QP Code: D 122704	Total Pages: 2	Name:
		Register No.

SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2025

PHYSICS

PHY2MN101 - Electromagnetism and Network Theorems

2024 Admission onwards

Maximum Time :2 Hours	Maximum Marks :70

Section A

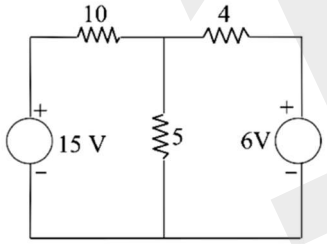
All Questions can be answered. Each Question carries 3 marks (Ceiling: 24 Marks)

1	State and explain Coulomb's law in electrostatics.
2	What is electric flux, and how can we determine the electric flux through a given area when the electric field is nonuniform?
3	What is the expression for the force experiencing on a moving charge in a magnetic field and explain the right-hand rule to find the direction for force.
4	What is cyclotron frequency and write down the expression for it.
5	Define the magnetic dipole moment of a current-carrying loop and write its expression.
6	State and explain Kirchhoff's second law.
7	How do you determine the equivalent current source when converting a voltage source with a series resistance?
8	Define ideal voltage source and ideal current source
9	State Norton's theorem.
10	What is Q factor in an AC circuit?

Section B

All Questions can be answered. Each Question carries 6 marks (Ceiling: 36 Marks)

11	A dipole consists of two charges, +3.0 μC and −3.0 μC, separated by a distance of 6.0 cm. The dipole is placed in a uniform electric field of magnitude 2.0×10^5 N/C. Initially, the dipole is oriented at an angle of 30^o with respect to the electric field. (a)Calculate the magnitude of the torque acting on the dipole. (b) Determine the potential energy of the dipole in this orientation.
12	Derive the expression for electric field due to an infinite plane sheet of charge in terms of its charge density.
13	A magnetron in a microwave oven emits electromagnetic waves with frequency f = 2450 MHz. What magnetic field strength is required for electrons to move in circular paths with this frequency?
14	A long, straight conductor carries a 1.0-A current. At what distance from the axis of the conductor does the resulting magnetic field have magnitude $B = 0.5\times10^{-4}$ T?

15	Two batteries A and B are connected in parallel and load of 10 Ω is connected across their terminals. A has an e.m.f. of 12 V and an internal resistance of 2 Ω; B has an e.m.f. of 8 V and an internal resistance of 1 Ω. Use Kirchhoff's laws to determine the values and directions of the currents flowing in each of the batteries and in the external resistance. Also determine the potential difference across the external resistance.
16	Apply Thevenin's theorem to calculate the current through the 4 Ω resistor in the given circuit. 
17	State and prove maximum power transfer theorem.
18	In a series circuit containing pure resistance and a pure inductance, the current and the voltage are expressed as: $i(t) = 5\sin(314t+2\pi/3)$ and $v(t)=15\sin(314t+5\pi/6)$ (a) What is the impedance of the circuit? (b) What is the value of the resistance? (c) What is the inductance in henrys? (d) What is the average power drawn by the circuit?
Section C	
Answer any ONE. Each Question carries 10 marks (1x10=10 Marks)	
19	Discuss the characteristics of a series RLC circuit when an AC voltage is applied. How does resonance occur, and what are its effects?
20	State Ampere's law and derive the expression for the magnetic field produced by a solenoid and a toroid.