3 A2B and Diploma. (140)

CMR INSTITUTE OF TECHNOLOGY

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Internal Assessment Test 1 – September 2016

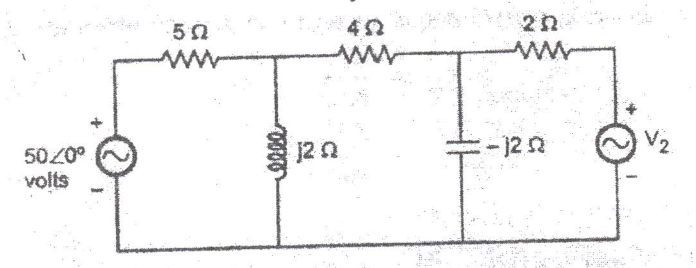
A&B-Section

Sub: Electric Circuit Analysis **Code:** 15EE32

Date: 06 /09/2016 Duration: 90 mins Max Marks: 50 **Sem:** III **Branch:** EEE

Note: Answer any five full questions.
10X5=50M

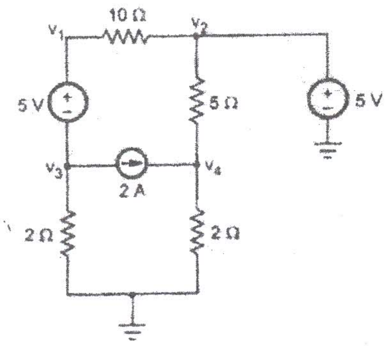
Q 1) In the circuit shown in Fig.1, determine V2, which results in zero current through the 4Ω resistor. Use mesh analysis. 10M



$26.25\angle 113^\circ$ V.

Fig. 1

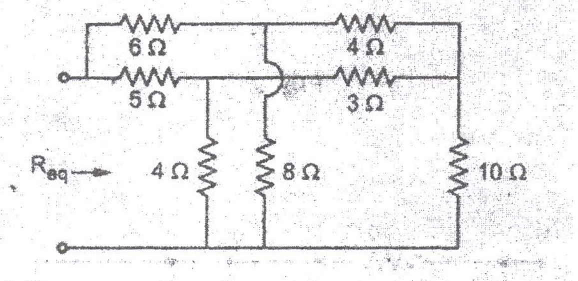
Q2. For the network shown in Fig. 2 determine the node voltages V1, V2, V3and V4 using nodal analysis. **10M**



$V_1 = 1.67$ V.
$V_2 = 5$ V.
$V_3 = -3.33$ V.
$V_4 = 4.28$ V.

Fig. 2

Q3. Referring Fig. 3 determine the equivalent Req by using star delta transformation. 10M



4.935Ω.

Fig. 3

Q4. Use mesh analysis to determine what value of V2 in the network in Fig. 4 causes v = 0 is the voltage across 20 Ω. 10M

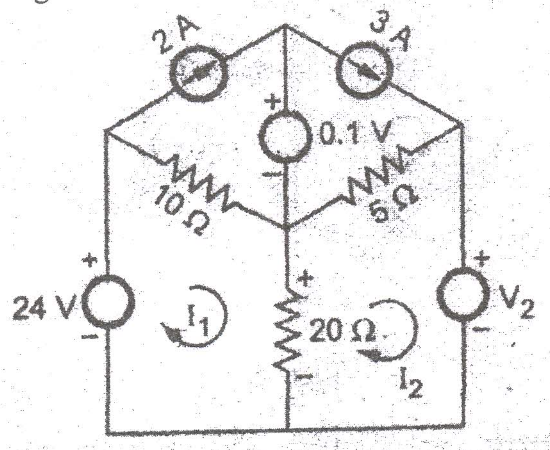
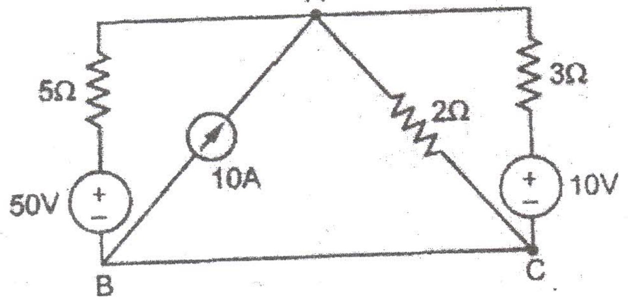


Fig. 4

$V_2 = -7$ V.

