Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

Third Semester

Electrical and Electronics Engineering

EE3301- Electromagnetic Fields

Regulations - 2021

Duration : 3 Hrs *Maximum: 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	Questions	BLT	CO	Marks
1.	What are the sources and effects of electromagnetic fields?	RE	1	2
2.	The satellite is located at 12° N, 37° E in the earth. The radius of the earth is 6371 km. calculate the point in cartesian coordinate. Assuming center of earth as origin.	UN	1	2
3.	Write the Poisson's and Laplace's equations in electrostatic fields.	RE	2	2
4.	Calculate the energy stored in 10µF capacitor which has been charged to a voltage of 400 V.	UN	2	2
5.	What is magnetic torque and give the expression in terms of magnetic dipole moment?	RE	3	2
6.	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.	UN	3	2
7.	State Faraday's law.	RE	4	2
8.	Find displacement current density for the field E=300 sin 10^9t V/m.	UN	4	2
9.	What is skin depth?	RE	5	2
10.	Calculate the intrinsic impedance in free space.	UN	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*13 = 65)*

Q.No			Questions	BLT	CO	Marks
11.	a	i	Find Divergence and curl of vector $\vec{A}=2x^2yz\,\vec{a}_x + 2xz\,\vec{a}_z$.	AP	1	5
		ii	Derive an expression for electric field intensity E due to anuniformly charged finitely long straight line with constant charge density of ρ_l in C/m.	UN	1	8
			Or			
	b	i	Find gradient of vector $V = e^{-z}sin2x\,coshy$.	AP	1	5
		ii	State and prove the coulomb's law.	UN	1	8
12.	a	i	A parallel plate capacitor with separation of 1 cm has 29 kV applied, when air was used as dielectric. Assume dielectric strength of air as 30 kV/cm. A thin piece of glass with ε_r=6.5 with dielectric strength of 290 kV/cm with thickness 0.2 cm is inserted. Determine whether glass or air will break.	AP	2	5
		ii	A circular disc of radius R in m is uniformly charged with charge density of 'ρ_s' in C/m^2. Find the electric potential at a point 'h' in m from the disc along its axis.	UN	2	8
			Or			

	b	i	A capacitor of squared two metal plates each 100 cm side placed parallel and 2 mm apart. the space between the plates is filled with dielectric having a relative permittivity of 3.5. a potential drop of 500 V is maintained between the plates. Calculate 1. Capacitance 2. The electric flux density 3. The potential gradient.	AP	2	5
		ii	Derive the boundary condition expression between a perfect conductor and a dielectric for electrostatic fields. Use Gauss's law and the properties of electric field behavior at the boundary.	UN	2	8
13.	a	i	A Power line carries a current of 500 A. Determine the magnetic field in a house located 100 m away from the power line and illustrate the variation of magnetic fields.	AP	3	5
		ii	By apply the Biot-Savart's law, obtain the magnetic flux density produced by an infinitely long straight wire carrying a current I at any point with distant 'r' normal to the wire.	UN	3	8
			Or			
	b	i	A point charge of Q=-1.2 C has velocity V=5a_x+2 a_y - 3 a_z m/s. Find the magnitude of the force exerted on the charge if E=-18a_x+5 a_y - 10 a_z and B= -4a_x+4 a_y + 3 a_z T.	AP	3	5
		ii	State and prove the Ampere's circuit law.	UN	3	8
14.	a	i	The conduction current flowing through a wire with conductivity $\sigma = 3 \times 10^7$ s/m and relative permeability $\mu_r = 1$ is given by $I_c = 3\sin wt$(mA) If $w = 10^8$ rad/sec. Find the displacement current.	AP	4	5
		ii	Derive the integral and point form of Maxwell equation from Amperes circuital law.	UN	4	8
			Or			
	b	i	A conductor of length 0.5 m moves is a uniform magnetic field of density 2.2 T at a velocity of 30 m/s. Calculate the induced voltage in the conductor when the direction of motion is perpendicular to the field.	AP	4	5
		ii	Derive the integral and point form of Maxwell equation from Faradays law and Gauss's Law.	UN	4	8
15.	a	i	Describe the wave propagation parameters in lossy dielectrics.	UN	5	5
		ii	Derive the phasor form of wave equation for time varying fields.	UN	5	8
			Or			
	b	i	Explain the Poynting vector with necessary assumption.	UN	5	5
		ii	Obtain the expression for plane wave reflection and refraction coefficient in different medium.	UN	5	8

*PART – C (Marks 1*15 = 15)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
16.	a	In an ink-jet printer the drops are charged by surrounding the jet of radius 20 µm with a concentric cylinder of radius 600 µm as in figure1. Calculate the minimum voltage required to generate a charge 50 fC on the drop if the length of the jet inside the cylinder is 100 µm.	AP	2	15

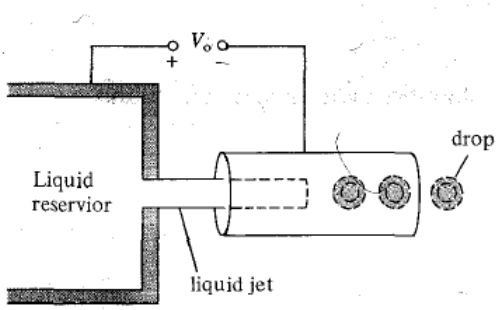

Figure 1

Or

	b	Current-carrying components in high-voltage power equipment must be cooled to carry away the heat caused by ohmic losses. A means of pumping is based on the force transmitted to the cooling fluid by charges in an electric field. The Electro Hydro Dynamic (EHD) pumping is modelled in below figure 2. The region between the electrodes contains a uniform charge ρ_0, which is generated at the left electrode and collected at the right electrode. Determine the electric field intensity.	AP	2	15

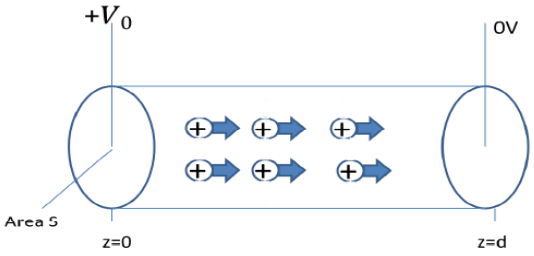

Figure 2