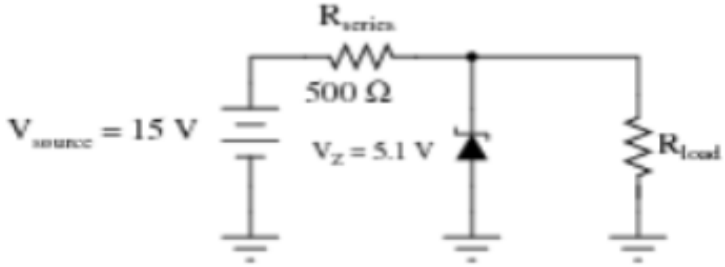
K. J. Somaiya College of Engineering, Mumbai-77
(A Constituent College of Somaiya Vidyavihar University)
Semester: II **Feb-Jun 2021**
In-Semester Examination

Class: F.Y. B. Tech.
Branch: EXTC,ETRX, MECH **Semester: II**
Full name of the course: Elements of Electrical and Electronics Engineering
Course Code: 116U06C107
Duration: 1hr.15 min (attempting questions) **Max. Marks: 30**
+20 min (uploading)

Q. No	Questions	Marks
Q1	**Solve following Multiple Choice Questions (Write appropriate option along with question number Eg. Q.1 : Option X)** 1. According to Thevenin's Theorem, any complex circuit can be represented by A. An independent current source in parallel with equivalent resistance B. An independent voltage source in parallel with equivalent resistance C. An independent voltage source in series with equivalent resistance D. An independent current source in series with load resistance 2. When two unequal resistances are connected in parallel to a DC source. Which of the following statement is true? A. Magnitude of current is lower in higher value of resistance B. Equal current flows in both resistors C. Magnitude of current is higher in higher value of resistance D. Power dissipated in both resistances is the same. 3. If we have three resistors of 2 Ω , 3 Ω and 6 Ω . Which of the combination will give equivalent resistance of 4.5 Ω ? A. 2 Ω connected in series with parallel combination of 3 and 6 Ω B. All resistances in parallel C. Parallel combination of 2 Ω and 6 Ω connected in series with 3 Ω D. Parallel combination of 2 Ω and 3 Ω connected in series with 6Ω 4. In the following circuit with Zener diode of 5.1V, what is the magnitude of Zener current if load resistance of 910 Ω is connected? 	10 marks (1 mark each)

A. 19.6mA
B. 14.2mA
C. 5.6mA
D. 12.2mA

5. For a common emitter configuration of NPN transistor with supply voltage (Vcc) of 10V. Which of following value of output voltage (V_{CE}) is most appropriate if the transistor is operating in cut –off region?
   A. 5V
   B. 0.2V
   C. 10V
   D. 0V
6. A Silicon diode with cut in voltage of 0.7V ($V_T = 0.7V$) is used in a half wave rectifier circuit. Sinusoidal input of peak input amplitude of 5V (Vm = 5V) is applied to the circuit. The average dc voltage is

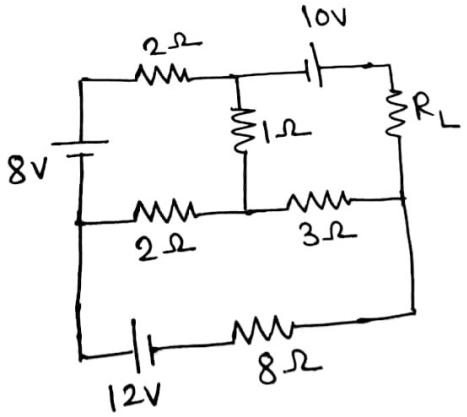
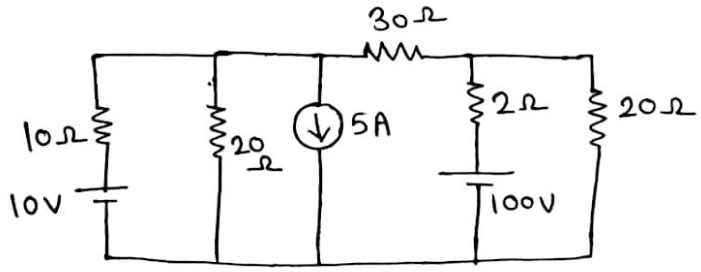
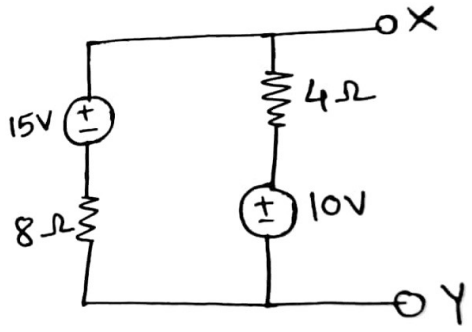
   A. > 1.87V
   B. 2.74V
   C. 5V
   D. 1.37V

