FIRST SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2025

(FYUGP)

(Regular/Supplementary/Improvement)

CC24UPHY1MN104 - ELECTRICITY AND MAGNETISM

(Physics - Minor Course)

(2024 Admission onwards)

Time: 2.0 Hours   Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)

Answer *all* questions. Each question carries 3 marks.

1. Explain the conditions under which a dipole in a uniform electric field experiences no torque.   [Level:2] [CO1]

2. Discuss the change in electrostatic force if the magnitude of one of the charges is tripled while keeping the distance constant.   [Level:2] [CO1]

3. Discuss the behavior of electric field lines between two parallel plates of opposite charge.   [Level:2] [CO1]

4. Discuss a real example which works on the principle of Faraday's Cage.   [Level:2] [CO2]

5. Electric charge Q is uniformly distributed along a line or thin rod of length 2a.Compute the potential at a point P along the perpendicular bisector of the rod at a distance x from its center   [Level:3] [CO2]

6. Express the SI unit of electric flux?Describe what this unit indicates in the context of electric fields.   [Level:2] [CO2]

7. Solve for the total resistance of a circuit that has resistors in series and parallel combinations.   [Level:3] [CO3]

8. Discuss on power input to a pure resistance.   [Level:2] [CO3]

9. Calculate the mean free time between collisions in copper at room temperature. For copper n= $8.5*10^{28}$ m^-3 and resistivity is $1.72*10^{-8}$ ohm m   [Level:3] [CO3]

10. Clarify how does the presence of a magnetic field affect the orientation of a compass needle, and what factors could influence this alignment?   [Level:2] [CO4]

(Ceiling: 24 Marks)

Part B (Paragraph questions/Problem)

Answer *all* questions. Each question carries 6 marks.

11. Two opposite charges of +1 μC and −1 μC are placed at two ends of a 0.2 m long dipole. Find the torque on the dipole if it is placed in a uniform electric field of 5×10^4 N/C at an angle of 30° to the field.

[Level:1] [CO1]

12. A small conducting sphere has a charge of 4×10^{-9} C.Infer how many excess protons are present on the sphere?

[Level:2] [CO1]

13. Considering the electric field of a point charge located at the center of a spherical surface and determine the expression for electric flux through that surface.

[Level:3] [CO2]

14. Discuss the implications of Faraday's experiment for our understanding of electrostatic shielding.How does this principle protect sensitive instruments?

[Level:2] [CO2]

15. Explain how the concept of electric flux relates to the net charge enclosed within a closed surface.Provide an example to illustrate your explanation.

[Level:2] [CO2]

16. Define current , resistance and resistivity.Explain their interrelations.

[Level:2] [CO3]

17. Solve for An 1600 W toaster, a 1.4 k-W electric frying pan ,and a 100 W lamp are plugged into the same 20A , 120 V circuit.a).what current is drawn by each device,and what is the resistance of each device ?b).Will this combination blow the fuse?

[Level:3] [CO3]

18. Explain how the magnetic force acts on a current-carrying straight conductor placed in a magnetic field, using the right-hand rule to describe the direction of the force.

[Level:2] [CO4]

(Ceiling: 36 Marks)

Part C (Essay questions)

Answer any *one* question. The question carries 10 marks.

19. Calculate the Potential

a) At a distance r from a very long line of charge with a linear charge density.

b) At a point P on the ring axis at a distance x from the center of the ring.

[Level:3] [CO2]

20. Discuss the concept of emf and show how current is related to the source emf.

[Level:2] [CO3]

(1 × 10 = 10 Marks)

****