OBJECTIVES

This course deals with mainly introduction of the concepts of electric field and magnetic fields and their applications and also in the development of theory for power transmission lines and electrical machines.

1. Group - A   (Short Answer Questions)

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
	UNIT-I **ELECTROSTATICS**		
1	Describe the different sources of electric and magnetic fields?	Remember	1
2	What is a scalar quantity and vector quantity?	Understand	1
3	Find the dot product of the vectors A and B if A =2ax-3ay+4az, B= -ax+2ay+2az.	Understand	1
4	Write down expression for x, y, z in terms of spherical co-ordinates r, θ and Φ.	Remember	2
5	Give the limitations of Gauss's law.	Application	1
6	Represent point P (2, 3and 1) m given in Cartesian co-ordinates into cylindrical co-ordinates.	Remember	2
7	Give the relation between three co ordinate systems.	Remember	1
8	State divergence theorem.	Understand	1
9	How is the unit vectors defined in three co ordinate systems?	Remember	2
10	State coulombs' law?	Remember	2
11	State gauss law?	Remember	1

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
12	Write expression for differential length in cylindrical and spherical co-ordinates.	Remember	1
13	What is physical significance of divergence of D?	Remember	1
14	Express the divergence of a vector in the three system of orthogonal Co-ordination.	Understand	1
15	Define dipole and dipole element?	Understand	1
16	Define electric flux and flux density?	Remember	1
17	Define electric field and electric intensity?	Application	1
18	Distinguish electric potential and potential difference?	Remember	1
19	State point form of ohms law?	Remember	2
20	State stokes theorem	Understand	1
21	Define electric scalar potential	Remember	1
22	Obtain Poisson's equation from Gauss's law	Understand	1
UNIT-II CONDUCTORS, DIELECTRICS AND CAPACITANCE			
1	What is an electric dipole? And write down the potential due to an electric dipole.	Remember	2
2	What is displacement current?	Understand	1
3	What is magnetic dipole moment?	Understand	2
4	Define magnetization	Remember	6
5	Define magnetic susceptibility.	Application	2
6	What is the relation between relative permeability and susceptibility?	Remember	2
7	State the boundary conditions at the interface between two perfect dielectrics.	Remember	2
8	What is capacitor? Define the capacitance of a capacitor and state its units.	Understand	2
9	Write the point form of Ohm's law.	Remember	2
10	Define dielectric strength?	Understand	6
11	Define B-H curve for classifying magnetic materials.	Understand	6
12	Classify the magnetic materials.	Remember	6
13	Write the expression for energy stored in an inductor.	Remember	6

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
14	Write the boundary condition for the electric field	Remember	2
15	What are the basic properties of a good conductor?	Understand	6
16	What are the different types of magnetic materials?	Understand	6
17	Define magnetic flux?	Remember	2
18	Define mmf?	Remember	2
19	Define Reluctance and permeance?	Understand	2
20	Define self inductance. Define Mutual inductance.	Understand	2
	UNIT-III **MAGNETO STATICS**		
1	Define Lorentz law of force.	Remember	3
2	State Biot-Savart Law.	Analysis	3
3	State Ampere's circuital law.	Understand	3
4	What is the difference between scalar and vector magnetic potential.	Analysis	3
5	Define Magnetic Moment.	Analysis	3
6	What is magnetic dipole moment?	Remember	2
7	Define magnetic vector potential.	Understand	3
8	Define flux density or energy density in a magnetic circuit?	Remember	3
9	What is the relation between magnetic flux density and field intensity?	Analysis	2
10	Write down the magnetic boundary conditions?	Remember	3
11	Give the force on a current element carrying 10A if the separation of two parallel plates is 1m?	Understand	3
12	A Current of 3A flowing through an inductor of 100mH. What is the energy stored in inductor?	Analysis	3
13	Define magnetization vector?	Remember	2
14	Write Lorentz equation for F = Q (E + (V X B))	Analysis	2
15	What is solenoid?	Understand	3
16	Define magnetic field intensity	Understand	3
17	Give the torque experienced by a current carrying loop placed in a magnetic field?	Understand	3
18	What is the relation between relative permeability and susceptibility?	Understand	3

