ii. Calculate the impedance-parameters of the circuit in Figure 6.   **6**
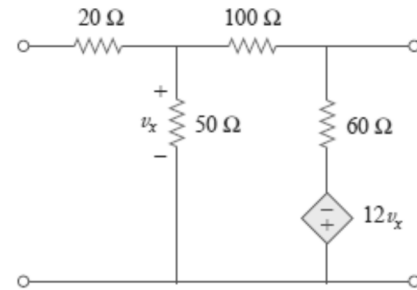

Figure 6

OR iii. Obtain the Y parameters of the two-port network as shown in Figure 7. **6**
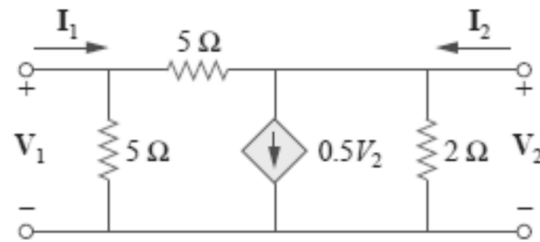

Figure 7

Q.6   Attempt any two:

i. Check whether the following function is a Positive Real function or **5**
not:
$$F(S)=(2s^4+7s^3+11s^2+12s+4)/(s^4+5s^3+9s^2+11s+6)$$

ii. The Driving Point Impedance of a LC network is given by **5**
$Z(s)= s^4+4s^2+3s^{-3}+2s$. Synthesis using second Caure method.

iii. The Driving Point Impedance of a RL network is given by **5**
$Z(s)= [5(s+1)(s+4)]/[(s+3)(s+5)]$. Synthesis using first Foster method.

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Enrollment No.......................................

Faculty of Engineering
End Sem Examination Dec-2023
EC3CO05 Circuit Analysis & Synthesis
Programme: B.Tech.   Branch/Specialisation: EC

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. A voltage source having an open circuit voltage of 200 V and internal **1**
resistance of 50Ω is equivalent to a current source of-
(a) 4A with 50Ω in series   (b) 4A with 50Ω in parallel
(c) 0.5A with 50Ω in parallel   (d) None of these

ii. Four resistance 80Ω, 50Ω, 25Ω and R are connected in parallel. **1**
Current through 25Ω resistor is 4 A. Total current of the supply is 10
A. The value of R will be-
(a) 66.66Ω (b) 40.25Ω (c) 36.36Ω (d) 76.56Ω

iii. What should be done, if the dependent current and voltage sources are **1**
present in a circuit while applying 'Superposition Theorem'?
(a) Replace them by open circuit
(b) Replaced them by short circuit
(c) Keep in their original form without replacing by either open   or
short circuit
(d) None of these

iv. Which one of the following theorems is a manifestation of law of **1**
conservation of energy?
(a) Tellegen's Theorem   (b) Reciprocity Theorem
(c) Thevenins's Theorem   (d) Superposition Theorem

v. The Laplace transform of $f(t) = te^t$ is-   **1**
(a) $F(s) = s + e^{-s}$ (b) $F(s) = 1 / (s – 1)^2$
(c) $F(s) = (s – 1) /s^2$ (d) $F(s) = 1/ s^2$

vi. Laplace transform of the output response of a linear system is the **1**
system transfer function when the input is :
(a) A step signal   (b) A ramp signal
(c) An impulse signal   (d) A sinusoidal signal

vii. When port 1 of a two-port circuit is short-circuited, $I_1 = 8*I_2$ and $V_2 = 0.2*I_2$. Which of the following is true? **1**
(a) y11 = 8 (b) y12 = 40 (c) y21 = 0.16 (d) y22 = 0.2

viii. For a symmetrical two port network- **1**
(a) $Z_{11} = Z_{22}$ (b) $Z_{12} = Z_{21}$
(c) $Z_{11} Z_{22} - Z_{11}^2 = 0$ (d) $Z_{11} = Z_{22}$ and $Z_{12} = Z_{21}$

ix. What is an ideal value of network function at poles? **1**
(a) Zero (b) Infinity (c) Unity (d) Finite and non-zero

x. A stable system must have- **1**
(a) positive real part for any pole or zero
(b) negative real part for all poles and zeros
(c) zero or negative real part for poles and zeros
(d) at least one pole or zero in right half of s plane

Q.2 i. Three light bulbs are connected to a 9-V battery as shown in Figure 1. Calculate the total current supplied by the battery. **2**
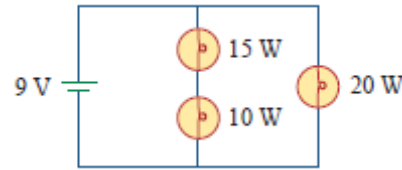