Q5. Using source transformation, find the power delivered by the 50 V voltage source in the circuit shown in Fig below. 10M



274 W

Q.6) Draw the dual network shown in fig. 6. And write the equilibrium equations. 10M

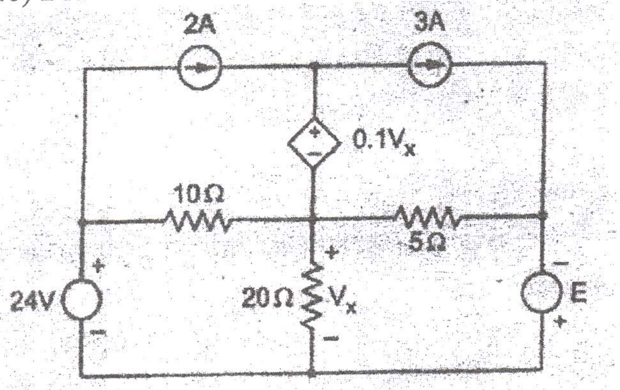
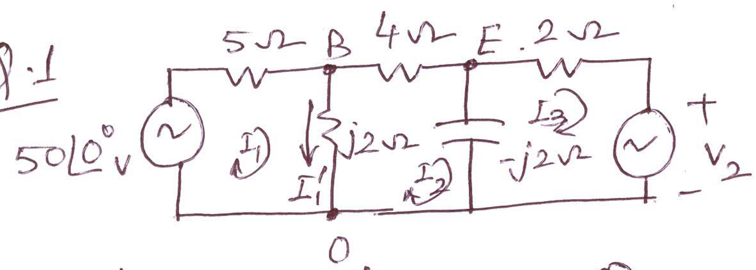


Fig. 6

Sem : 3rd - EEE   Subject : ECA -   Subject Code 15EE32

IAT-1 Solutions .

Q.1



Given I through 4Ω resistor is 0A - that means $I_2 = 0$.

$\therefore$ potential B = potential E.

Applying KVL, in mesh ①,

$-5I_1 - j2I_1 + 50\angle 0° = 0$.

or, $I_1 = \dfrac{50\angle 0°}{5+j2} = 9.2847\angle -21.80$ A.

$I_1' = I_1$ as $I_2 = 0$.

KVL @ mesh ②

$-V_2 - I_3(-j2) - 2I_3 = 0$.

or, $I_3 = \dfrac{-V_2}{(2-j2)}$

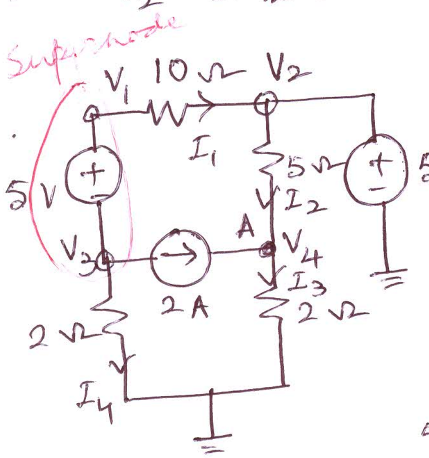
potential at B w.r.t O is $(9.2847\angle -21.8 \times j2)$ V.

potential at E w.r.t O is $(-j2) \times (-I_3)$.

$\therefore 9.2847 \times 2\angle 90 - 21.8 = j2 \times \dfrac{(-V_2)}{(2-j2)}$

$\therefore V_2 = 26.26\angle 113.2°$ Volts.

Q2.



$V_2 = 5$ V.

$V_1 - V_3 = 5$ V — ①

Applying KCL at node A,

$I_2 - I_3 + 2 = 0$.

or, $\dfrac{5 - V_4}{5} - \dfrac{V_2 - 0}{2} + 2 = 0$.

or, $V_4 = 4.285$ V.

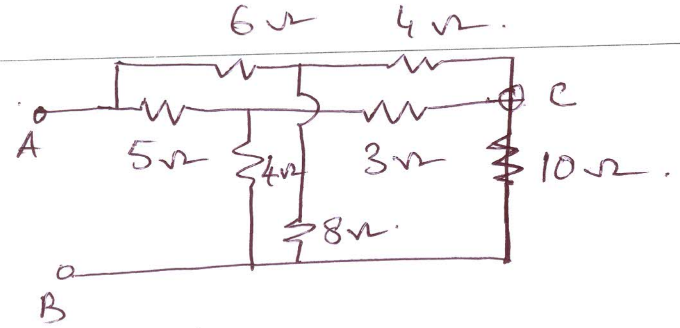
KCL at Supernode,

$I_1 + 2 + I_4 = 0$ or, $\dfrac{V_1 - 5}{10} + 2 + \dfrac{V_3 - 0}{2} = 0$.

or, $\dfrac{V_1}{10} + \dfrac{V_3}{2} = -1.5 \rightarrow$ ② . / Solving ① & ②

$V_1 = 1.666$ V, $V_3 = -3.33$ V.

