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PES University, Bangalore

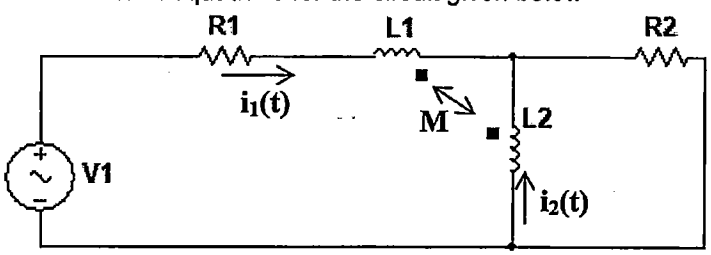
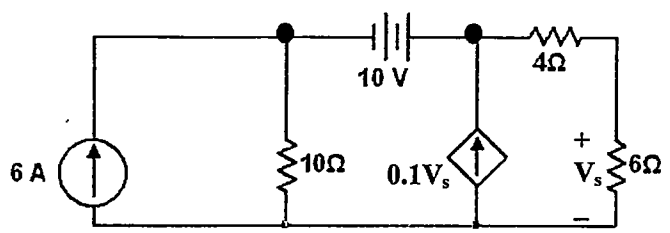
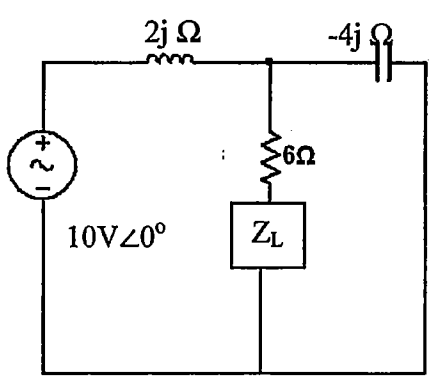
(Established under Karnataka Act No. 16 of 2013)

UE15EC201

DECEMBER 2016: END SEMESTER ASSESSMENT (ESA) B.TECH. III SEMESTER

UE15EC201- Network Analysis and Synthesis

Time: 3 Hrs | Answer All Questions | Max Marks: 100

1.	a)	State four differences between nodal analysis and mesh analysis	4
	b)	Answer the following. i. Suppose the transformer is ideal. Suppose it has one primary winding and one secondary winding. How is the mutual inductance M related to the self inductances L_1 and L_2? ii. Suppose L_1 is 2 H and M is 0.6 H, what is the value of L_2?	4
	c)	Write the mesh equations for the circuit given below 	6
	d)	Find the values of the nodal voltages (at the dark circles) in the given circuit using the concept of super node. Find the power contribution of the dependent source. 	6
2.	a)	Find the Norton's equivalent circuit across the load Z_L. 	4
	b)	For the circuit given below, find the maximum power that can be dissipated by the load resistance R_L which is variable (note the load reactance is zero). Find the optimal value of R_L. Write appropriate formula in the calculation.	6

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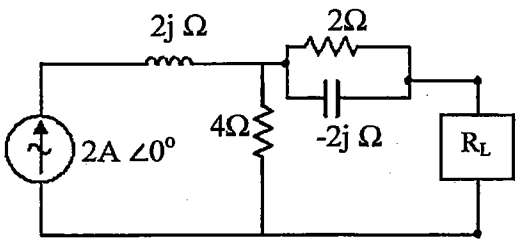
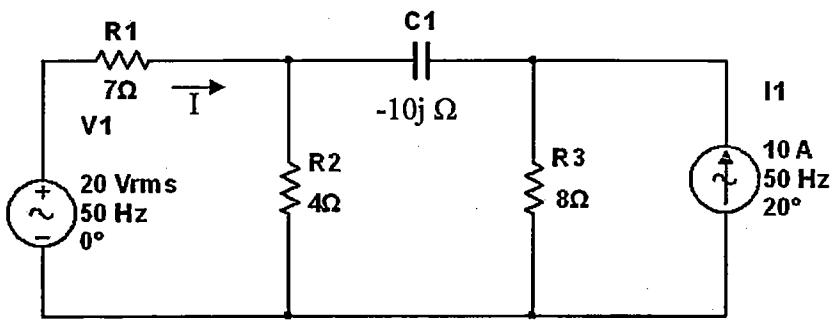
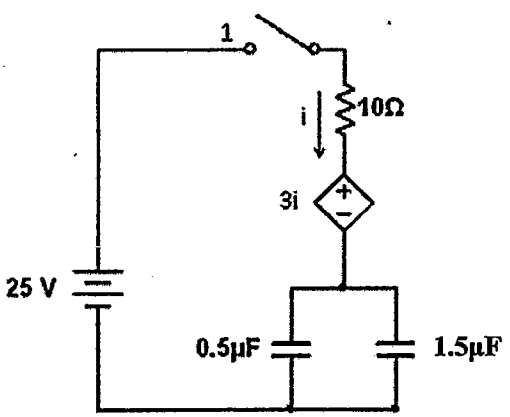


c) Apply superposition theorem to find the current flowing through the resistance R_1 — 6



d) State Millman's Theorem using appropriate expressions. — 4

3. a) The switch was open for a long time before it moves to position 1 at t=0. For the circuit given below find the transient current i(t) for $t > 0$. — 5



b) Suppose a series RL circuit is excited by a current source of 1A at t=0. Suppose if the value of R=10 Ohms. Find the value of L such that the transient voltage across the inductor reaches 3V at 3ms. Explain your calculation. — 5

c) Consider a source free series RLC circuit having $R = 10\,\Omega$, $\omega_0 = 1000\ \text{rad/s}$ and damping ratio $\zeta = 1.5$. Suppose the initial values are $v_c(0^+) = 10\ \text{V}$ and $\frac{dv_c(0^+)}{dt} = -3\ \text{V/s}$. — 10

i. Find the values of L and C.
ii. Find the transient voltage $v_c(t)$ across the capacitor for $t \geq 0$.
iii. Without changing L and C, what value of R will make the circuit critically damped?

4. a) Determine the y parameters of the two port network using nodal analysis. Based on the y parameters, calculate the parameter z_{11}. — 5

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		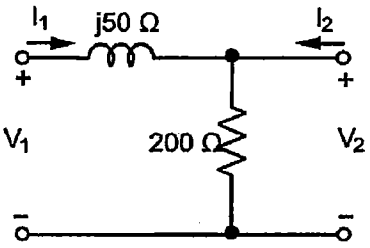	
	b)	State the condition for symmetry in two port networks in two port networks in terms of z parameters, y parameters, hybrid parameters and transmission parameters. Also state the condition for reciprocity in terms of the transmission parameters.	5
	c)	Draw and explain the cascaded interconnection model using 2 two port networks. Write the network equations, in terms of the individual two port parameters.	10
5.	a)	Check whether the following polynomial is Hurwitz. Show full calculation and justification. $H(s) = s^5 + 4s^4 + 6s^3 + 8s^2 + 10s + 12$	5
	b)	Synthesize the impedance function given below into Foster I form. Draw the resulting circuit. $Z(s) = s(s+2)/(s^2 + 4s + 3)$	5
	c)	Synthesize the impedance function into Cauer II form. Express the impedance as a continued fraction expansion. Draw the circuit $Z(s) = (s^2 + 1)(s^2 + 4)/s(s^2 + 2)$	10