Elmansoura University بسم الله الرحمن الرحيم First year final exam

Faculty Of Engineering Circuit Theory Jan. 2013

Electronics and communications Dept. Time 3 Hours

Answer the following

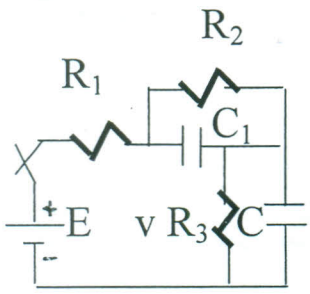


Fig C

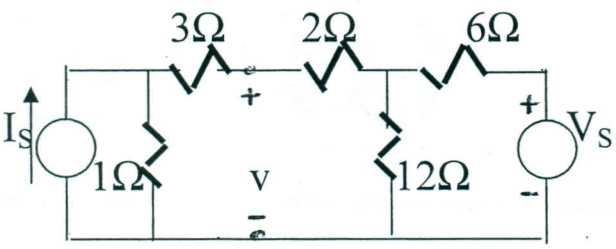


Fig B

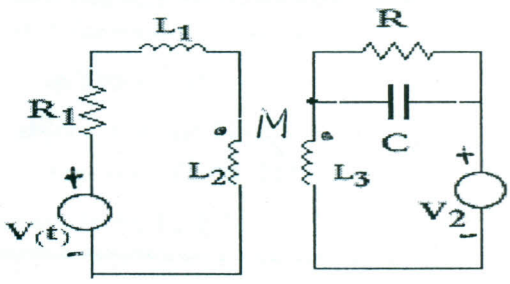


Fig A

1- For the circuit in fig.A.: (a) Draw the graph. (b) Draw two possible trees. (c) what is the number of necessary node voltage equations? (d)Write the loop current equations necessary to solve the circuit.

2- For the circuit in Fig.B, find the voltage v, given $I_S = 10$ A and $V_S = 20$ Volts.

3- For the circuit in fig.C, the switch has been closed for a long time before being opened at t = 0, find and sketch the variation of v with time, given E = 15 V , R_1 =15 kΩ , R_2 =20 kΩ, R_3 = 4 kΩ, C=1μF and C_1 = 5μF.

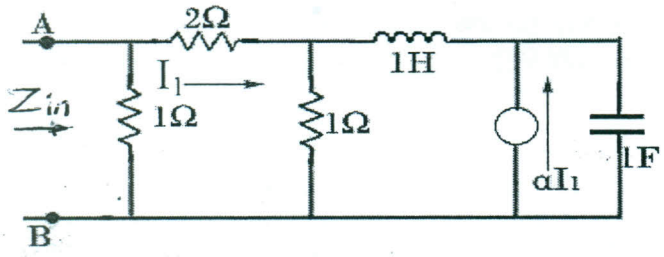


Fig.E

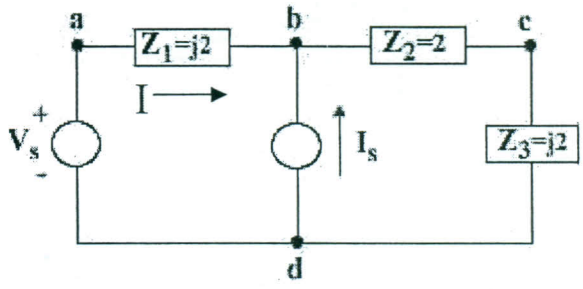


Fig.D

4- For the circuit in Fig.D, find the steady state current I, given I_s=3cos ωt and v_s=10cos(ωt+45°)

5- For the circuit in Fig.E, find the input impedance at a frequency ώ = 1 rad./sec.

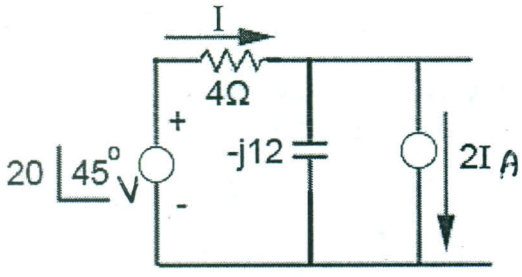


Fig.G

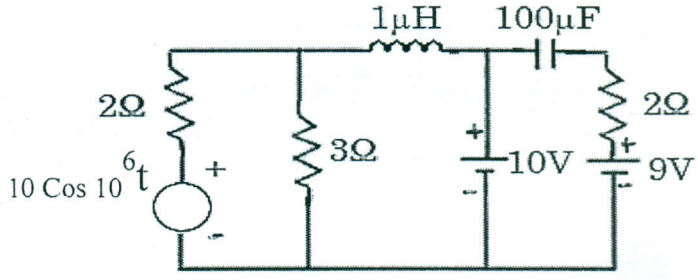


Fig.F

6- For the circuit in Fig.F, find the power dissipated in the 3 Ω resistance

7- In Fig.G. find the impedance that receives maximum power from the circuit and find this power.

8-A series resonance circuit has $L = 10\ mH$. Select C and R so that the circuit has $\omega_o = 10$ krad./sec. and to have BW = 200 rad./sec. What are the upper and lower cutoff frequencies?

9-A balanced star connected load of 150 kW takes a leading current of 100 A with line voltage 1100 V at 50 Hz find the circuit elements of the load per phase. And calculate the reactive power.