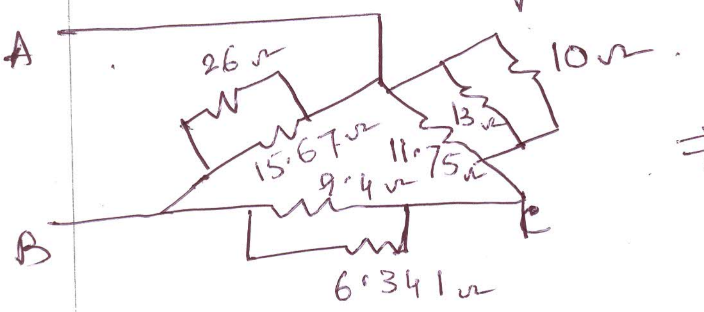
Q3.



Find R_{AB} using λ/Δ or Δ/λ Conversion.

⇓

~~Hear~~ Here it is clear that two stars are connected in parallel between the point A, B, & C points. Converting the stars to their equivalent delta we get



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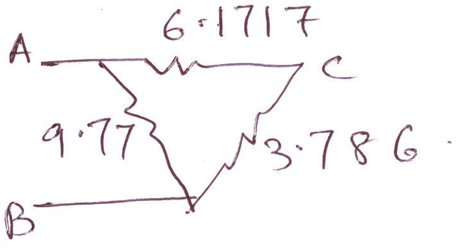
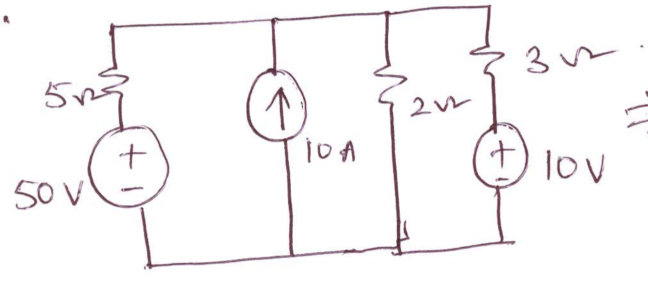


$R_{AB} = (9.77) \| (6.1717 + 3.786)\ \Omega$

$= 4.9332\ \Omega$. Ans

Q4.



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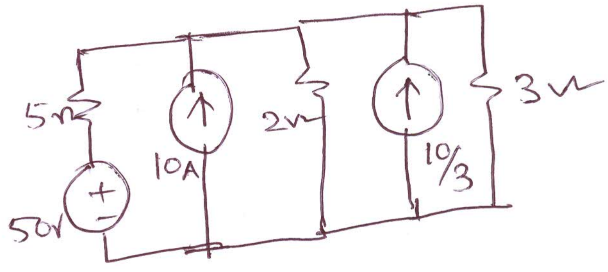

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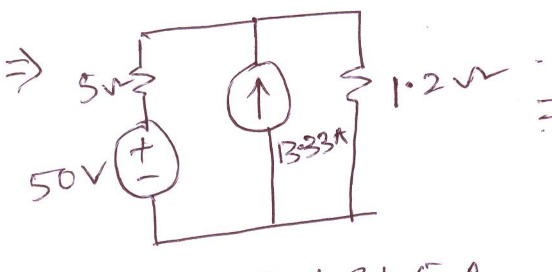

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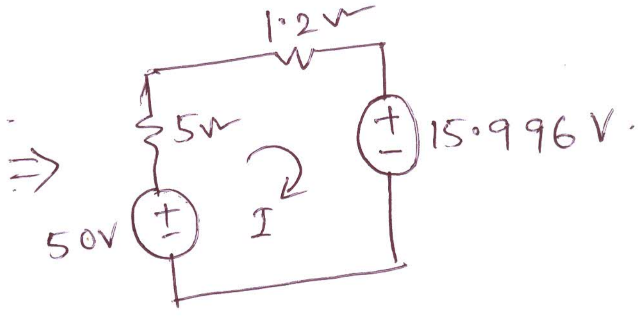
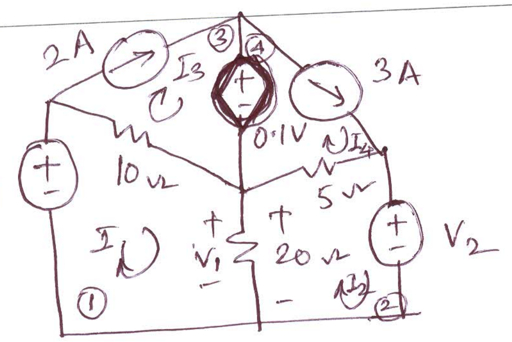


$I = 5.4845\ A$.