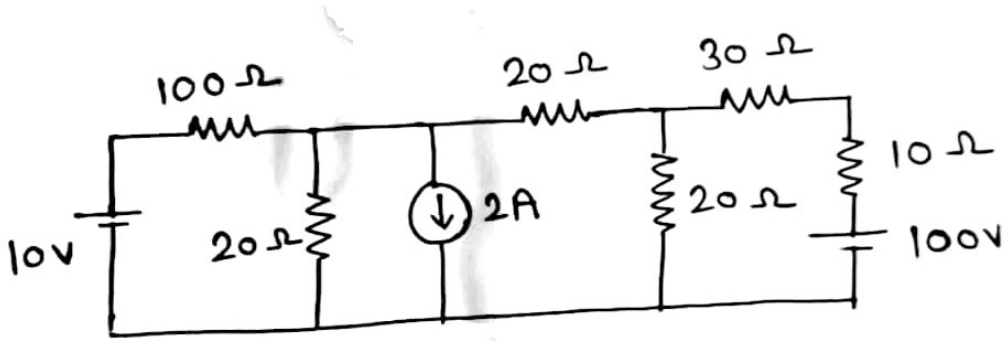
7. In a delta connected resistive network, if each of the branch has resistance of ($\sqrt{3}$ R), then the resistance of each branch of equivalent star network will be
   A. ($3\sqrt{3}$ R)
   B. (R /3)
   C. (R/$\sqrt{3}$)
   D. $\sqrt{3}$ R

8. Which of the following statements is WRONG with reference to a diode?
   A. The current in PN diode is due to both majority and minority carriers
   B. Voltage greater than peak inverse voltage (PIV) should be applied to diode to conduct
   C. The diode V-I characteristics is sensitive to temperature
   D. Germanium diode has smaller value of threshold voltage than silicon voltage.

9. A practical voltage source is represented as
   A. A non-zero resistance in parallel with the ideal voltage source
   B. An open circuit across the voltage ideal source
   C. A zero resistance in series with the ideal voltage source
   D. A non-zero resistance in series with the ideal voltage source

10. A super mesh is formed when
    A. A current source is shared by two meshes but none of them contain a current source in their outer path
    B. A voltage source is shared by two adjacent meshes
    C. Two adjacent meshes current sources in opposite directions
    D. There are multiple mesh in a complex circuit

Q2	**Solve any one of the following:** (i) State Maximum Power Transfer theorem. For a given circuit find the value of R_L so the maximum power will dissipate in it. Also find P_{max}.  (ii) By using Superposition Theorem, find current through 30Ω resistor for the network given.  	10 marks
Q3	**Solve any two of the following:** (i) Draw neat circuit diagram and waveforms and explain working of full wave bridge rectifier using diodes. Also explain effect of addition of capacitor across the load resistance in the circuit. (ii) Using source transformation convert the following circuit into a single voltage source in series with the resistor  	10 marks

	(iii) Using Nodal Analysis find current flowing through 100Ω resistor for the circuit shown: 	

