Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, June 2021

Course: Electricity and Magnetism
Semester: II
Course Code: PHYS1013
Programme: B Sc H- Physics **Max. Marks: 100**
Total pages: 2 **Time: 03 hrs.**
Instructions:

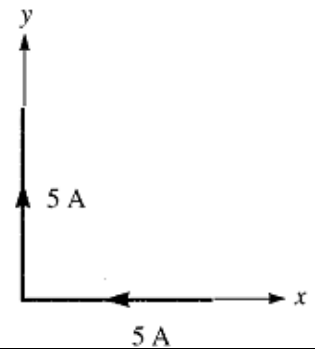
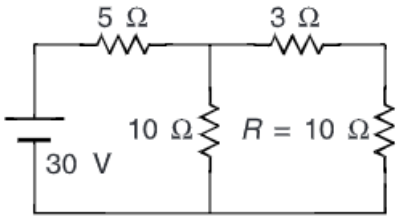
- All questions are compulsory (**Q11, 12** has internal choices)
- Use blank paper as rough work to solve the questions in section-A and write only the correct options (type brief answers/ numerical values, no upload)

SECTION A

S. No.		Marks	CO
Q1.	(i) The ratio of the intensity of magnetic field at the center of a very long solenoid to that at the extreme ends is – (a) 2 (b) ½ (c) 4 (d) ¼ (ii) If a Magnetic field of 1800 Ampere/Meter produce a magnetic flux of 3 x 10^{-5} Weber, in an iron bar of cross sectional area 0.2 cm^2, the relative permeability will be- (a) 663.14 (b) 319.1 (c) Infinite (d) None of above	**5**	**CO1**
Q2.	A parallel plate capacitor has circular plates of radius R = 5.0 cm. While charging, the electric field increases at the rate of $\frac{dE}{dt} = 10^{12} V/(m-s)$. The displacement current would be- (a) 2.5 x 10^{-4} mA (b) 70 mA (c) 0 (d) None of the above	**5**	**CO2**
Q3.	Define Kirchoff's voltage law for AC circuits (statement only)	**5**	**CO3**
Q4.	The maximum potential gradient which a 0.5 mm thick mica sheet can be subjected is -------- Volts. (Given- The dielectric strength for mica is 10^8 V/m.)	**5**	**CO2**
Q5.	The relaxation time of a material with dielectric constant of 6 is 53 seconds. Calculate the conductivity of the material.	**5**	**CO2**
Q6.	Express the point $P(-2, 1, 3)$ in cylindrical coordinates (Enter values only)	**5**	**CO1**

SECTION B

Q7.	Obtain the Electrostatic Boundary conditions for an interface made up of two dielectric media of absolute permittivities ε_1 and ε_2.	**10**	**CO4**
Q8.	Make a comparative discussion on various classes of magnetic materials. Also discuss soft and hard magnetic materials, alongwith their applications.	**10**	**CO3**

Q9.	State Faraday's law of electromagnetic induction. Obtain the differential form of it. A conducting circular loop of radius 20 cm lies in the $z = 0$ plane in a magnetic field $\mathbf{B} = 10 \cos 377t\ \mathbf{a_z}$ mWb/m^2. Calculate the induced voltage in the loop.	**10**	**CO4**
Q10.	Write the Differential form of Maxwell's equation for time varying fields. Point out the term, which expresses the displacement current density. Write few lines about the displacement current.	**10**	**CO4**
Q11.	In a certain conducting region, $\mathbf{H} = yz(x^2 + y^2)\ \mathbf{a_x} - y^2xz\ \mathbf{a_y} + 4x^2y^2\mathbf{a_z}$ A/m . Determine the value of **J** at (5, 2, -3). **OR** An infinitely long conductor is bent into an L shape as shown in Figure below. If a direct current of 5A flows in the conductor, find the magnetic field intensity at $(\mathbf{a})\ (2, 2, 0), (\mathbf{b})\ (0, -2, 0)$, and $(\mathbf{c})\ (0, 0, 2)$. Take the origin at the bend. 	**10**	**CO4**
	SECTION-C		
Q12.	Describe a series resonant LCR circuit, and obtain the expression for impedance, resonant frequency, quality factor and band width. In a LCR circuit, an inductance of 12 mH and resistance of 3 ohms is connected. What is the value of capacitance that will produce resonant frequency of 9000 Hz? Also calculate the maximum instantaneous energy stored in the inductance at resonance. Assume the supply voltage 240 V. **OR** Discuss about the Current and Voltage sources. Utilizing the concept define Thevenin's theorem. Find the current through resistance R and the voltage across it, for the network shown below- 	**20** **20**	**CO3** **CO3**
	Physical constants: $\mu_0 = 4\pi \times 10^{-7} H/m$, $\varepsilon_0 = 8.854 \times 10^{-12} F/m$		