

Reg. No.:



Y8080

Name:

University of Kerala

Fourth Semester FYUGP Degree Examination, May 2026

Discipline Specific Core Course

PHYSICS

UK4DSCPHY201 - Electromagnetics and Transient Currents

Academic Level: 200-299

2024 Admission

Time: 1 Hour 30 Minutes(90 Mins.)

Max. Marks: 42

Part A. 6 Marks.Time:6 Minutes.(Cognitive Level:Remember(RE)/Understand(UN)) Objective Type. 1 Mark
Each.Answer all questions

Qn No.	Question	CL	CO
1	List the factors on which electrostatic force depends.	RE	1
2	Memorize the expression for charging current in a CR circuit.	RE	2
3	Explain the concept of energy density of an electromagnetic wave.	UN	5
4	Interpret the reason for the magnetic force always perpendicular to the velocity of the particle.	UN	3
5	Describe the reason for the magnetic flux to be zero when the field is parallel to the surface.	UN	3
6	Interpret the significance of surface charge density (σ).	UN	1

Part B. 8 Marks.Time:24 Minutes.(Cognitive Level:Understand(UN)/Apply(AP))Short Answer. 2 marks each.Answer all questions

Qn No.	Question	CL	CO
7	Outline the expression for decay of current in LR circuit.	UN	2
8	Illustrate the orientation of the electric field, the magnetic field, and the direction of propagation.	UN	5
9	Determine the charge density ρ corresponding to the electric field $\vec{E} = kr^3\hat{r}$ (k is some constant) in spherical coordinates.	AP	1
10	A charged particle moves with velocity $\vec{v} = (3\hat{i} + 4\hat{j})$ m/s in a magnetic field $\vec{B} = (2\hat{i} - \hat{j})$ T. Calculate the magnetic force acting on it (charge = 1 C).	AP	3

Part C. 28 Marks.Time:60 Minutes (Cognitive Level:Apply(AP)/Analyse(AN)/Evaluate(EV)/Create(CR)) Long Answer.7 marks each.Answer all 4 Questions choosing among options * within each question

Qn No.	Question	CL	CO
11	A) The electric field in a region is known. (a) Use the electric field to calculate the energy stored per unit volume of the field.(3 marks) (b) Determine the total electrostatic energy in the region by integrating over the volume. (4 marks) OR B) A system consists of three charges placed along a straight line. (a) Determine the total electrostatic energy by considering all pairwise interactions. (4 marks) (b) Explain how the sign of charges affects the total energy of the system. (3 marks)	AP	1, 1
12	A) A capacitor is charged by DC supply through a resistance of 2 mega ohms. If it takes 0.5 s for the charge to reach three quarters of its final value, examine the capacitance of the capacitor. OR B) A battery of emf V is connected to a series LR circuit. (a) Using Kirchhoff's voltage law, deduce the expression for current i(t) during growth. (b) Examine why the current does not rise instantaneously.	AN	2, 2
13	A) Support the statement that Lenz's law is a consequence of the law of conservation of energy. OR B) Justify the modification of Ampere's law using the concept of a charging capacitor.	EV	4, 4
14	A) Develop Poisson's equation for the magnetic vector potential, and describe the type of solutions it enables for the vector potential. OR B) Generate magnetic field B from the vector potential $A = -xz\hat{j} + \frac{1}{2}x^2\hat{k}$ and verify that $\nabla \cdot B = 0$	CR	3, 3