PSN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

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Department of Electrical and Electronics Engineering

QUESTION BANK

Degree/Branch: B.E / EEE

Semester: III

Subject Code/Title: 504003 / Electromagnetic Field Theory

Regulation: 2018

Academic Year: 2021-2022

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UNIT I -VECTOR ANALYSIS			
Vector fields – Different Co-ordinate systems-Rectangular, Cylindrical and Spherical coordinate systems. Gradient - Divergence – Curl – Line Integral-Surface Integral-Divergence theorem-Stoke's theorem			
Part A (2 marks)			
Q. No	**Questions**	**BT Level**	**Competence**
1	What are the sources of electro magnetic fields?	**BTL 1**	**Remember**
2	Transform a vector $A=ya_x-xa_y+za_z$ into cylindrical coordinates.	**BTL 1**	**Remember**
3	How the unit vectors are defined in cylindrical co-ordinate systems?	**BTL 1**	**Remember**
4	Give the relation between Cartesian and cylindrical co-ordinate systems	**BTL 1**	**Remember**
5	What is unit vector? What is its function while representing a vector?	**BTL 2**	**Understand**
6	Define dot product.	**BTL 3**	**Apply**
7	Define cross product.	**BTL 1**	**Remember**
8	What is the physical significance of divergence?	**BTL 1**	**Remember**
9	Define gradient	**BTL 1**	**Remember**
10	Define curl.	**BTL 1**	**Remember**
11	State Divergence theorem.	**BTL 1**	**Remember**
12	Define Surface Integral.	**BTL 3**	**Apply**
13	What is volume charge density?	**BTL 1**	**Remember**
14	Define Line Integral.	**BTL 1**	**Remember**
15	State stokes theorem.	**BTL 1**	**Remember**
Part B (16 marks)			
Q. No	**Questions**	**BT Level**	**Competence**
1.	State and prove Divergence theorem.	**BTL 1**	**Remember**
2.	State and prove Stokes theorem.	**BTL 1, BTL 4**	**Remember, Analyze**

3.	Explain the spherical and cylindrical co-ordinate system	**BTL 5**	**Evaluate**
4.	Explain the spherical and cylindrical co-ordinate system	**BTL 1**	**Remember**
5.	Given point P (-2, 6, 3) and $\bar{A}=y\,\bar{\imath} + (x+z)\,j$ express p and $\bar{A}$ in cylindrical and spherical coordinates. Evaluate $\bar{A}$ at P in the Cartesian, cylindrical and spherical system	**BTL 4**	**Analyze**
6.	Explain about the following i) Gradient ii) Divergence iii) Curl	**BTL 2**	**Understand**
7.	Determine the constant c such that the vector F = (x + ay)i + (y + bz)j + (x + cz)k will be solenoidal.	**BTL 2**	**Understand**

UNIT II ELECTROSTATICS

Coulomb's Law in Vector Form – Definition of Electric Field Intensity –Electric Field due to discrete charges – Electric field due to continuous charge distribution - Electric Field due to charges distributed uniformly on an infinite line – Electric Field on the axis of a uniformly charged circular disc-Electric Scalar Potential – Relationship between potential and electric field - Potential due to infinite uniformly charged line – Potential due to electrical dipole - Electric Flux Density – Gauss Law – Proof of Gauss Law.

Part A (2 marks)

Q. No	Questions	BT Level	Competence
1	State coulomb's law.	**BTL 1**	**Remember**
2	What are the different types of charges?	**BTL 4**	**Analyze**
3	Define electric field intensity.	**BTL 4**	**Analyze**
4	State Gauss Law.	**BTL 1**	**Remember**
5	Define Electric scalar potential.	**BTL 2**	**Understand**
6	State Electric flux density	**BTL 1**	**Remember**
7	What is the capacitance of a coaxial cable.	**BTL 4**	**Analyze**
8	Write the relationship between Potential and Electric field.	**BTL 1**	**Remember**

9	Define dipole and dipole moment	**BTL 1**	**Remember**
10	Differentiate potential and potential difference.	**BTL 2**	**Understand**
Part B (16 marks)			
Q. No	**Questions**	**BT Level**	**Competence**
1	State and explain coulomb's law.	**BTL 2**	**Understand**
2	A circular disc of radius 'a', m is charged uniformly with a charge density of σ C/m^2 Find the electric field intensity at a point 'h', m from the disc along its axis.	**BTL 2**	**Understand**
3	Explain the Electric field due to charges distributed uniformly on an Infinite and Finite line	**BTL 2**	**Understand**
4	Explain about the applications of Gauss law	**BTL 2**	**Understand**
5	State and prove Gauss's law.	**BTL 2**	**Understand**
6	Define the potential difference and absolute potential. Give the relation between potential and field intensity.	**BTL 2**	**Understand**
7	What is dipole moment? Obtain expression for the potential and field due to an electric dipole.	**BTL 1**	**Remember**
UNIT III - MAGNETOSTATICS			
Theories of magnetic field- Biot- Savart Law in vector form – Magnetic Field intensity due to a finite and infinite wire carrying a current I –Magnetic field intensity on the axis of a circular loop– Ampere's circuital law. Magnetic flux density – Lorentz Law of force – Force on a wire carrying a current I placed in a magnetic field – Torque on a loop carrying a current I – Magnetic moment – Magnetic Vector Potential.			
Part A (2 marks)			
Q. No	**Questions**	**BT Level**	**Competence**
1	State Biot–Savart's law.	**BTL 4**	**Analyze**
2	State Ampere circuital law.	**BTL 1**	**Remember**
3	State magnetic field intensity.	**BTL 1**	**Remember**
4	State Magnetic Flux density.	**BTL 1**	**Remember**
5	Write an expression of Lorentz law of force.	**BTL 3**	**Apply**
6	Define Magnetic Moment.	**BTL 1**	**Remember**

