INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	**ELECTROMAGNETIC FIELDS**
Course Code	:	**AEEB10**
Program	:	**B.Tech**
Semester	:	**THREE**
Branch	:	**Electrical And Electronics Engineering**
Section	:	**A&B**
Academic Year	:	**2020 - 2021**
Course Faculty	:	**Mr. T Anil Kumar**

COURSE OBJECTIVES:

The students will try to learn	
I	The concepts of electro-statics , magneto-statics and time varying fields that allows required foundations in structure of power generation, transmission and distribution systems.
II	The nature of wave propagation in free space, conductors and dielectrics to frame multi-disciplinary assignments with real time constraints.
III	The fundamentals of electromagnetic fields and wave propagation to figure out the complex engineering problems with solutions and also helps in pursuing higher studies.

COURSE OUTCOMES:

After successful completion of the course, Students will be able to:

CO No	Course Outcomes
CO 1	Make use of coloumb's law for obtaining force and electric filed intensity due to line, surface and volume charge distribution.
CO 2	Recognize the basic nomenclatures of point charge that helps in characterizing the behavior of electro-static fields.
CO 3	Make use of the Gauss law for obtaining electric field intensity, density and deduce Poisson's, Laplace equations.
CO 4	Determine the potential and torque due to electric dipole used in structuring the principle of electrical equipments.
CO 5	Realize the behavior of conductors and dielectrics, their by compute the capacitance of different configured plates.
CO 6	Make use of Biot-Savart law and Ampere circuital law for obtaining magnetic field intensity due to circular, square, rectangular and solenoid current carrying wire.
CO 7	Predict the force due to moving charge in the magnetic field of various configuration for developing principles of electrical machines.

CO 8	Signify the magnetic dipole , dipole moment for obtaining torque due to magnetic dipole helps in structuring electrical devices..
CO 9	Calculate the self inductance and mutual inductance for different configurations of wires and energy stored in the coil.
CO 10	State the Faraday's laws of electromagnetic induction and note the nature of emf induced in the coil for fixed and variable fields.
CO 11	List out the differential and integral forms of Maxwell's equation in time varying fields and fields varying harmonically with time for obtaining numerical solutions of complex engineering problems.
CO 12	Make use of the Maxwell Equations to produce a wave equation for the free- space, insulators and conductors for propagation of electromagnetic waves.

DEFINITIONS AND TERMINOLOGY QUESTION BANK

S.No	QUESTION	ANSWER	Blooms Level	CO
		MODULE-I		
1	Define dot product in vector analysis.	The dot product, also called the scalar product, of two vectors is a number (scalar quantity) obtained by performing a specific operation on the vector components. The dot product has meaning only for pairs of vectors having the same number of dimensions. The symbol for dot product is a heavy dot ($\bullet$).	Remember	CO 1
2	Define cross product in vector analysis.	The cross product a × b is defined as a vector c that is perpendicular (orthogonal) to both a and b, with a direction given by the right-hand rule and a magnitude equal to the area of the parallelogram that the vectors span.	Remember	CO 1
3	Write the mass of electron and proton.	Mass of , electron M_e= 9.109390 x 10^{-31} kg Proton M_p= 1.672623 x 10^{-27} kg	Remember	CO 1
4	Define point charge.	A charge with smallest dimensions on the body compare to other charges is called as point charge.	Remember	CO 2
5	Discuss about permittivity of medium.	The ability of a substance or medium to store electrical energy in an electric field.	Understand	CO 1
6	Define electric field.	It is the region around the point and group charges in which another charge experiences force is called as electric field.	Remember	CO 1
7	Define electric field intensity mathematically.	Electric field intensity is defined as force experienced by point charge. E = F/q	Remember	CO 2
8	Name types of charge distributions.	The types of charge distribution are : Line charge, Surface charge and Volume charge.	Remember	CO 1
9	Write the expression for work done in electric fields.	Work done to move point charge through the existing electric field w = -q$\int \vec{E}$ dl	Remember	CO 2
10	State STOKE's theorem.	The strokes theorem says that surface integral of any function is equal to volume integral of divergence of same function. Q= $\int_S$ D ds = $\int_V$ (▼. D) dv	Remember	CO 3
11	Resolve unit vector (direction vector) in terms of distance vector.	Unit vector in terms of distance vector is, $\hat{a}_1 = \vec{R}$ / R	Remember	CO 1

