VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRICAL ENGINEERING
FALL SEMESTER 2022-2023
CAT-I

SLOT: G1

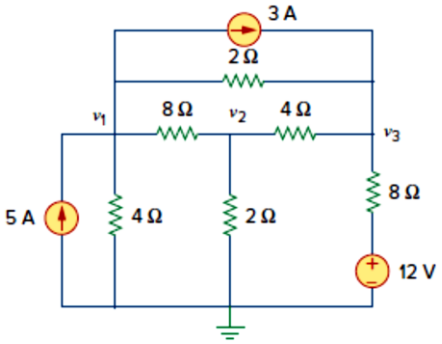
Programme Name & Branch: B.Tech (CSE, ECE, CSB) Course Code: EEE102L

Course Name : Basic Electrical and Electronics Engineering

Date of the Examination : 12.11.2022

Duration : 90 minutes **Max. Marks : 50**

	Question	Mark
1.	Find the node voltages V_1, V_2, and V_3. Also Find the current i_1,i_2 and i_3	



At Node 1

$$\frac{V_1-V_2}{8}+\frac{V_1}{4}-5+\frac{V_1-V_3}{2}+3=0$$

$$V_1-V_2+2V_1-40+4V_1-4V_3+24=0$$

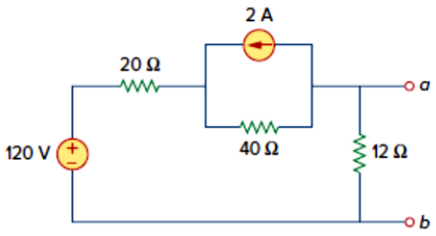
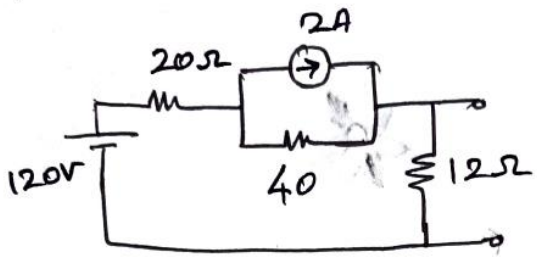
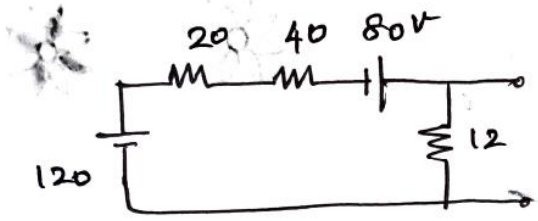
$$7V_1-V_2-4V_3=16 \quad -(1)$$ 1.5

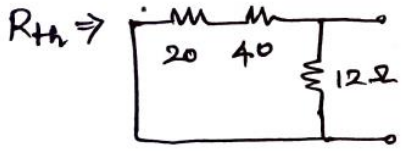
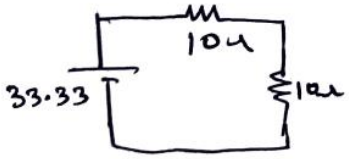
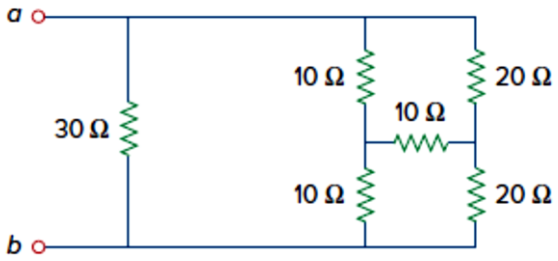
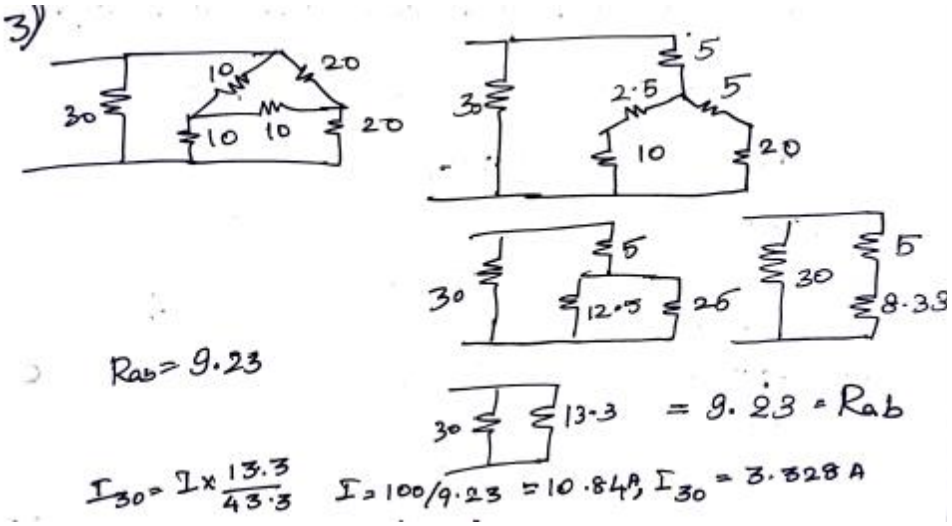
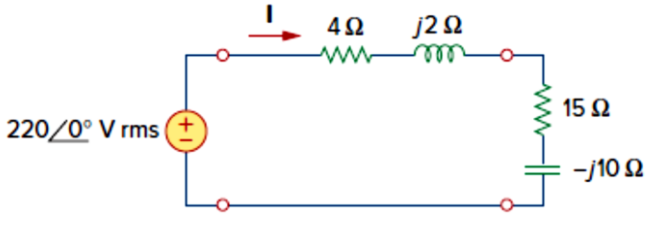
At Node 2

