	(2)
	b)	Determine the divergence of vector field $1) P = x^2 yz\overrightarrow{a_x} + xy\overrightarrow{a_z}$ $2) Q = 1/r^2 \cos\theta\ \overrightarrow{a_r} + r\cos\theta \sin\theta\ \overrightarrow{a_\theta}$	(8)

PART C

Answer any two full questions, each carries10 marks.

12 a) State and explain Ampere's circuit law. (3)

b) A current filament carries a current of 10 A in the a_z direction on the z axis. Find $\vec{H}$ in rectangular system at point P(1,2,3) due to this filament if it extends from a)z = -∞ to +∞ b) 5 to ∞. (7)

13 a) Derive the expression of inductance of solenoid having N turns. (6)

b) Explain the electric boundary conditions of two dielectric media. (4)

14 a) Formulate the Maxwell's equation in differential form and point form in phasor form. (7)

b) Explain the continuity equation. (3)

PART D

Answer any two full questions, each carries 10 marks.

15 a) What is skin depth? (3)

b) Show that the power flow along a concentric cable is the product of voltage and current using Poynting Theorem. (7)

16 a) Explain group velocity and phase velocity. (5)

b) Derive the attenuation constant and phase shift constant for a perfect conductor. (5)

17 a) Explain about electromagnetic interference. (4)

b) A 9375 MHz uniform plane wave is propagating in polystyrene. If the amplitude of the electric field intensity is 20 V/m and the material is assumed to be loss less find α, β, λ, intrinsic impedance, propagation constant and amplitude of H. (6)

****

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: EE302

Course Name: ELECTROMAGNETICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

1		Find the divergence of $\bar{A}$ where $\bar{A} = \rho z \sin\phi \bar{a}_\rho + 3\rho z^2 \cos\phi \bar{a}_\phi$	(5)
2		Define equipotential surface?	(5)
3		Explain Biot-Savart Law.	(5)
4		Derive Maxwell's equations in differential and integral form from Faraday's Law	(5)
5		What is displacement current?	(5)
6		Apply Poynting theorem to derive an expression for power flowing through a co-axial cable	(5)
7		Compute the phase constant and attenuation constant for a uniform plane wave having frequency 10GHz in a lossy dielectric material for which $\mu = \mu_0$, $\varepsilon_r = 2.3$ and $\sigma = 2.56\times10^{-4}$ ℧/m.	(5)
8		What is electromagnetic interference? What are its causes?	(5)

PART B

Answer any two full questions, each carries 10 marks.

9	a)	State and Prove Stoke's Theorem	(5)
	b)	What is Curl of a vector field? Explain its physical significance.	(5)
10	a)	State and Prove Gauss's law.	(5)
	b)	Apply Gauss's law to find the expression for Electric field Intensity and Electric flux density due an infinite line charge distribution.	(5)
11	a)	Explain the concept of electric potential and potential gradient.	(5)
	b)	Explain spherical co-ordinate system.	(5)

PART C

Answer any two full questions, each carries 10 marks.

12	a)	Apply Biot-Savart law and determine an expression for magnetic field intensity at a point due to an infinitely long straight conductor carrying current I.	(7)
	b)	Explain continuity equation for current.	(3)
13	a)	State Ampere's circuital law and explain any one application of Ampere's circuital law	(5)
	b)	Derive the boundary conditions with respect to the electric field at the interface of a dielectric – dielectric boundary	(5)
14	a)	Derive an expression for energy stored in an electrostatic field in terms of electric flux density.	(7)
	b)	What is electric polarisation? Explain.	(3)

PART D

Answer any two full questions, each carries 10 marks.

15		State and explain Poynting theorem and Poynting vector. Also derive an expression for average power density.	(10)
16	a)	A uniform plane wave is travelling at a velocity of 2.5×10^5 m/s having wavelength $\lambda = 0.25$mm in a non magnetic good conductor. Calculate the frequency of wave and the conductivity of a medium.	(5)
	b)	What are electromagnetic waves? Explain the concept of uniform plane waves.	(5)
17		Derive the wave equations for a transmission line.	(10)

****

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B. TECH DEGREE EXAMINATION(S), DECEMBER 2019

Course Code: EE302

Course Name: ELECTROMAGNETICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1		Explain the physical significance of Divergence of a vector field.	(5)
2		Two-point charges of 20nC and -20nC are located at (1,0,0) and (0,1,0) respectively in free space. Calculate the electric field intensity at (0,0,1).	(5)
3		State and prove Ampere's Circuital law.	(5)
4		Explain Electric Polarization.	(5)
5		What is meant by uniform plane waves? Also, why are electromagnetic waves called as transverse electromagnetic waves?	(5)
6		Explain Poynting vector and Poynting theorem.	(5)
7		Explain skin depth and obtain an expression for it.	(5)
8		Explain characteristic impedance and standing wave ratio of transmission line.	(5)

PART B

Answer any two full questions, each carries10 marks.