12	Write mathematical expression of dot product.	Dot product, $A.B = \|A\|.\|B\|.\cos\Theta$. Where, A and B = vectors.	Remember	CO 1
13	Convert Cartesian co-ordinates to cylindrical co-ordinates.	Cylindrical co-ordinates ,(r, Θ, z) $r= \sqrt{x^2+y^2}$, $\Theta = \tan^{-1}(y/x)$, z = z	Understand	CO 1
14	Convert Cartesian co-ordinates to spherical co-ordinates.	Spherical co-ordinates ,(ρ, Θ, ϕ) $\rho = \sqrt{x^2+y^2+z^2}$, $\Theta = \tan^{-1}(y/x)$, $\phi = \tan^{-1}(\sqrt{x^2+y^2}\ /z)$	Understand	CO 1
15	Convert cylindrical co-ordinates to spherical co-ordinates.	Spherical co-ordinates , (ρ, Θ, ϕ) $\rho = \sqrt{r^2+z^2}$, $\Theta = \tan^{-1}(y/x)$, $\phi = \tan^{-}1(r/z)$	Understand	CO 1
MODULE-II				
1	Define electric dipole.	Two opposite charges +q and –q separated by some distance d forms the electric dipole.	Remember	CO 4
2	Explain electric dipole moment.	The distance travelled by the point charge is defined as dipole moment (or) the product of charge and distance travelled by it is called as electric dipole.	Understand	CO 4
3	Write expression for potential due to electric dipole.	The potential due to electric dipole, $Kqd.\cos\Theta/ (r^2 – d^2/4 \cos^2\Theta)$	Remember	CO 4
4	Give the relation between electric field intensity and electric potential.	The relation between electric field intensity and electric potential, $E = - \blacktriangledown V$	Understand	CO 4
5	Write expression for torque due to electric dipole.	The torque due to electric dipole, $T = PE.\sin\Theta$.	Remember	CO 4
6	Define polarization.	If an piece if dielectric or insulator placed between the charges plates of condenser, then center of gravity of negative charges is concentrated towards positive plate and center of gravity of positives charges concentrated towards negative plate, this process of separation opposite charges is called a polarization.	Remember	CO 5
7	Define dielectric constant.	Dielectric constant is defined as ratio capacitance of capacitor with dielectric to the capacitance of capacitor without dielectric .	Remember	CO 5
8	Define electric susceptibity.	Electric susceptibility is the ratio of polarization and electric field intensity.	Remember	CO 5
9	Define capacitance of capacitor.	Capacitance of capacitor is defined as charge Q developed between the plates when voltage V is applied.	Remember	CO 5
10	Capacitance between parallel plates is ----------.	Capacitance between parallel plates is $C = \varepsilon A/d$.	Remember	CO 5
11	Write expression for capacitance of co-axial cable.	The expression for capacitance of co-axial cable, $C = 2\pi\varepsilon / \ln(b/a)$	Remember	CO 5

12	Write the expression for energy stored in capacitor.	The expression for energy stored in capacitor, $= CV^2 / 2$	Remember	CO 5
13	Define energy density in electro-static field.	Energy density of capacitor is defined energy stored per unit volume, $W_d = DE/ 2$	Remember	CO 5
14	Write the relation between electric flux density and intensity.	The relation between electric flux density and intensity is, $D = \varepsilon E$	Remember	CO 5
15	Define current density.	If charge is distributed in the given area, then current density is defined as current constituted In given area. $J = i / A \quad (A/mt^2)$	Remember	CO 5
MODULE-III				
1	Define magneto-statics.	Magneto-statics is the study of magnetic field developed by the constant current through the coil Or due to permanent magnets.	Remember	CO 6
2	Name the laws used in magneto-statics.	The behavior of contant magnetic field is studied by using two basic laws, they are, □ Bi-Savart's law □ Ampere's circutal law.	Understand	CO 6
3	Define magnetic field.	This formation magnetic from North pole to south pole ia called as magnetic field. The direction of magnetic flux in an coil is Given by right hand thumb rule.	Remember	CO 6
4	Define magnetic flux density.	Magnetic flux density is defined as magnetic flux per unit area. $B=\phi/A$	Remember	CO 6
5	Explain magnetic field intensity.	The force experienced by coil when some current passes through it is magnetic field Intensity. $H = NI / l \ (AT/mt)$	Understand	CO 6
6	Explain permeability of core.	Permeability is the inherent property of core which helps in sustaining flux in the core. $\mu = B /H$	Understand	CO 6
7	Write the relation between magnetic flux density and intensity.	The relation between magnetic flux density and intensity, $B = \mu H$	Remember	CO 6
8	Explain intensity of magnetization.	When a magnetic substance is placed in a magnetic field it experiences magnetic momentum. The magnetic momentum per unit volume of substance is intensity of magnetization.	Understand	CO 8
9	Define magnetic susceptibility.	The ratio intensity of magnetization to the magnetic field intensity is called as Magnetic Susceptibility. $K = I / H.$	Remember	CO 8
10	Give the range of relative permeability for different magnetic material.	The range relative of permeability for different magnetic material $\mu_r > 1$, paramagnetic materials $\mu_r < 1$, diamagnetic materials $\mu_r = 0$, non-magnetic materials	Remember	CO 8
11	State Bio-Savart's law.	According Bio-Savart's law, $dH \alpha Idl$ (current element) $dH \alpha \sin\Theta$ (angle between current element and length joining point) $dH \alpha 1 / r^2$ (square of distance between current element and point)	Remember	CO 6

