

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5826

J

Unique Paper Code : 2222011203

Name of the Paper : Electrical Circuits Analysis

Name of the Course : B.Sc. (Hons.) Physics- NEP: UGCF-2022

Semester : II

Duration : 2 Hours

Maximum Marks : 60

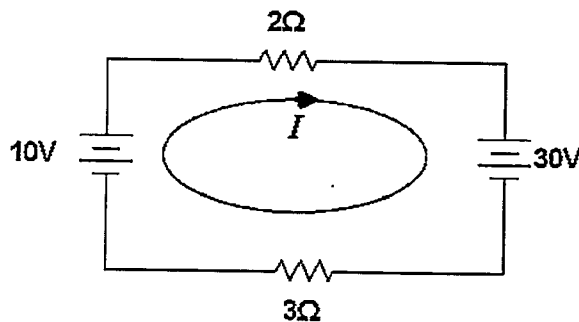
Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. All questions carry equal marks.
3. Ques. No. 1 is compulsory and attempt any **three** from the remaining **four** questions.
4. Use of non-programmable scientific calculator is allowed.

1. Attempt any **five** of the following :

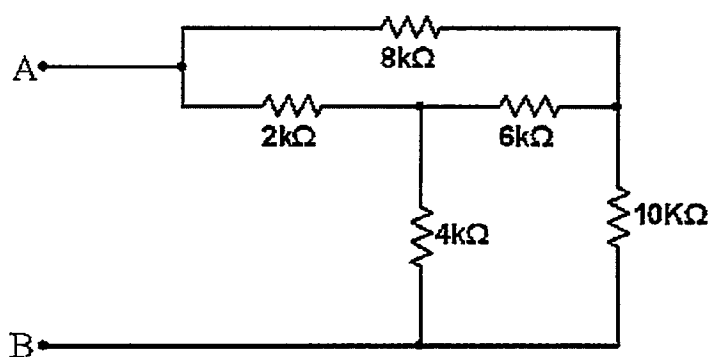
(5×3=15)

- (a) For the given circuit determine the power dissipated in the resistors :

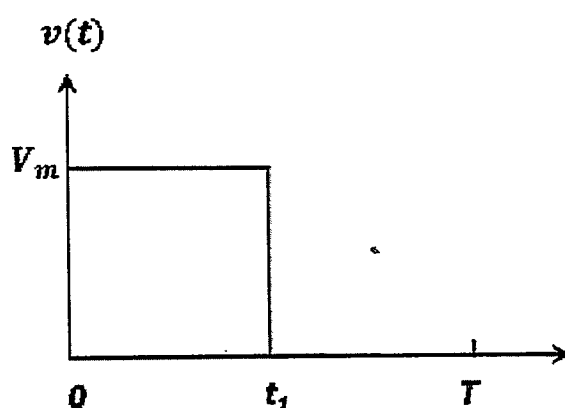


P.T.O.

- (b) Find the equivalent resistance of the following circuit using Star-Delta transformations:

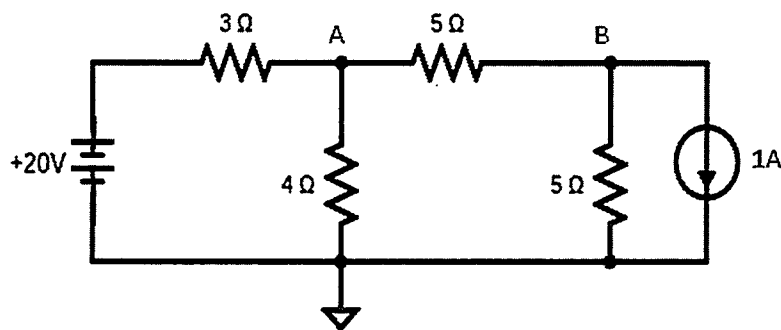


- (c) Define inductive reactance. Write its S.I. units. Plot a graph showing variation of resistance and inductive reactance with change in the frequency of the ac source.
- (d) Prove that an ideal capacitor does not dissipate power in an ac circuit.
- (e) Find the form factor for the periodic wave shown below with time period T :



- (f) A series RC circuit with $R = 5 k\Omega$ and $C = 20 \mu F$ has a constant voltage source of $100 V$ applied at $t = 0$. Obtain the value of voltage across the capacitor and the resistor for $t > 0$ if there is no initial charge on the capacitor.

2. (a) Calculate the direction and magnitude of the current through the $5\ \Omega$ resistor between points A and B in the given circuit by Nodal analysis method. (7)

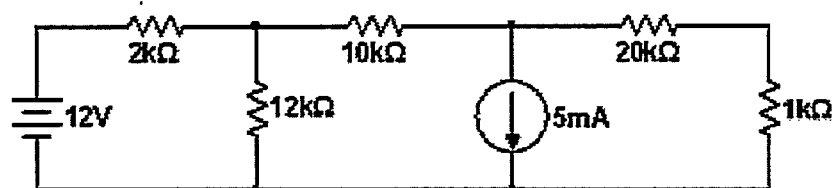


- (b) A coil with a self-inductance of 2.4 H and resistance $12\ \Omega$ is suddenly switched across a 120 V DC supply of negligible internal resistance. Determine the time constant of the coil, the instantaneous value of the current after 0.1 second, the final steady value of the current and the time taken for the current to reach 5 A . (8)
3. (a) In a parallel LCR circuit, the inductance of 0.1 H having a Quality factor of 5 is in parallel with a capacitor. Determine the value of capacitance and coil resistance at resonant frequency of 500 Hz . (7)
- (b) In a series RL circuit containing pure resistance and pure inductance, the current and the voltage are expressed as :

$$i(t) = 5\sin(314t + 2\pi/3) \text{ and } v(t) = 15 \sin(314t + 5\pi/6)$$

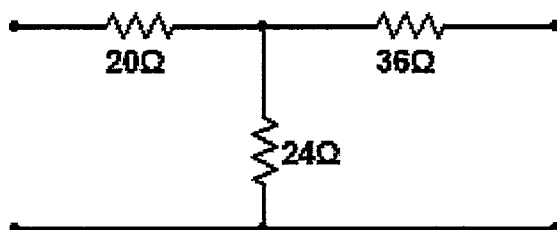
Determine the values of impedance, resistance, inductance and average power drawn by the circuit. (8)

4. (a) Find the Norton equivalent circuit for the given circuit and calculate the load voltage across $1\text{ k}\Omega$ resistance. (7)



(b) Explain Millman's and Tellegen's theorem for the ac circuits. (8)

5. (a) Find the Y-parameters for the following T-network : (7)



(b) According to Maximum Power Transfer theorem, what should be the value of load resistance R_L to obtain maximum power from the 12 V battery shown in the following circuit? What is the value of this power? (8)