9		Verify divergence theorem for the vector field $\overline{H} = 2\rho Z^2\overline{a_\rho} + \rho cos^2\emptyset\overline{a_Z}$ over the surface defined by π.	(10)
10	a)	A vector field ——— ——— at a point with spherical coordinates – –). Find (i) Magnitude of (ii) Unit vector in cartesian coordinate in the direction of $\bar{E}$.	(6)
	b)	Explain Equipotential surface.	(4)
11	a)	Derive the expression of Electric field intensity due to infinite line charge having line charge density ρ_L C/m.	(6)
	b)	Derive Laplace's equation for electrostatic field.	(4)

PART C

Answer any two full questions, each carries10 marks.

12		Derive Maxwell's equations in integral form and point form.	(10)
13	a)	A circular loop of radius 'a' m is carrying a current of I A. Find the magnetic	(6)

field intensity at a point 'h' m from the loop along its axis.

b) Explain magnetic scalar and vector potential. (4)

14 a) Derive Continuity equation. (3)

b) Explain displacement current density. Obtain the dielectric-dielectric boundary conditions for electric fields. (7)

PART D

Answer any two full questions, each carries 10 marks.

15 Derive wave equation from Maxwell's equation for a plane wave in a perfect dielectric. (10)

16 Explain power flow in a co-axial cable using poynting theorem. (10)

17 a) Explain very briefly about Electromagnetic Interference and Electromagnetic compatibility. (2)

b) A 180 MHz plane wave is travelling in a medium characterized by $\mu_r = 1,\ \varepsilon_r = 25, and\ \sigma = 2.5\frac{mS}{m}$. Find (i) intrinsic impedance (ii) Attenuation constant (iii) Propagation constant (iv) Skin depth. (8)

****

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth semester B.Tech examinations (S), September 2020

Course Code: EE302

Course Name: ELECTROMAGNETICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

1 Given the two points A (2, 3,-1) and B (4, 25^0, 120^0). Find the Spherical coordinates of A and Cartesian coordinates of B. (5)

2 Obtain Poisson's equation from Gauss's law (5)

3 Explain (i) scalar magnetic potential and (ii) vector magnetic potential (5)

4 Show that the displacement current through a parallel plate capacitor is equal to the conduction current *I* flowing in the external circuit. (5)

5 A coaxial cable carries a dc voltage *V* and current *I.* Show that the power flow is VI using Poynting's theorem. (5)

6 In a transverse electromagnetic wave, electric field intensity is given by $\mathbf{E}=E_m\sin(\omega t-\beta z)\mathbf{a_y}$ in free space, Sketch **E** and **H** at t=0. (5)

7 Derive the expressions for attenuation constant and phase constant for a uniform plane wave propagating in a conducting medium. (5)

8 In a non-magnetic medium, electric field intensity is $\mathbf{E}=4\sin(2\pi\times10^7 t-0.8x)\mathbf{a_z}$ V/m. Find the relative permittivity and intrinsic impedance of the medium. (5)

PART B

Answer any two full questions, each carries10 marks.

9 a) Define divergence of a vector field. Explain its physical significance. (4)

b) Transform the vector $F=\frac{1}{r}a_r$ in spherical coordinates into a vector in Cartesian coordinates. (6)

10 a) State and prove Stokes theorem. (5)

b) What is an electric dipole? Derive an expression for the electric field intensity at any point due to dipole. (5)

11 a) State Gauss's law. Using Gauss's law, derive an expression for electric field intensity due to an infinite plane sheet of charge. (6)

b) If the electric potential in a region is given by, $V = 2x^2y + 20z - \frac{4}{x^2+y^2}$ volts. Find electric field intensity and electric flux density at P (6, -2.5, 3). (4)

PART C

Answer any two full questions, each carries10 marks.

12 a) Consider an infinitely long straight conductor carrying current I. Calculate the magnitude of magnetic flux density at a distance r from the conductor assuming the permeability of the medium to be equal to μ (5)

b) A square loop of side 10 cm centered at the origin carries 100A in the counter clockwise direction. Calculate the magnetic field intensity at the centre of the loop. (5)

13 a) A circular loop located on $x^2 + y^2 = 9, z = 0$, carries a direct current of 10A along $\mathbf{a_\Phi}$. Determine the magnetic field intensity, $\boldsymbol{H}$ at (0, 0, 4). (6)

b) Derive the expression for electrostatic energy stored in an assembly of N point charges. (4)

14 a) Derive the electrostatic boundary conditions at the interface between two perfect dielectrics. (6)

b) Explain the inconsistency of Ampere's circuital law for time varying fields. (4)

PART D

Answer any two full questions, each carries 10 marks.

15 State and prove Poynting's theorem and explain the physical significance of Poynting's vector. (10)

16 a) Derive the wave equation for electric field in phasor form. (5)

b) Calculate the skin depth and wave velocity at 2 MHz in aluminium with conductivity $40\times10^6\ \Omega^{-1}m^{-1}$ and relative permeability, $\mu_r=1$. (5)

17 a) A transmission line has R=30Ω/km, L=100mH/km, G=0 and C=20μF/km. At a frequency of 1 kHz, calculate the characteristic impedance and propagation constant of the line. (6)

b) Define standing wave ratio. How is it related to voltage reflection coefficient? (4)

****