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
19	Can a magnetic field exist in a good conductor if it is static or time varying? Explain.	Understand	3
20	Write down the equation for general integral and point form of Ampere's law?	Remember	3
21	What is field due to torrid and solenoid?	Understand	3
22	Define magnetic moment?	Remember	3
23	Give torque on closed circuits?	Remember	2
24	What are the major classifications of magnetic materials?	Understand	3
25	State gauss law for magnetic field?	Remember	3
26	Give the similarities between electrostatic and magnetic field?	Understand	3
27	Define magnetic dipole?	Remember	3
28	Define magnetic susceptibility?	Remember	3
UNIT-IV **FORCE IN MAGNETIC FIELDS AND MAGNETIC POTENTIAL**		
1	State Faraday's law of induction.	Remember	5
2	State Lorentz's law	Remember	5
3	What is motion of charged particle in magnetic field.	Understand	5
4	Define magnetic dipole.	Analysis	4
5	Define self Inductance.	Remember	4
6	Define Mutual Inductance.	Understand	4
7	What is scalar magnetic potential.	Remember	4
8	What is vector magnetic potential.	Understand	4
9	Define propagation constant.	Remember	4
10	Define Polarization of uniform plane wave.	Remember	4
11	For a loss dielectric material having $\mu r=1$, $\varepsilon r=48$, $\sigma=20s/m$. calculate the propagation constant at a Frequency of 16 GHz	Analysis	4
12	Write down the expression for instantaneous power flow in electromagnetic field and instantaneous Pointing vector?	Analysis	4
13	Define Circular Polarization.	Remember	4
14	Define Elliptical and Linear polarization.	Remember	4
15	Write Helmholtz equation?	Understand	4

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
16	Find the velocity of a plane wave in a lossless medium having a relative permittivity of 5 and relative Permeability is unity?	Remember	4
17	Write down the complex pointing vector in rectangular coordinates?	Analysis	4
18	An EM has Ex and Hx as components of electric and magnetic fields respectively.	Understand	4
19	Find the direction of power of flow.	Analysis	4
20	State Silesian vector?	Understand	4
21	Define surface impedance.	Understand	4
22	Can a magnetic field exist in a good conductor if it is static or time varying? Explain.	Analysis	4
23	In a time varying situation how do you define a good conductor and lossy dielectric?	Analysis	4
24	Write the two dimensional wave equations for a wave travelling in z direction	Remember	4
UNIT-V **TIME VARYING FIELDS**		
1	Explain faraday law of electromagnetic induction.	Remember	5
2	What is statically induced E.M.F.	Understand	5
3	What is dynamically induced E.M.F.	Understand	5
4	Write Maxwell's equation in point and integral form.	Remember	5
5	What is significance of displacement current density?	Understand	5
6	What is motional E.M.F?	Understand	5
7	What is the E.M.F produced by moving loop in time varying field?	Remember	5
8	What is conduction and displacement current density?	Analysis	5
9	State Pointing Theorem.	Understand	5
10	Explain Faraday's Disc generator.	Analysis	5
11	Give time harmonic Maxwell's equation in point forms. Assume time factor e-iωt .	Understand	5
12	Give the expression for lifting force of an electromagnet.	Understand	5
13	Write the Maxwell's equation from faradays law?	Understand	5
14	Write the Maxwell's equation in differential form.	Analysis	5
15	What is the energy stored expression in a magnetic field?	Analysis	5

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
16	Compare energy stored in inductor and capacitor?	Remember	5
17	Explain why Del dot B is zero?	Remember	5
18	What is the mutual inductance of two inductively tightly coupled coils with self inductance of 25mH and 100 mH ?	Remember	5
19	Explain why curl E is zero?	Remember	5
20	State the flux rule for a nonrectangular loop moving through a no uniform magnetic field.	Analysis	5
21	Give the situations when the rate of change of flux results in a non-zero value.	Understand	5
22	Write the Maxwell's equations from ampere circuital law both in integral and point form?	Analysis	5
23	Tabulate the Maxwell's equation for conducting and free space medium?	Understand	5
24	What is the electric field and power flow in the co axial cable?	Remember	5
25	Write the expression for total current density	Analysis	5