7	Distinguish magnetic scalar potential and magnetic vector potential.	**BTL 1**	**Remember**
8	Define Magnetization.	**BTL 1**	**Remember**
Part B (16 marks)			
Q. No	**Questions**	**BT Level**	**Competence**
1	State and Explain Biot-savart law.	**BTL 3**	**Apply**
2	Explain about Magnetic Field intensity due to a finite and infinite wire carrying a current I.	**BTL 3**	**Apply**
3	Explain about Magnetic field intensity on the axis of a circular loop.	**BTL 2**	**Understand**
4	Derive an expression for Lorentz law of force.	**BTL 2**	**Understand**
5	Derive the force equation on a wire carrying a current I placed in a magnetic field.	**BTL 2**	**Understand**
6	Two wires carrying currents in the same direction of 5000 A and 10000 A are placed with their axes 5 cm apart. Calculate the force between them.	**BTL 2**	**Understand**
UNIT IV ELECTRIC AND MAGNETIC FIELDS IN MATERIALS			
Poisson's and Laplace's equation – Electric field in free space, conductors, dielectric -Dielectric polarization – Capacitance- Dielectric strength - Electric field in multiple dielectrics – Electrostatic energy and energy density – Boundary conditions for electric fields. Definition of Inductance – Inductance of loops and solenoids – Definition of mutual inductance – simple examples. Energy density in magnetic fields –magnetic boundary conditions.			
Part A (2 marks)			
Q. No	**Questions**	**BT Level**	**Competence**
1	Write an expression for Poisson's and Laplace's equation.	**BTL 1**	**Remember**
2	What are the properties of electric field in conductor and dielectrics.	**BTL 1**	**Remember**
3	Define Dielectric Polarization	**BTL 3**	**Apply**
4	Define Capacitance.	**BTL 1**	**Remember**
5	Define Dielectric strength.	**BTL 1**	**Remember**
6	Define Inductance	**BTL 1**	**Remember**
7	Define Mutual Inductance.	**BTL 3**	**Apply**

8	What is magnetic boundary condition?	**BTL 1**	**Remember**
9	Write an expression for Electrostatic energy and energy density.	**BTL 1**	**Remember**
10	Write the boundary conditions for electric field.	**BTL 1**	**Remember**
Part B (16 marks)			
Q. No	**Questions**	**BT Level**	**Competence**
1	Discuss Electric field in free space, dielectric and in conductor.	**BTL 4**	**Analyze**
2	Derive the Poisson's and Laplace 's equation.	**BTL 1**	**Remember**
3	Derive an expression for capacitance with two dielectric media.	**BTL 1**	**Remember**
4	Derive an expression for electrostatic energy and energy density in a electric field.	**BTL 2**	**Understand**
5	Derive the magnetic boundary conditions at the interface of two different magnetic media.	**BTL 1**	**Remember**
6	Derive the boundary conditions in a electric field.	**BTL 1**	**Remember**
7	Calculate B due to a long solenoid and a thin toroid.	**BTL 2**	**Understand**
UNIT V - ELECTRODYNAMIC FIELDS AND ELECTROMAGNETIC WAVES			
Displacement current - Maxwell's equations (differential and integral forms) –.Electro Magnetic Wave equations – Uniform plane waves -Wave parameters; velocity, intrinsic impedance, propagation constant –Waves in free space, lossy and lossless dielectrics, conductors-skin depth, Poynting Theorem.			
Part A (2 marks)			
Q. No	**Questions**	**BT Level**	**Competence**
1	Define displacement current.	**BTL 1**	**Remember**
2	Write down the wave equation for E and H in a non-dissipative (free space) medium.	**BTL 2**	**Understand**
3	What are the properties of uniform plane wave?	**BTL 1**	**Remember**
4	Define intrinsic impedance.	**BTL 1**	**Remember**
5	Define Poynting theorem.	**BTL 1**	**Remember**
6	Calculate the skin depth and wave velocity at 2 MHz in Aluminum with conductivity 40 MS/m and μ_r=1.	**BTL 1**	**Remember**

7	Define skin depth.	**BTL 1**	**Remember**
8	Find the velocity of a plane wave in a lossless medium having $\mu=10$, $\varepsilon_r=20$.	**BTL 2**	**Understand**
9	What do you mean by "depth of penetration"?	**BTL 3**	**Apply**
10	For a lossy dielectric material having $\mu_r=1$, $\varepsilon_r=48$, $\sigma=20$ s/m. Calculate the propagation constant at a frequency of 16 GHz.	**BTL 1**	**Remember**
11	What is the velocity of electromagnetic wave in free space and in lossless dielectric?	**BTL 3**	**Apply**
	Part B (16 marks)		
Q. No	**Questions**	**BT Level**	**Competence**
1	Summarize Maxwell's equation for time varying fields in integral and differential form.	**BTL 2**	**Understand**
2	What do you meant by displacement current? Write down the expression for the total current density.	**BTL 4**	**Analyze**
3	State poynting's theorem and explain its physical significance.	**BTL 1**	**Remember**
4	Explain in detail on what happened when the wave is normally incident on dielectric medium.	**BTL 1**	**Remember**
5	Derive the wave equation for a conducting medium.	**BTL 1**	**Remember**
6	Explain the electromagnetic wave propagation in i) lossless dielectrics ii) free space iii) good conductor	**BTL 2**	**Understand**