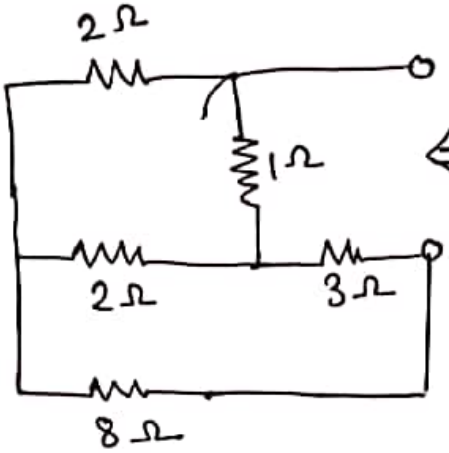
Q.1

(1) Option C
(2) Option A
(3) Option C
(4) Option B
(5) Option C
(6) Option D
(7) Option C
(8) Option B
(9) Option D
(10) Option A

01 mark each

Q.2 (i) Statement of MPT — (1m)

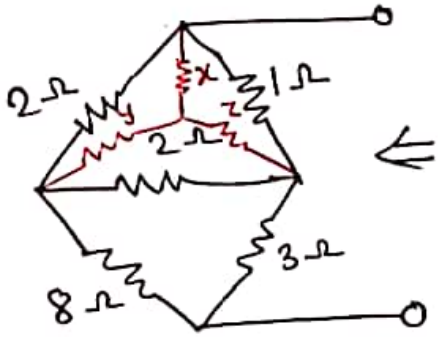
To find R_L



$\Leftarrow R_L = R_{Th}$

(4m)

Rearranging circuit:



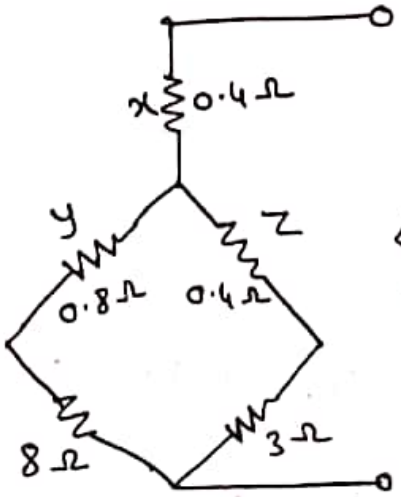
$\Leftarrow R_L = R_{Th}$

Converting upper delta to star:

$$x = \frac{(2)(1)}{2+2+1} = \frac{2}{5} = 0.4\,\Omega$$

$$y = \frac{(2)(2)}{2+2+1} = \frac{4}{5} = 0.8\,\Omega$$

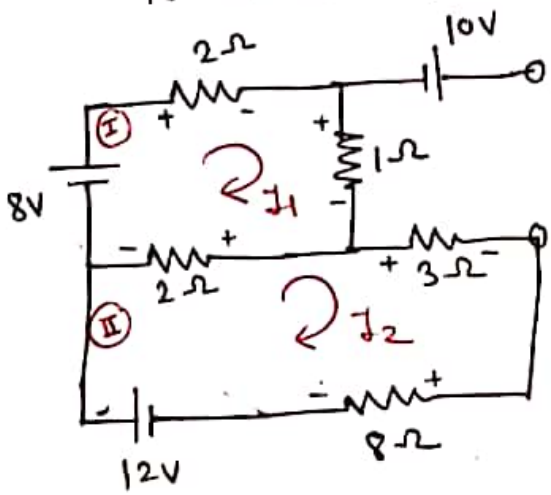
$$z = \frac{(2)(1)}{2+2+1} = \frac{2}{5} = 0.4\,\Omega$$



$\Leftarrow R_L = R_{Th}.$

$$R_L = R_{Th} = [(8+0.8) \,\|\, (3+0.4)] + 0.4$$
$$= [8.8 \,\|\, 3.4] + 0.4$$
$$R_L = 2.852\ \Omega$$

To find V_{Th}:



