B.Sc. 1st Semester (Honours) Examination-2022-23

ELECTRONICS

Course ID : 11711 Course Code : SH/ELC/101/C-1T

Course Title : Basic Circuit Theory and Network Analysis (New)

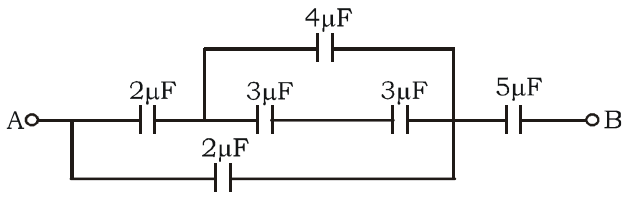
Time : 1 Hour 15 Minutes *Full Marks :* 25

The figures in the right hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer **any *three*** of the following questions : 1×3=3

(a) What is equivalent capacitance between terminals A and B of the following network?



(b) What is the value of the electrical resistance of the resistor with colour rings as follows :

green, blue, yellow and silver.

(c) A sine wave has a frequency of 50kHz. How many cycles does it complete in 20 msec?

(d) What do you mean by '*electric circuit*' and '*electric network*'?

(e) Mention two limitations of Ohm's law.

(f) What do you mean by '*linear*' and '*non-linear*' circuit elements? Give examples.

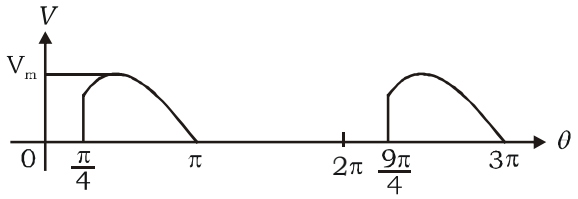
2. Answer **any *three*** of the following questions : 2×3=6

(a) What is the source transformation? Show how a voltage source can be converted into a current source and vice-versa.

(b) The current and voltage through a certain element is given by $v = 100\sin(314t + 45°)$ and $i = 10 \sin(314t + 315°)$. Identify the circuit element and find its value.

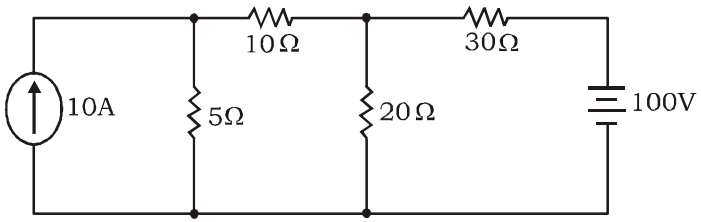
(c) Define frequency, instantaneous value, effective value and average value for a sinusoidal signal. Find RMS and average value of the given waveform.

2+2+2

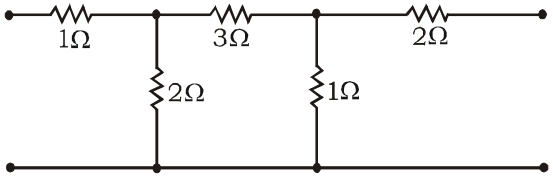


4. Answer **any *one*** question : 6×1=6

(a) State Superposition theorem for a dc network. Find the current through 10Ω resistor using this theorem. 2+4



(b) Find Y parameters for the network shown below. Hence, determine whether the network is symmetrical or reciprocal. 4+2



(c) A series RLC circuit has the following parameters : R = 10Ω, L = 0·01 H and C = 100μF. Find the lower and upper half-power frequencies of the circuit.

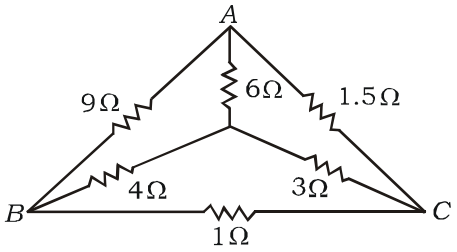
(d) A voltage of $v(t) = 100 \sin \omega t$ is applied to a circuit. The current flowing through the circuit is $i(t) = 15 \sin (\omega t - 30°)$. Determine the average power delivered by the circuit.

(e) If $Z_1 = 3 + j7$ and $Z_2 = 12 - j6$ are connected in parallel, then find the equivalent impedance of their combination.

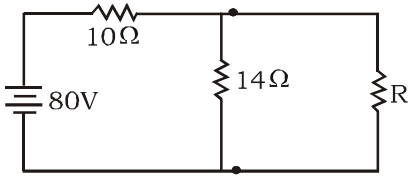
(f) Explain the following terms : Node, Junction, Branch and Mesh.

3. Answer **any *two*** of the following questions : 5×2=10

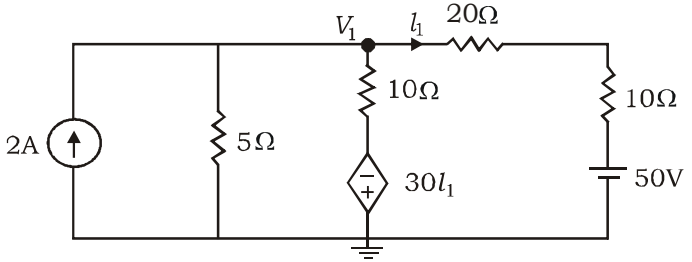
(a) Derive the relationship to express three delta connected resistances into equivalent star. Hence, find the equivalent resistance between the terminals A and B of the given network. 2+3



(b) If the current flowing through R is 3A, find the value of R using i) KVL and ii) KCL. $2\frac{1}{2}+2\frac{1}{2}$



(c) What are dependent sources? Find the voltage across 5Ω resistor in the network shown below. 1+4



(d) What is a '*supernode*'? Using the concept, find the current through 5Ω resistor shown in figure below. 1+4