2. Group - II (Long Answer Questions)

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
	UNIT-I **ELECTROSTATICS**		
1	State and explain Curl, Gradient and Divergence also find the potential due to an electric dipole.	Understand	1
2	Check validity of the divergence and curl theorem considering the field D=2xy ax+x2ay c/m^2 and the rectangular parallel piped formed by the planes x=0,x=1,y=0,y=2 &z=0,z=3.	Analysis	1
3	Derive poisons and Laplace equations.	Understand	1
4	State and prove Gauss law and explain applications of Gauss law.	Remember	1
5	Define the potential difference and electric field. Give the relation between potential and field intensity. Also Derive an expression for potential due to infinite uniformly charged line and also derive potential due to electric dipole.	Remember	2
6	State and explain a) Stokes theorem b) Divergence theorem c) The electric flux density	Understand	2
7	Find the electric field due to n-charges, and also establish the relation between potential and electric field.	Understand	1
8	Derive an expression for the electric field intensity at any point due to a uniformly line charge with density r_l c/$_m$	Analysis	1
9	Derive an expression for the electric field intensity at any point due to a uniformly charged sheet with density r_s c/$_m^2$	Understand	1

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
10	Derive an expression for the electric field intensity at any point due to a volume charge with density r_v c/ $_m^3$	Understand	1
11	State gauss law for the electric and magnetic fields. Derive its integral and differential forms. Make at least two conclusions?	Understand	1
12	Define the terms (i) Electric Field Intensity (ii) Electric Potential.	Analysis	1
13	Derive the relation between electric field and electric potential in rectangular co-ordinates.	Analysis	1
14	Define potential difference and derive the express for potential difference $V_{AB.}$	Analysis	1
UNIT-II **CONDUCTORS, DIELECTRICS AND CAPACITANCE**			
1	Derive the boundary conditions of the normal and tangential components of electric field at the Inter face of two media with different dielectrics	Understand	6
2	Derive the expression for electric potential due to Dipole.	Analysis	2
3	Drive an expression for energy stored and energy density in an Electrostatic field	Understand	2
4	Find the expression for the cylindrical capacitance using Laplace equation.	Remember	2
5	Find the capacitance of a two concentric spherical shells.	Understand	6
6	Derive the expression for co-efficient of coupling.	Understand	6
7	Derive the expression for the energy stored in the parallel plate capacitor.	Understand	6
8	Using the concept of magnetic vector potential, derive Biot Savart's law and amperes law?	Understand	6
9	Derive an expression for the capacitance of a spherical capacitor with conducting shells of radius a and b.	Remember	3
10	Derive the expression for the continuity equation of current in differential form and also derive the expression for inductance of a solenoid with N turns and l meter length carrying a current of I amperes.	Understand	2
11	Derive the express for torque on an Electric dipole placed in electric field.	Understand	2
12	A solenoid has an inductance of 20 mH If the length of the solenoid is increased by two times and the radius is decreased to half of its original value, find the new inductance	Analysis	2
13	Derive the expression for potential energy stored in the system of n-point charges	Understand	2
14	Derive an expression for Poisson and Laplace equations and also Derive an expression for the inductance of solenoid	Remember	2

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
15	Derive the boundary conditions at an interface between two magnetic medias.	Remember	6
	UNIT-III **MAGNETO STATICS**		
1	Derive the expression for magnetic field intensity and magnetic flux density due to finite and infinite line.	Understand	3
2	Derive the expressions for magnetic field intensity and magnetic flux density due to circular coil.	Understand	3
3	Derive an expression for force between two current carrying conductors.	Remember	3
4	Derive the expression for torque developed in a rectangular closed circuit carrying current I in a uniform field.	Analysis	3
5	State Ampere's circuital law and explain any two applications of Ampere's Circuital law.	Understand	3
6	Derive the magnetic field intensity developed in a triangular closed circuit carrying current I in a uniform field.	Understand	3
7	Derive the magnetic field intensity developed in a circular loop carrying steady current I in a uniform field. Using Ampere circuital law derive the magnetic field intensity due to a co-axial cable carrying a steady current I	Understand	3
8	Derive the magnetic field intensity developed in a square loop carrying current I in a uniform field. Also State Lorentz force equation for a moving charge and explain its applications.	Understand	3
9	Derive the expression for coefficient of coupling in terms of mutual and self inductances	Understand	3
10	Derive the expression for curl H=J?	Understand	3
	Explain the concepts of scalar magnetic potential and vector magnetic potential? Find the maximum torque on an 85 turns rectangular coil with dimension (0.2x0.3) m carrying a current of 5 Amps in a field B = 6.5T	Understand	3
11	State and explain ampere circuital law	Analysis	4
12	Define magnetic induction, magnetic field ,magnetic flux density, magnetic field intensity, magnetic permeability and magnetic susceptibility.	Understand	4
13	State and explain Bio Savarts law, use the same to find an expression for the magnetic field intensity due to a long current carrying conductor.	Remember	3
14	Derive the expression for Maxwell's second and third equations.	Remember	3
15	Using Biot Savarts Law .Find H at any point on the axis of a circular current carrying coil.	Understand	3
	UNIT-IV **FORCE IN MAGNETIC FIELDS AND MAGNETIC POTENTIAL**		
1	A plane wave propagating through a medium with εr=8, μr=2 has E=0.5 sin (108t-βz) az v/m. Determine (i) β (ii) The loss tangent (iii) Wane impedance (iv) Wave velocity	Understand	4