Figure 1

ii. In the Q2 (i) find the current through each bulb. **3**

iii. Two similar coils connected in series gave a total inductance of 600 mH and when one of the coil is reversed, the total inductance is 300 mH. Determine the mutual inductance between the coils and coefficient of coupling. **5**

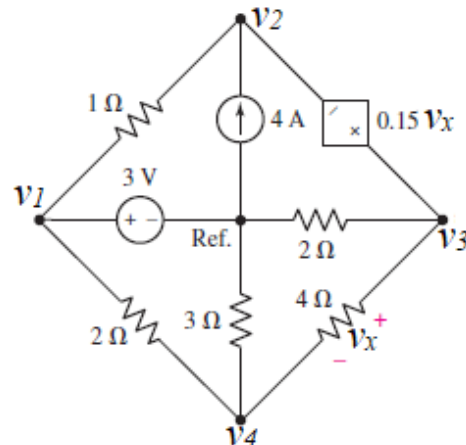OR iv. Find the node voltages for the circuit shown in Figure 2. **5**

Figure 2

Q.3 i. What is meant by natural and forced response? **2**

ii. State and explain Maximum power transfer theorem. Derive the formula for the condition for maximum power transfer and the amount of maximum power that can be transferred in case of purely resistive load and purely resistive source. **8**

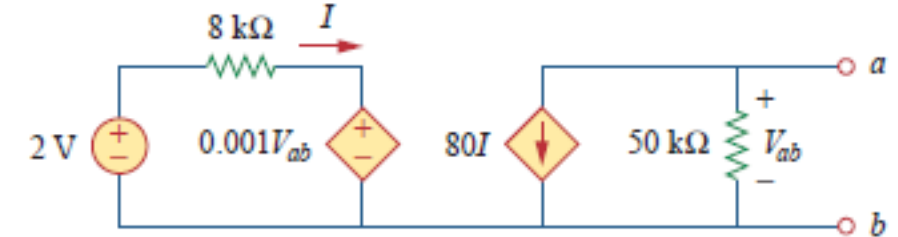OR iii. Find the Norton equivalent across terminal a-b shown in Figure 3. **8**

Figure 3

If a load of 10 ohms is connected across terminal a-b, find the current through it.

Q.4 i. Explain any three properties of Laplace Transform in detail. **3**

ii. The switch in Figure 4 has been in position a for a long time. At t= 0, it moves to position b. Calculate $i(t)$ for all $t > 0$. **7**

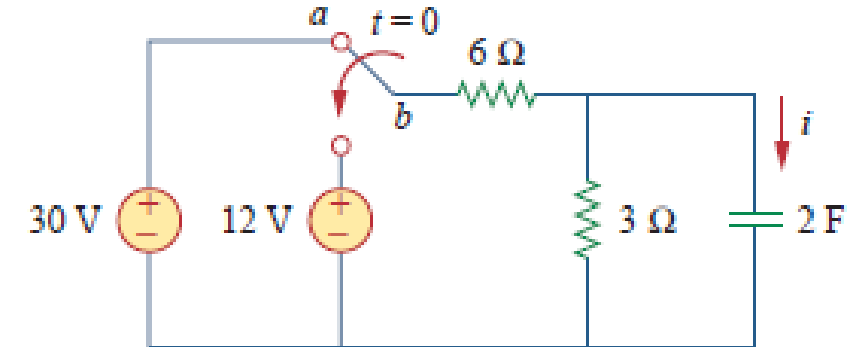Figure 4

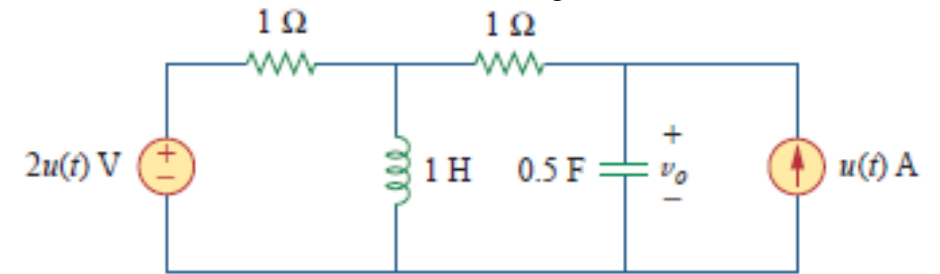OR iii. Find $v_o(t)$, for all $t > 0$, in the circuit of Figure 5. **7**

Figure 5

Q.5 i. Express Z parameters in terms of ABCD parameters **4**