Total No. of printed pages = 7

19/3rd Sem/DIE301

2021

ELECTRICAL CIRCUITS AND NETWORKS

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Determine the equivalent resistance between A and B (Figure 1). 6

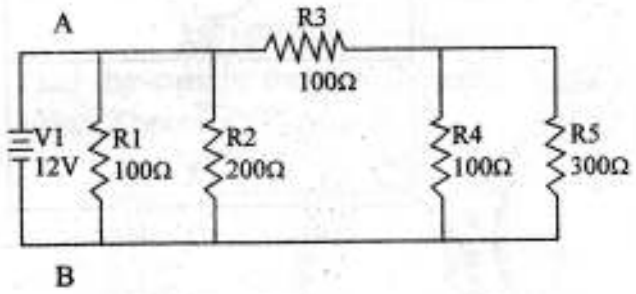

Figure 1

[Turn over

(b) Determine the current through resistor R_1 using current divide rule (Figure 2). 6

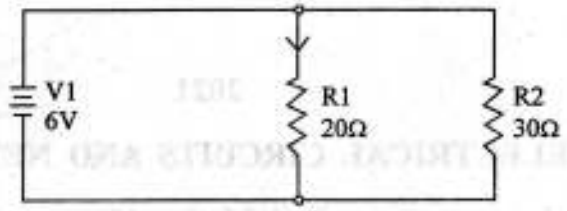

Figure 2

(c) State and explain Kirchhoff's voltage law and Kirchhoff's current law using suitable circuit diagrams. 8

2. (a) Using mesh analysis, determine the current through resistor R_1 (Figure 3) 8

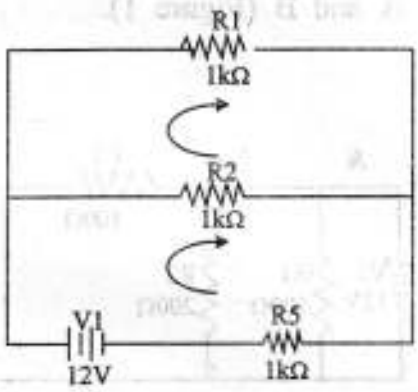

Figure 3

(b) Determine voltage V_a using nodal analysis (Figure 4). 6

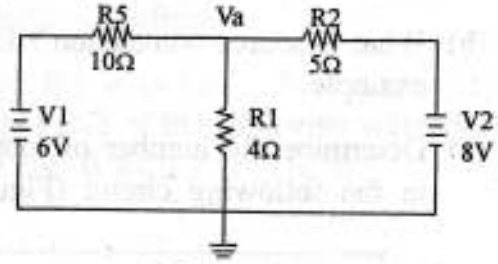

Figure 4

(c) Explain Maximum Power Transfer Theorem with a suitable example. 6

3. (a) Find the current through resistance R_3 using Thevenin's Theorem (Figure 5). 10

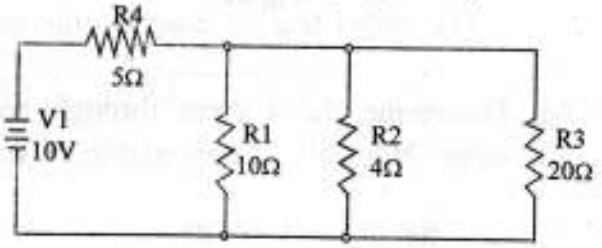

Figure 5

(b) Find the current through R_1 using Superposition Theorem (Figure 6). 10

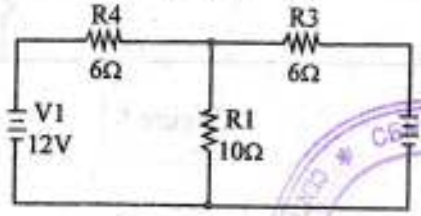

Figure 6

4. (a) What are independent and dependent sources ? Draw their symbols. 4

(b) What is source conversion ? Explain with an example. 4

(c) Determine the number of loops and meshes in the following circuit (Figure 7). 2

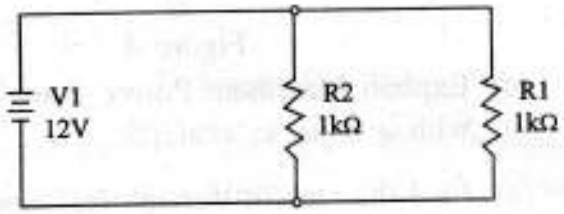

Figure 7

(d) Determine the current through resistor R_5 using Norton's Theorem (Figure 8). 10