$$\frac{V_2-V_1}{8}+\frac{V_2-V_3}{4}+\frac{V_2-0}{2}=0$$

$$V_2-V_1+2V_2-2V_3+4V_2=0$$

$$-V_1+7V_2-2V_3=0$$ 1.5

	At Node 3 $\frac{V_3-12}{8} + \frac{V_3-V_2}{4} + \frac{V_3-V_1}{2} - 3 = 0$ $V_3 - 12 + 2V_3 - 2V_2 + 4V_3 - 4V_1 - 24 = 0$ (i_1, i_2) $-4V_1 - 2V_2 + 7V_3 = 36$ (i_3) Solving $V_1 = 10V$, $V_2 = 4.93$, $V_3 = 12.67$. $i_1 = \frac{V_1-V_2}{8} = 0.634$ $i_2 = \frac{V_2-V_3}{4} = -1.935$ $i_3 = \frac{V_2-0}{2} = 2.465$	1.5 1.5 +3 +1 for units
2.	Find the value of maximum power that can be transferred across the terminals *a-b* using Maximum Power Transfer Theorem.     $V_{12} = I \times 12 = \frac{200}{72} \times 12 = 33.33V$	4

	 $R_{th} = 60 \parallel 12\,\Omega$ $= 10\,\Omega$ ∴ Thevenin Eq ckt is; & For P_{max} $R_L = 10\,\Omega$  $P_{max} = \frac{V_{th}^2}{4R_{th}} = \frac{33.33^2}{4 \times 10} = 27.77\,W$.	3 1 2
3.	a) Obtain the equivalent resistance at the terminals *a-b* for the circuit shown below. Also find the current in 30 Ω resistor if a voltage of 100V is applied across the terminals *a-b*.  	2 2 2 2,2
4.	Below figure shows a load being fed by a voltage source through a transmission line. The impedance of the line is (4+j2) Ω and the load in (15 – j10) Ω. Find the current, real and reactive power absorbed by each of these impedances. Also calculate the system power factor and the value of L & C at a supply frequency of 50Hz. 	

	4) $V = 220\angle 0$ $Z = 19 - j8$ $I = \frac{220\angle 0}{19-j8} = 9.84 + j4.14 = 10.67\angle 22.84$ $P_{line} = I^2 R_{line} = 10.67^2 \times 4 = 455.4W$; $Q_{line} = I^2 X_{line} = 10.67^2 \times 2 = 227.69$ lag $P_{load} = I^2 R_{load} = 10.67^2 \times 15 = 1707.7W$; $Q_{load} = I^2 X_L = 10.67^2 \times 10 = 1138.5$ VAr lead p.f = cos 22.84 = 0.921 $X_L = L\omega = 2$; $L = \frac{2}{\omega} = \frac{2}{2\pi f} = 6.37$ mH $X_C = \frac{1}{\omega C} = 10$ $C = \frac{1}{\omega \times 10} = \frac{1}{2\pi f \times 10} = 0.318$ mF	3 2 2 1 1 1
5.	A Y – Y system has source whose phase voltages are $V_{an} = 120\angle 0°$, $V_{bn} = 120\angle -120°$, $V_{cn} = 120\angle 120°$. A balanced star connected load of impedance 19+j13Ω per phase is connected to this source. Find the line currents, line voltages, apparent power supplied by the source, Real and Reactive power at the load 5) $V_{an} = 120\angle 0$, $V_{bn} = 120\angle -120$, $V_{cn} = 120\angle 120$. $Z = 19 + j13 = 23.02\angle 34.38$ $I_{an} = \frac{V_{an}}{Z} = \frac{120}{23.02\angle 34.38} = 5.213\angle -34.38$ $I_{bn} = 5.213\angle -154.38$ $I_{cn} = 5.213\angle 85.62$ As it is a 6bar connected system they represent line currents as well Line Voltages : $V_{ab} = 207.85\angle 30$ $V_{bc} = 207.85\angle -90$ $V_{ca} = 207.85\angle 150°$ $S = VI^* = 120\angle 0 \times 5.213\angle 34.38 = 625.56\angle 34.38$ $= 516.28 + j353.24$ ∴ Apparent power = 625.56VA Real power = 516.28W Reactive power = 353.24VAr.	1 1 1 1 1 1 1 1 1 +1 For

		units