~~1m~~ 4m

Applying KVL to loop I

$$8 - 2I_1 - I_1 - 2(I_1 - I_2) = 0$$
$$8 - 5I_1 + 2I_2 = 0$$
$$5I_1 - 2I_2 = 8 \quad \text{— (1)}$$

Applying KVL to loop II

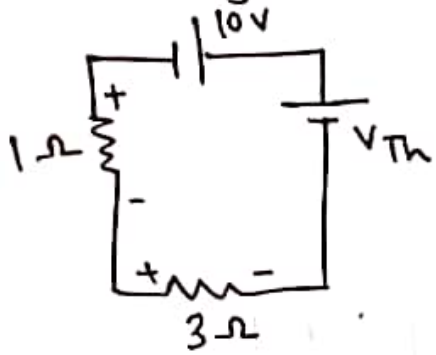
$$12 - 2(I_2 - I_1) - 3I_2 - 8I_2 = 0$$
$$12 - 2I_2 + 2I_1 - 3I_2 - 8I_2 = 0$$
$$12 + 2I_1 - 13I_2 = 0$$
$$2I_1 - 13I_2 = -12 \quad \text{— (2)}$$

Solving ① & ②

$I_1 = 2.098$ A

$I_2 = 1.246$ A.

writing V_{Th} equation:



$$-V_{Th} + 3I_2 + I_1 + 10 = 0$$

$$V_{Th} = 15.83V.$$

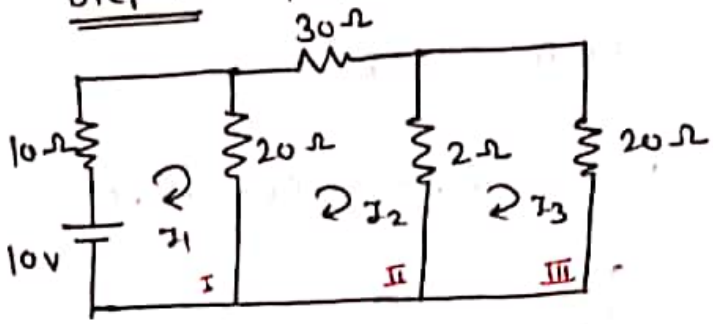
According to maximum power transfer Th^m

$$P_{max} = \frac{V_{Th}^2}{4R_{Th}} = 21.97 \text{ watts}$$

1m

Q.2 (ii)

Step I When 10 V source acting alone.



3M

KVL to loop I.

$10 - 10I_1 - 20(I_1 - I_2) = 0$ —(1)

KVL to loop II

$-30I_2 - 2(I_2 - I_3) - 20(I_2 - I_1) = 0$ —(2)

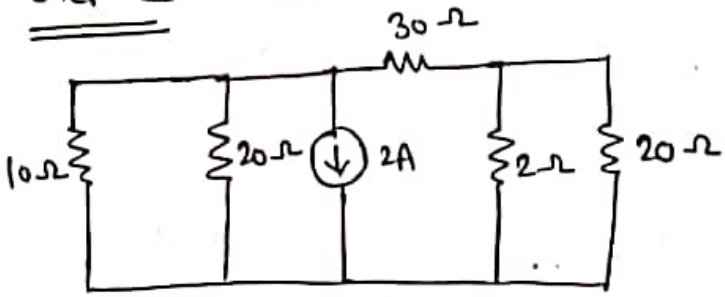
KVL to loop III

$-20I_3 - 2(I_3 - I_2) = 0$ —(3)

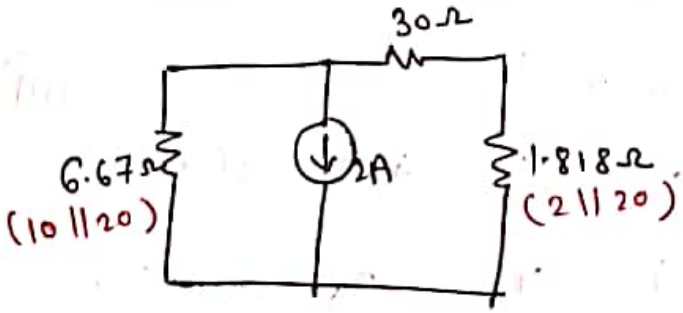
Solving (1), (2) & (3)