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
	(v) Magnetic field		
2	Discuss motion of charged particle in magnetic field.	Understand	4
3	Derive the expression for Lorentz force equation.	Understand	4
4	Derive the expression for force on a straight current carrying conductor placed in a magnetic field.	Understand	4
5	Derive the expression for the force between two current carrying conductors in the same direction.	Understand	4
6	Derive the expression for the torque on a current loop placed in a magnetic field.	Analyze	4
7	Define magnetic dipole? What is magnetic moment? Describe how a differential current loop behaves like a magnetic dipole.	Understand	4
8	Derive the expression for vector magnetic potential 'A' which satisfies the vector poisons equation.	Understand	4
9	Derive the expression for self-inductance of solenoid and torrid.	Analysis	4
10	Derive the expression for energy stored and energy density in a magnetic field.	Understand	4
11	Derive the general wave equations? And also discuss the wave motion in good conductors?	Remember	4
12	Analyze the wave behavior at boundaries under oblique incidence and derive the Brewster's angle. Also prove that a linearly polarized wave can be resolved into a right hand circularly polarized wave and a left hand circularly polarized wave of equal amplitude.	Remember	4
13	With reference to electromagnetic waves, explain the following a) Linear polarization b) Circular polarization c) Elliptical polarization and also derive the expression for standing wave. Find the location of nodes and antinodes in E and H fields.	Understand	4
14	Obtain the wave equation for conducting medium	Understand	4
15	Obtain the expression for the reflection by a perfect dielectric normal incidence	Analysis	4
16	From Maxwell's equation, derive the electromagnetic wave equation in conducting medium for E and H fields. And also explain different types of polarizations of uniform plane waves.	Understand	4
	UNIT-V **TIME VARYING FIELDS**		
1	Write and explain the Maxwell's equation in differential and integral forms for fields varying harmonically with time.	Understand	5
2	Derive Maxwell's four equations in point form and in differential form.	Understand	5
3	What is the physical significance of the pointing vector? And explain it in detail? Derive the expression for total power flow in coaxial cable?	Understand	5
4	Derive general field relations for time varying electric and magnetic fields using Maxwell's equation?	Understand	5
5	Explain faraday's law of Electromagnetic induction and derive the expression for induced E.M.F?	Analysis	5

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
6	Explain about induced E.M.F. and Derive the expressions for statically induced E.M.F and dynamically induced E.M.F	Understand	5
7	What do you mean by displacement currents? Write down the expression for the total current density?	Analysis	5
8	Explain briefly about the motional emf and derive an expression for it?	Understand	5
9	Discuss the pointing vector and pointing theorem? Also derive the ampere circuital law.	Understand	5
10	Define faradays laws. What are the different ways of emf generation? Explain with governing equation and suitable example for each? Also derive the differential and integral form of faradays law.	Understand	5
11	Define Brewster angle and derive its expression?	Understand	5
12	Derive the relationship between electric and magnetic fields?	Analysis	5
13	Explain complex, average and instantaneous poynting vector.	Understand	5
14	Derive the modified form of ampere circuital law in integral and differential forms.	Remember	5
15	Generate Ampere's law for time varying fields. Also list the Maxwell's equations in integral and point form for free space conditions.	Understand	5
16	Derive an expression for displacement current density J_d, and also give the physical interpretation of Maxwell's equation.	Analysis	5