Hall Ticket No | | | | | | | | | | | Question Paper Code: AEEB10

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER - II

Second Year B.Tech III Semester End Examinations, November – 2019

Regulations: R18

ELECTRO-MAGNETIC FIELD

(EEE)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT - I

1.	a)	Illustrate in detail about the coulomb's law in electric field	[7M]
	b)	Determine the electric field intensity of an infinitely long, straight line charge of a uniform density ρ in air.	[7M]
2.	a)	Derive the boundary conditions for electrostatic fields	[7M]
	b)	A parallel plate capacitor consists of two parallel conducting plates of area S separated by a uniform distance *d*. The space between the plates is filled with a dielectric of a constant permittivity, ε. Determine the capacitance	[7M]

UNIT – II

3.	a)	An infinitely long, straight conductor with a circular cross section of radius *b* carries a steady current I. Determine the magnetic flux density both inside and outside the conductor.	[7M]
	b)	Derive the vector magnetic potential.	[7M]
4.	a)	Find the inductance per unit length of a very long solenoid with air core having 'n' turns per unit length.	[7M]
	b)	Determine the force per unit length between two infinitely long parallel conducting wires carrying currents I_1 and I_2 in the same direction. The wires are separated by a distance d.	[7M]

UNIT – III

5.	a)	Derive the integral form of Maxwell's equation.	[7M]
	b)	A circular loop o N turns of conducting wires lies in the xy plane with its center at the origin of a magnetic field specified at the origin of a magnetic field specified by $B = a_z B_0 \cos(\pi r / 2b)\sin\omega t$, where 'b' is the radius of the loop and ω is the angular frequency. Find the emf induced in the loop	[7M]
6.	a)	Using Ampere circuital law to derive the expression for magnetic field intensity Due to short current carrying filament and due to an infinite current sheet.	[7M]

	b)	A rectangular loop in the xy-plane with sides b1 and b2 carrying a current I lies in a uniform magnetic field $B = a_xB_x+a_yB_y+a_zB_z$. Determine the force and torque on the loop.	[7M]

UNIT – IV

7.	a)	State Biot Savart's law and derive the expressions for magnetic field intensity of a straight current carrying conductor.	[7M]
	b)	Derive the magnetic field intensity of a circular current carrying conductor.	[7M]
8.	a)	Derive the inductance of toroid and solenoid	[7M]
	b)	Derive the equation which relates magnetization and permeability and explain the different types of magnetic materials.	[7M]

UNIT – V

9.	a)	State the poynting theorem equation from Maxwell's curl equation	[7M]
	b)	Derive the Maxwell's equations in differential form and integral form	[7M]
10.	a)	Apply Lorentz force equation, to derive the force on a differential current element n magnetic field.	[7M]
	b)	Illustrate with an example, to apply Poisson's and Laplace equation.	[7M]

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COURSE OBJECTIVES:

The course should enable the students to:

I	Demonstrate the concept of electrostatic field intensity and electric potential.
II	Illustrate polarization of dielectrics and the behavior of conductors and dielectrics in an electric field.
III	Understand the concept of field intensity and flux density in magnetic fields.
IV	Discuss forces in magnetic fields and laws of electromagnetic induction
V	Summarize the concept of time varying field and analyze propagation of electro-magnetic waves.

COURSE OUTCOMES (COs):

CO 1	Determine the force and electric field intensity due various types of charge distribution with the help of vector calculus.
CO 2	Estimate the capacitance of various configurations and study behaviour of charges in conductors and dielectrics.
CO 3	Understand Bio-Savart's law and determine magnetic field intensity due different configuration of conductors, their other deductions.
CO 4	Calculate the magnetic force acting on body due to different configurations of conductors and deduce the magnetic potentials.
CO 5	State Faraday's laws of electromagnetic induction in time varying fields and analyze wave propagation in electro-magnetic fields.

COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

S. No	Description
AEEB10.01	Analyze the force and electric field intensity in the electrostatic field.
AEEB10.02	Identify the characteristics of electrostatic fields in terms of definitions.
AEEB10.03	State different laws which defines characteristics of electrostatic fields.
AEEB10.04	Illustrate polarization of dielectrics and the behavior of conductors and dielectrics in electric field.
AEEB10.05	Demonstrate the electric dipole and its effect on electric field.
AEEB10.06	Estimate the capacitance of parallel plates, spherical and coaxial capacitors with composite dielectrics.
AEEB10.07	Summarize the concept of magneto static and interrelate the terms of magnetic fields.
AEEB10.08	Interpret the magnetic field intensity due to circular, square and solenoid current carrying wire.
AEEB10.09	Use Ampere circuital law to determine magnetic field intensity due to an infinite sheet of current, a long current carrying filament and its applications.

AEEB10.10	Predict the force due to moving charge in the magnetic field for different configuration of current carrying conductor.
AEEB10.11	Demonstrate the magnetic dipole and its effect on magnetic field.
AEEB10.12	Calculate the self inductance and mutual inductance for different configurations of wires and applications of permanent magnet.
AEEB10.13	State the Faraday's laws of electromagnetic induction and nature of voltage induced in the coil.
AEEB10.14	Derive and explain the differential and integral form of Maxwell's equation in time varying fields and fields varying harmonically with time.
AEEB10.15	Discuss the electromagnetic wave propagation and its analysis.
AEEB10.16	Apply the concept of electromagnetic and electrostatic fields to solve real time world applications.
AEEB10.17	Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.

MAPPING OF MODEL QUESTION PAPER QUESTIONS TO THE ACHIEVEMENT OF COURSE LEARNING OUTCOMES:

SEE QUESTION No.		COURSE LEARNING OUTCOMES		BLOOM'S TAXONOMY LEVEL
1	a	AEEB10.01	Analyze the force and electric field intensity in the electrostatic field.	Understand
	b	AEEB10.01	Identify the characteristics of electrostatic fields in terms of definitions.	Understand
2	a	AEEB10.03	State different laws which defines characteristics of electrostatic fields.	Understand
	b	AEEB10.02	Illustrate polarization of dielectrics and the behavior of conductors and dielectrics in electric field.	Understand
3	a	AEEB10.05	Demonstrate the electric dipole and its effect on electric field.	Understand
	b	AEEB10.06	Estimate the capacitance of parallel plates, spherical and coaxial capacitors with composite dielectrics.	Understand
4	a	AEEB10.05	Summarize the concept of magneto static and interrelate the terms of magnetic fields.	Understand
	b	AEEB10.06	Interpret the magnetic field intensity due to circular, square and solenoid current carrying wire.	Understand
5	a	AEEB10.08	Use Ampere circuital law to determine magnetic field intensity due to an infinite sheet of current, a long current carrying filament and its applications.	Understand
	b	AEEB10.09	Predict the force due to moving charge in the magnetic field for different configuration of current carrying conductor.	Understand
6	a	AEEB10.08	Demonstrate the magnetic dipole and its effect on magnetic field.	Understand
	b	AEEB10.08	Calculate the self inductance and mutual inductance for different configurations of wires and applications of permanent magnet.	Understand
7	a	AEEB10.08	State the Faraday's laws of electromagnetic induction and nature of voltage induced in the coil.	Remember
	b	AEEB10.11	Derive and explain the differential and integral form of Maxwell's equation in time varying fields and fields varying harmonically with time.	Understand
8	a	AEEB10.12	Discuss the different numerical methods to calculate the electrostatic and magneto static fields.	Understand
	b	AEEB10.10	Apply the concept of electromagnetic and electrostatic fields to solve real time world applications.	Understand

SEE QUESTION No.		COURSE LEARNING OUTCOMES		BLOOM'S TAXONOMY LEVEL
9	a	AEEB10.10	Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.	Understand
	b	AEEB10.10	Analyze the force and electric field intensity in the electrostatic field.	Understand
10	a	AEEB10.13	Identify the characteristics of electrostatic fields in terms of definitions.	Understand
	b	AEEB10.13	State different laws which defines characteristics of electrostatic fields.	Understand

Signature of the Course Coordinator
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HOD, EEE