QP CODE: D4BPH2401	**(Pages: 2)**	**Reg. No**	**: .....**
		Name	**: .....**

FOURTH SEMESTER FYUGP EXAMINATION, APRIL 2026

Discipline Specific Core (DSC) Courses - Major

PHY4CJ203 : ELECTRODYNAMICS – I

(Credits: 4)

Time: 2 Hours **Maximum Marks: 70**

Section A

Answer the following questions. Each carries 3 marks (Ceiling: 24 marks)

1.	State the transformation relations between Cartesian and cylindrical coordinates.	BL2	CO1
2.	Derive the expression for the gradient of a scalar field and explain its physical significance.	BL2	CO1
3.	Define capacitance. Write the SI unit of capacitance and state on what factors it depends.	BL1	CO2
4.	Define electric field intensity. Write the expression for the electric field due to a point charge.	BL2	CO2
5.	State the boundary condition satisfied by the tangential component of the magnetic field B across a surface carrying surface current density K.	BL2	CO3
6.	Explain the significance of the vector cross product in the Biot–Savart law.	BL2	CO3
7.	State the expression for torque on a rectangular current-carrying loop placed in a uniform magnetic field. Define each term and give the direction of torque.	BL2	CO1, CO4, CO6
8.	How is a voltage source replaced while applying the Superposition Theorem?	BL2	CO4
9.	What are the advantages of using a Wheatstone's bridge for resistance measurement?	BL3	CO4
10.	Write the expression used to determine the difference between two nearly equal resistances using a Carey–Foster bridge.	BL3	CO4

Section B

Answer the following questions. Each carries 6 marks (Ceiling: 36 Marks)

11.	Explain the difference between line, surface, and volume integrals with suitable examples from electromagnetics.	BL2	CO1

(PTO)

12.	Explain vector addition and subtraction using geometrical representation. Prove that vector addition is commutative and associative.	BL1	CO1
13.	A ring of radius R=0.2 m carries a total charge Q=6 μC uniformly distributed over it. (a) Derive an expression for the electric potential at a point on the axis of the ring at a distance x from its center. (b) Calculate the potential at a point 0.3 m from the center along the axis.	BL3	CO2
14.	Show that the curl of an electrostatic field is zero and explain the physical meaning of a curl-free electric field and its relation to conservative nature of electrostatic forces.	BL2	CO2
15.	An electron enters a uniform magnetic field with a given speed at an angle to the field direction. Using the Lorentz force law, describe the nature of the trajectory and obtain expressions for the radius and pitch of the path.	BL3	CO3
16.	A long toroidal coil of N turns carries a steady current I. Using Ampère's law, derive an expression for the magnetic field inside the toroid.	BL3	CO3
17.	Analyse the Wheatstone bridge circuit using Maxwell's loop current method to derive the condition for a balanced bridge. Assume a galvanometer in the bridge arm and show that the bridge is balanced when $\frac{P}{Q} = \frac{R}{S}$.	BL4	CO1, CO2, CO6
18.	Two cells of e.m.f.s E_1 and E_2 are balanced on a potentiometer wire at lengths 75 cm and 60 cm respectively. Find the ratio of their e.m.f.s. State the principle used.	BL3	CO4
	Section C		
	Answer any one question. Each carries 10 marks (1 x 10 = 10 Marks)		
19.	Derive the expression for work done in moving a charge in an electrostatic field. Hence obtain the formula for the electrostatic potential energy of a system of point charges. Also show this expression can be extended to a continuous charge distribution and discuss the physical significance of each term.	BL2	CO2
20.	State and derive the Maximum Power Transfer Theorem for a DC network. Obtain the condition for maximum power transfer and explain the physical significance of the result.	BL2	CO4
	CO : Course Outcome		
	BL : Bloom's Taxonomy Levels (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)		