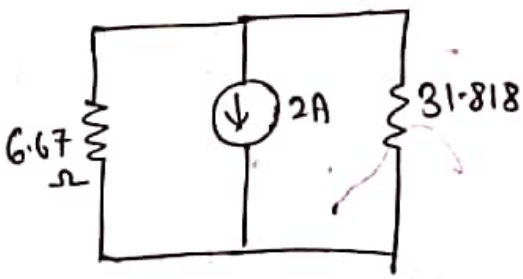
$I_2' = I_{30\Omega} = 0.1732\,A\ (\rightarrow)$

Step II when 2A source acting alone.



3M

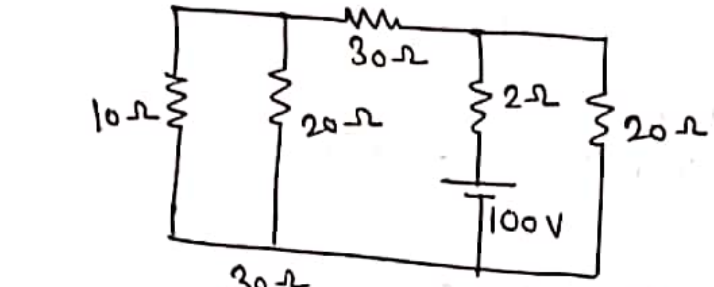




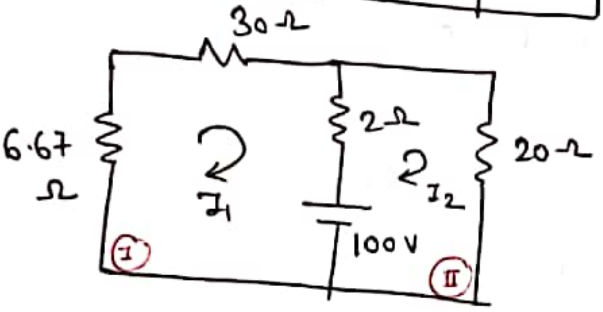
$$I''_{30\Omega} = \frac{2 \times 6.67}{31.818 + 6.67}$$

$$I''_{30\Omega} = 0.3466\ A\ (\leftarrow)$$

Step III When 100 V source acting alone.



3M



Applying KVL to loop I

$$-6.67I_1 - 30I_1 - 2(I_1 - I_2) - 100) = 0 \quad \text{—④}$$

KVL to loop II

$$100 - 2(I_2 - I_1) - 20I_2 = 0 \quad \text{—⑤}$$

Solving ④ & ⑤

$$I'''_{30\Omega} = -2.362\ A\ (\rightarrow) \quad = 2.362A\ (\leftarrow).$$

$$I_{30\Omega} = I'_{30\Omega} + I''_{30\Omega} + I'''_{30\Omega}$$

1M

$$= 0.1732(\rightarrow) + 0.3466(\leftarrow) + 2.362(\leftarrow)$$

$$I_{30\Omega} = 2.5354\ (\leftarrow) \quad \underline{OR} \quad -2.5354\ A\ (\rightarrow)$$

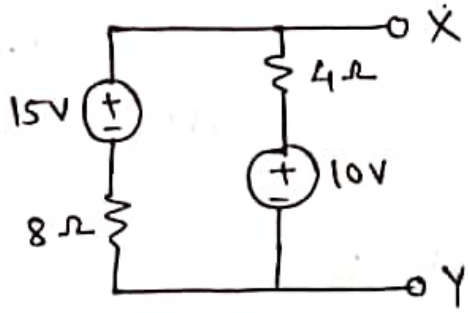
Q.3 (i)