∴ power delivered by 50V source is $VI = 274.225\ W$.

Q5



Given $V_1 = 0$.
Find V_2.

Applying KVL at mesh 1;

$+24 - 10(I_1 - I_3) = 0$ — ①

Constraint equations:

$I_3 = 2A, \quad I_4 = 3A$.

KVL @ mesh 2;

$5(I_2 - I_4) - V_2 = 0$.

$V_1 = 0 \therefore I_1 = I_2$.

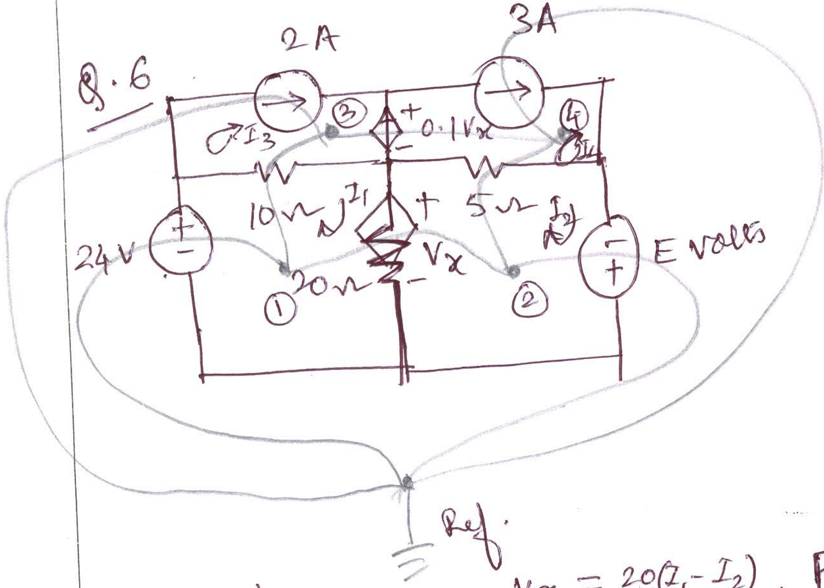
u, $5I_2 - 5I_4 = V_2 \longrightarrow$ ②.

Solving equations, we get $I_1 = 4.4A$, $I_2 = I_1 = 4.4A$.

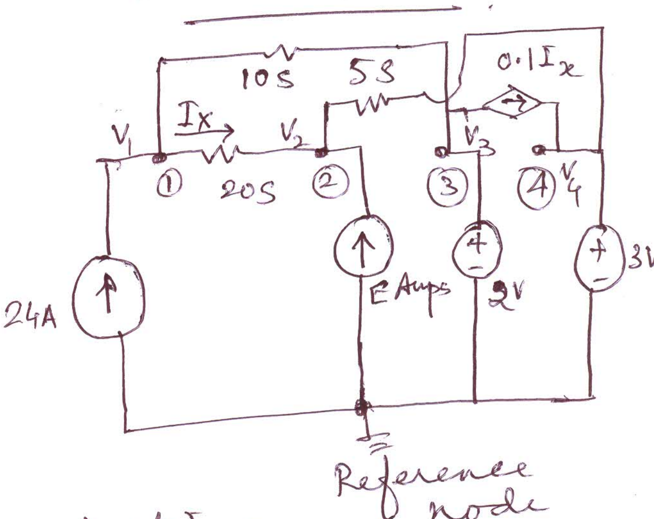
$\therefore$ From eqn. ②

$V_2 = -7V$.

Q.6



Dual n/w



$V_x = 20(I_1 - I_2)$

For meshes;

Equilibrium equations :-

$I_3 = 2A; \quad I_4 = 3A$.

$24 - 10(I_1 - I_3) - 20(I_1 - I_2) = 0$.

$-20(I_2 - I_1) - 5(I_2 - I_4) + E = 0$.

For dual n/w, $I_x = 20(V_1 - V_2)$

Equilibrium equations

$V_3 = 2V, \quad V_4 = 3V$.

$24 - 10(V_1 - V_3) - 20(V_1 - V_2) = 0$.

$-20(V_2 - V_1) - 5(V_2 - V_4) + E = 0$.