3hrs   **80marks**

N. B:(1) Question No.1 is compulsory.
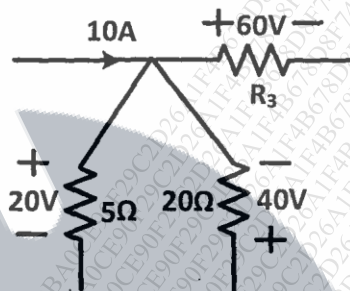
    (2) Answer any THREE from the remaining five questions.

    (3) Assume suitable data if required and state the assumption.

Q1.   **Answer any five.**

    (i) Find value of R_3 in the figure given below by applying Kirchhoff's laws.   4

    (ii) Briefly describe the operation of any one type of stepper motor.   4

    (iii) Two pure circuits elements in a series connection have the following current   4
and applied voltage: $v(t) = 150 \sin(500t+10°)$ V, $i(t) = 13.42 \sin(500t-53.4°)$ A.
Find the supply frequency (in Hz) and the value of circuit elements.

    (iv) A three-phase, three-wire, 100V system supplies a balanced delta-connected   4
load with per phase impedance of $20\angle 45°$ ohms. Determine the line current drawn
and active power taken by the load.

    (v) Draw the phasor diagram of a single phase non ideal transformer feeding a   4
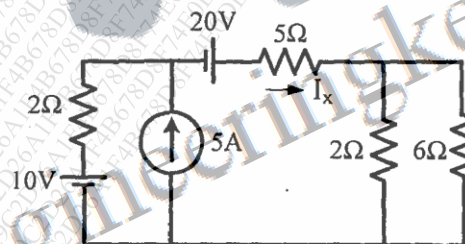resistive load.

    vi) Single phase induction motor is not self-starting. State True or False and Justify   4
your answer.

Q2.   **(A)** Find the current through 5Ω (I_x) using Superposition theorem **without using**   10
source transformation.

**(B)** State and prove Maximum Power Transfer theorem.   05

(C) Plot the variation of current, impedance, resistance, inductive reactance and capacitive reactance when supply frequency is varied in R-L-C series circuit.   05

Q3. **(A)** The Open Circuit (OC) and Short Circuit (SC) tests on a 5 KVA, 200/400 V, 50 Hz, single phase transformer gave the following results.   10
OC: 200 V, 1 A, 100 W (lv side), **SC:** 15 V, 10 A, 85 W (hv side). Draw the equivalent circuit referred to primary and put all values.

(B) Derive the EMF equation of a dc motor.   05

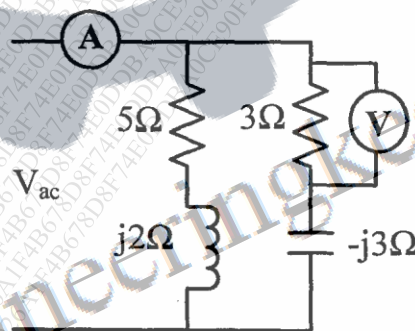**(C)** Find the Root Mean Square (RMS) value of the following waveform.   05
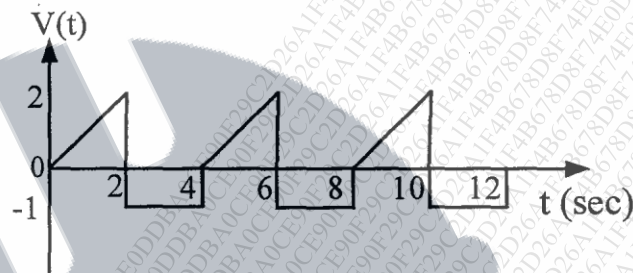
Q4. **(A)** With neat circuit diagram and phasor diagram, prove that by two watt meter method active power and reactive power of a three phase load can be measured.   10

(B) A sinusoidal voltage $v(t)=200\sin\omega t$ is applied to a series *R-L-C* circuit with $R = 20\ \Omega$, $L=100$ mH, and $C =10\ \mu F$. Find (i) the resonant frequency, (ii) RMS value of current at resonance (iii) Quality factor of the circuit, (iv) voltage across the inductor at resonant frequency and (v) phasor diagram at resonance.   10

Q5. **(A)** Derive the transformation formula to convert a delta network of resistors to an equivalent star network and star network of resistors to an equivalent delta network.   10
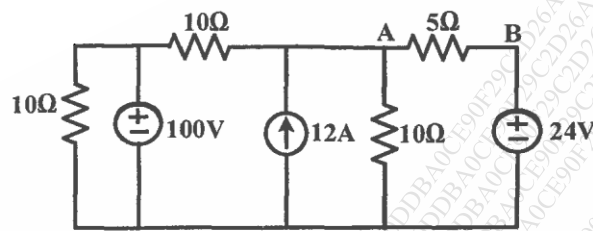
(B) In the parallel circuit, voltmeter across 3 Ω resistor reads 45 V. What is the indication on the ammeter? Also find the input power factor.   10

Q6. **(A)** Find current through 5Ω from A to B using Thevenin's theorem.   10

(B) A 20 KVA Transformer has iron loss of 450W and full load copper loss of   05
900W. Assume power factor of load as 0.8 lagging. Find full load and half load
efficiency of the transformer.

(C) Briefly explain the principle of operation of three phase Induction motor. What   05
are the types of three phase Induction motor?