① Circuit Diagram and waveforms — 2m

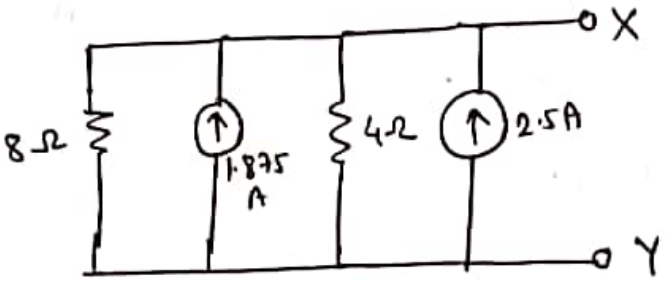
② working — 2m

③ Effect of addition of capacitor with waveform — 1m

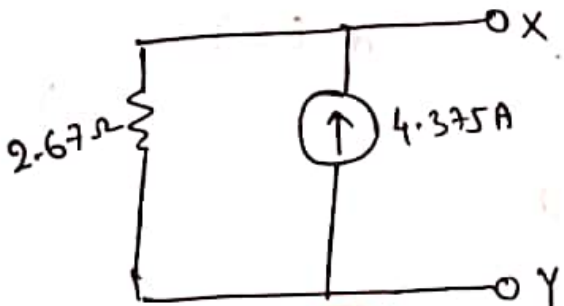
(ii)



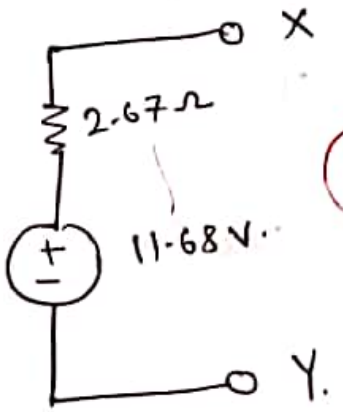
Using source transformation



2m

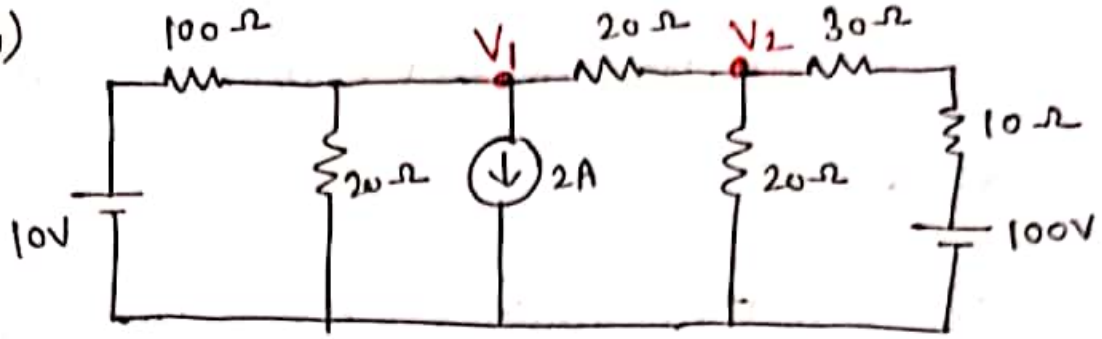


2m



1m

(iii)



Applying KCL at node 1

$$\frac{V_1 - 10}{100} + \frac{V_1}{20} + \frac{V_1 - V_2}{20} + 2 = 0$$

2m

$$-11V_1 + 5V_2 = 190 \quad \text{—— (1)}$$

Applying KCL at node 2

$$\frac{V_2 - V_1}{20} + \frac{V_2}{20} + \frac{V_2 - 100}{40} = 0$$

2m

$$2V_1 - 5V_2 = -100 \quad \text{— (2)}$$

Solving (1) & (2)

$$V_1 = -10 \text{ V}$$

$$I_{100\Omega} = \frac{V_1 - 10}{100} = -0.2 \text{ A } (\leftarrow)$$

1m

$$I_{100\Omega} = 0.2 \text{ A } (\rightarrow)$$