QP CODE: D2BPH2403	(Pages: 3)	Reg. No : .....
		Name : .....

SECOND SEMESTER FYUGP EXAMINATION, APRIL 2025

MINOR COURSE

PHY2MN101 : ELECTROMAGNETISM AND NETWORK THEOREMS

(Credits: 4)

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

Section A

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

1.	State Norton's theorem. How can we Nortonize a given circuit?	BL2	CO3
2.	What is the formula for the magnetic field at a point along the axis of a single circular current loop?	BL2	CO2
3.	Evaluate the determinant: 7 -3 -4 -3 6 -2 -4 -2 11	BL2	CO3
4.	State and explain Gauss's law.	BL2	CO1
5.	State and explain the principle of superposition of forces.	BL2	CO1
6.	Distinguish between active,reactive and apparant power of a RL circuit.	BL2	CO5
7.	Obtain a relation between Resonant power P_o and off- resonant power P for a LCR series ac circuit.	BL2	CO5
8.	State Thevenin's theorem. How can we thevenize a given circuit?	BL2	CO3
9.	What is an ideal voltage source? Explain.	BL2	CO3
10.	What is magnetic flux and how is it defined mathematically? What is the SI unit of magnetic flux?	BL1	CO2

(PTO)

Section B			
Answer the following questions. Each carries 6 marks (Ceiling: 36 Marks)			
11.	Two protons move parallel to the x-axis in opposite directions at the same speed v (small compared to the speed of light c). Find the electric and magnetic forces on the upper proton and compare their magnitudes.	BL3	CO2
12.	A battery having an E.M.F. of 110V and an internal resistance of 0.2 Ω is connected in parallel with another battery having an E.M.F. of 100 V and internal resistance 0.25 Ω. The two batteries in parallel are placed in series with a regulating resistance of 5 Ω and connected across 200 V mains. Calculate the magnitude and direction of the current in each battery and the total current taken from the supply mains.	BL3	CO1
13.	Two load resistance R_1 and R_2 dissipate the same power when connected to a voltage source having an internal resistance of R_i . Prove that (a) $R_i^2 = R_1R_2$ and (b) $\eta_1 + \eta_2 = 1$.	BL2	CO3
14.	A tungsten filament bulb rated at 500-W, 100-V is to be connected to series with a capacitance across 200-V, 50-Hz supply. Calculate : (a) the value of capacitor such that the voltage and power consumed by the bulb are according to the rating of the bulb. (b) the power factor of the current drawn from the supply. (c) draw the phasor diagram of the circuit.	BL3	CO5
15.	The electric field at a distance of 0.145 m from the surface of a solid insulating sphere with radius 0.355 m is 1750 N/C. (a) Assuming the sphere's charge is uniformly distributed, what is the charge density inside it? (b) Calculate the electric field inside the sphere at a distance of 0.200 m from the center	BL3	CO1
16.	An electric dipole is centered at the origin, with dipole moment in the direction of the +y-axis. Derive an approximate expression for the electric field at a point P on the y-axis for which y (where y is the distance betwwen point p and the origin) is much larger than d(where d is the distance between the two charges) . To do this, use the binomial expansion $(1+x)^n = 1+nx +n(n-1)\, x^2/2 +$.....(valid for the case $\|x\|<1$).	BL3	CO1
17.	Derive the expression for the magnetic force on a current-carrying conductor when the magnetic field makes an angle θ with the conductor.	BL3	CO2
18.	A flat sheet of paper of area 0.250 m^2 is oriented so that the normal to the sheet is at an angle of to a uniform electric field of magnitude 14 N/C.	BL3	CO1

	(a) Find the magnitude of the electric flux through the sheet. (b) Does the answer to question (a) depend on the shape of the sheet? Why or why not? (c) For what angle Ø between the normal to the sheet and the electric field is the magnitude of the flux through the sheet (i) largest and (ii) smallest? Explain your answers.		
	Section C		
	Answer any one question. Each carries 10 marks (1 x 10 = 10 Marks)		
19.	(a) Charge Q is uniformly distributed around a conducting ring of radius a. Find the electric field at a point P on the ring axis at a distance X from its center . (b) A nonconducting disk of radius R has a uniform positive surface charge density σ. Find the electric field at a point along the axis of the disk at a distance x from its center. Assume that x is positive.	BL5	CO1
20.	For a purely capacitive AC circuit, derive the instantaneous power equation. Show how the average power in the circuit is zero, and explain the frequency of the power wave. Discuss the significance of the maximum instantaneous power and how the power wave form differs from the voltage and current waveforms. Include an example where the applied voltage is 230V, and the capacitance is 26.5 μF, and calculate the resulting current and power.	BL2	CO4
	CO : Course Outcome		
	BL : Bloom's Taxonomy Levels (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)		