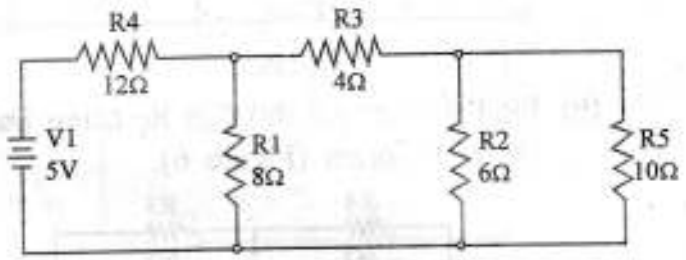

Figure 8

5. (a) What are instantaneous value, maximum value, frequency and time period of a sinusoidal waveform ? 6

(b) Deduce the expression for rms value and average value of the following waveform for the period 0 to 2 ? (Figure 9) 10

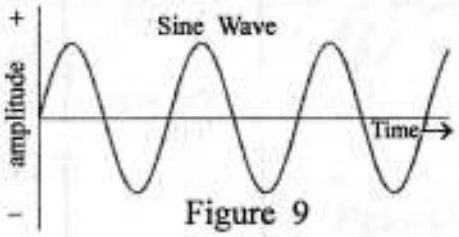

Figure 9

(c) Draw the phasor diagram of the following circuits (Figure 10 and Figure 11). 4

(i)

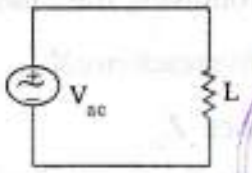

Figure 10

(ii)

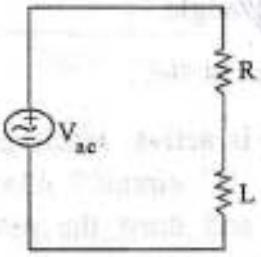

Figure 11

6. (a) To impedance $Z_1 = 2 + j6$ ohm and $Z_2 = 4 - j10$ ohm are connected in series in a circuit. Determine the resultant impedance in the polar form. 5

(b) A series RC circuit is shown below : 10

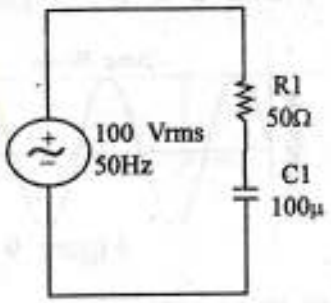

Figure 12

Determine the following from the circuit (Figure 12) :

(i) Capacitivereactance X_c.

(ii) Impedance Z_L

(iii) RMS Value of current.

(iv) Phase angle

(v) Power factor.

(c) What is active, reactive and apparent power in an AC circuit ? Also write their expressions and draw the power triangle. 5

7. (a) How an AC waveform is generated and represented in phasor diagram ? Explain. 5

(b) Determine the impedance and current of the circuit shown in figure 13. The supply frequency is 50 Hz. 5

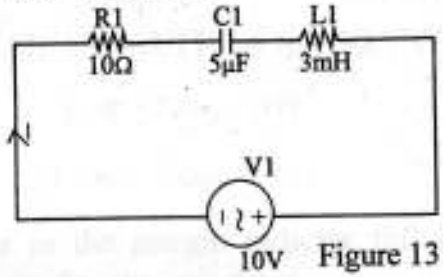

Figure 13

(c) Two impedances $Z_1 = 10 + j6$ and $Z_2 = 6 + j8$ are connected in parallel as shown in figure below (Figure 14) : 10

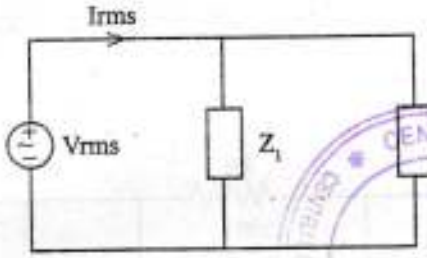

Figure 14

Given Irms = 10 A. Find :

(i) Vrms,

(ii) Phase angle and power factor of the circuit,

(iii) Power consumed by Z_1 and Z_2.