12	Write the expression for magnetic field intensity due to infinite straight conductor.	The expression for magnetic field intensity due to infinite straight conductor, H = I/(2πd)	Remember	CO 6
13	Write the analogous of Gauss law in magneto-statics.	From the guass law we can write magnetic flux in the given Surface is surface integral of Magnetic flux density.	Understand	CO 6
14	State Ampere circuital law.	The ampere circuital law states line integral magnetic filed intensity around any closed path Is equal to total current enclosed in that path. ∫ H dl = I	Remember	CO 6
15	Write the applications of Ampere circuital law.	Applications of Ampere's law : □ The magnetic field intensity in the surrounding closed path is always at tangential at Each and every point on it. □ At each every point on the closed path magnetic field intensity has the same value.	Understand	CO 6
		MODULE-IV		
1	Explain force on moving charge.	When an charge Q is with velocity $\vec{V}$ is placed in the magnetic field of density $\vec{B}$ then it Experiences force called as magnetic force. =QVB sinΘ	Understand	CO 7
2	Write neuman's formula.	Neuman's formula, M = ∫∫ μdl1 dl2/ 4πr	Remember	CO 9
3	Write limitations of moving charge in magnetic field.	The limitations of moving charge in the existing magnetic field, □ If the velocity of charge in the magnetic field is zero then force experienced also zero. □ If the velocity direction and magnetic field direction are parallel to each other then force Experienced is zero. □ To say that moving charge in the magnetic field experiences force velocity and field must be normal to each other.	Understand	CO 7
4	Write the expression for torque due to moving charge.	The expression for torque due to moving charge, = T*B	Understand	CO 8
5	Write the Lorentz force equation.	The Lorentz force is, = Q($\vec{E}$ + ($\vec{V}X\vec{B}$))	Remember	CO 7
6	Write the expression for force due to parallel straight conductors.	The expression for force due to parallel straight conductors, (F / l) = μ0 I1 I2 / 2ΠId	Remember	CO 7
7	Define magnetic dipole.	Magnetic dipole is formed when two opposite magnetic charges are separated by distance l.Qm.	Remember	CO 8
8	Write the expression for magnetic dipole moment.	The expression for magnetic dipole moment, m =Qm l.	Remember	CO 8
9	Define magnetization.	Moment per unit volume is called as magnetization.	Remember	CO 8
10	Write the expression for torque due to magnetic dipole.	The expression for torque due to magnetic dipole, $\vec{T}$ =$\vec{m}$ x $\vec{B}$	Remember	CO 8
11	Give the units of scalar magnetic potential.	The units of scalar magnetic potential is Ampere.	Remember	CO 9

12	Write the relation between magnetic field intensity and current density.	The relation between magnetic field intensity and current density, $\nabla \times H = J$	Remember	CO 9
13	What is divergence of curl of vector?	The divergence of curl of any vector is zero.	Remember	CO 9
14	Give the expression for self inductance of solenoid.	The expression for self inductance of solenoid, $L = \mu_0 N^2 A / l$	Remember	CO 9
15	Give the expression for magnetic flux in N turns if B and A are known.	The expression for magnetic flux in N turns if B and A are known, $\phi = NBA$	Remember	CO 7
MODULE-V				
1	How time varying fields are developed?	Time varying fields are produced due to accelerated charges or time varying currents.	Understand	CO 11
2	State Faraday's law of electro-magnetic induction.	Faraday law of electro-magnetic induction states if an coil experiences change in magnetic flux then emf is induced in it.	Remember	CO 10
3	State Lenz law.	Lenz law states that the cause opposes every cause of producing it.	Remember	CO 10
4	Write Mawell's fourth equation	Maxwell's fourth equation is , $\nabla \times E = -dB/dt$	Remember	CO 11
5	State Gauss law.	Gauss law states that surface integral of electric flux density is equal to charge enclosed in that surface.	Remember	CO 11
6	Name types of emf induced in coil.	The types of emf induced in the coil are, Dynamically induced emf and Statically induced emf.	Understand	CO 10
7	Define dynamically induced emf.	Dynamically induced emf is the emf induced in the coil when conductor cuts the flux i.e conductors are rotating and flux is constant.	Remember	CO 10
8	Define statically induced emf.	Statically induced emf is the emf induced in the coil when flux cuts the conductor i.e conductors are stationary and flux is variable.	Remember	CO 10
9	Write the maximum value of dynamically induced emf.	The maximum value of dynamically induced emf, $e = BlV$.	Remember	CO 10
10	Give the expression for statically induced emf.	The expression for statically induced emf, $E = N \phi_m \, w \cos wt$	Remember	CO 10
11	In time varying fields write the expression for total current density.	In time varying fields the expression for total current density is equal to sum of displacement current and conducting current, $J = J_r + J_c$	Remember	CO 11
12	Define displacement current density.	The displacement current density is defined as rate of change of electric flux density.	Remember	CO 11
13	Define conduction current density.	Conduction Current Density refers to the amount of current (charges) flowing on the surface of a conductor (conduction band) in a time t.	Remember	CO 11
14	Write the integral form of Farady's emf equation.	The integral form of farady's emf equation, $\int H \, dl = (\sigma + Jw\varepsilon) \int E \, ds$	Remember	CO 11

15	State Faraday's second law of electro-magnetic induction.	Faraday's second law of electro-magnetic induction states that magnitude of emf induced in coil is directly proportional to rate change of flux.	Remember	CO 10

Signature of the Faculty **HOD, EEE**