(All questions have equal weigh , 12 mark for each)

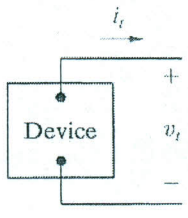
Mansoura University **Faculty of Engineering** **Department of Electronics and Communications Engineering** **1st Year Electronics**		**First Semester** من الخارج **Exam Time: 3 Hours** **Subject: Circuit Theory** **Course code: COM 9113** **Exam Date: 12-1-2013**

Attempt all questions. Assume any missed data. Full mark is 100

Q.1.a) The terminal voltage and terminal current were measured on the device shown and the values of v_t and i_t are tabulated.

i. Construct a circuit model of the device

ii. Predict the power this device will deliver to a 10Ω resistor. **[10 Marks]**

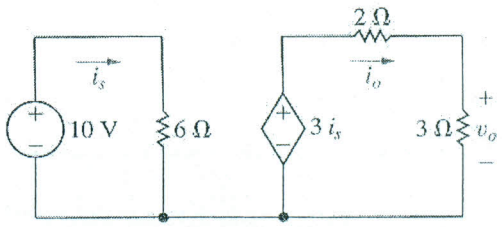


(a)

v_t (V)	i_t (A)
30	0
15	3
0	6

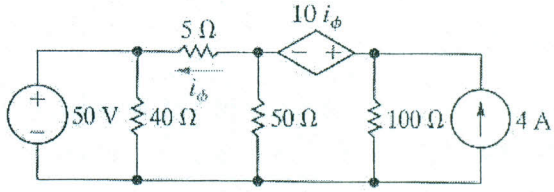
(b)

Q.1.b) Use Kirchhoff's laws and Ohm's law to find the voltage v_o as shown in figure. Show that your solution is consistent with the constraint that the total power developed in the circuit equals the total power dissipated. **[10 Marks]**



Q.2.a) Use node-voltage method to find the current i_ϕ in the 5Ω resistor.

ii. Find the power (delivered/dissipated) with each source in the circuit. **[10 Marks]**

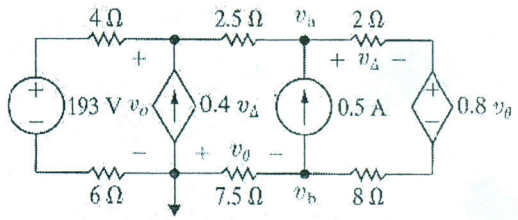


Q.2.b) Use mesh-current method to find:

i. The voltage v_θ across the 7.5 Ω resistor.

ii. The voltage v_Δ across the 2Ω resistor.

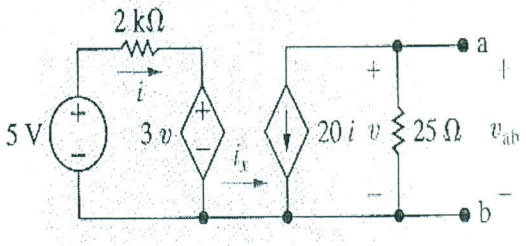
iii. The voltage v_o across the VCCS. **[10 Marks]**



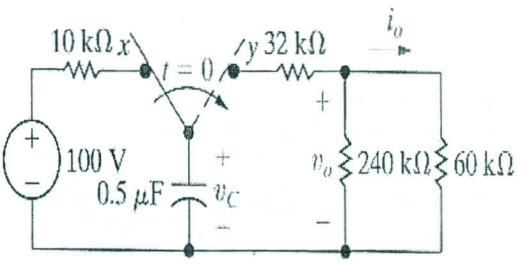
Q.2.c) If a 8KΩ resistor is connected between terminals a & b, use Thevenin equivalent to find the power dissipated in this resistor.

Sketch Norton equivalent of the shown circuit.

[10 Marks]



Q.3.a) The switch in the circuit shown has been in position *x* for a long time. At *t=0*, the switch moves instantaneously to position y. Find



i. $v_c(t)$ *for* $t \geq 0$

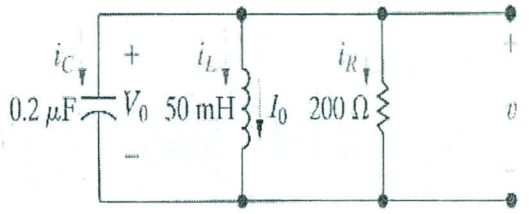
ii. $v_o(t)$ *for* $t \geq 0$

iii. $i_c(t)$ *for* $t \geq 0$

iv. The total energy dissipated in the *60KΩ* resistor

[10 Marks]

Q.3.b) For the circuit shown, $v(0^+) = 12V$, $i_L(0^+) = 30mA$.



i. Find the roots of characteristic equation that governs the transient behavior of the voltage shown

ii. Will the response be underdamped, overdamped, or critically damped?

iii. Find the initial current in each branch of the circuit.

iv. Find the initial value of *dv/dt*.

v. Find the expression for *v(t)*. **[10 Marks]**

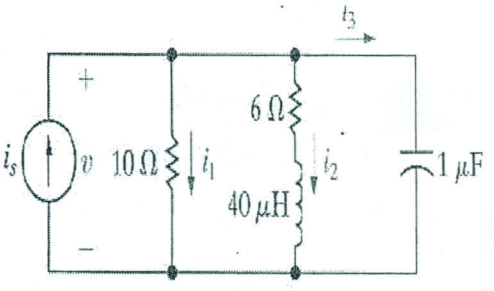
Q.4.a) An electrical load operates at 240V rms. The load absorbs an average power of 8KW at a lagging power factor of 0.8.

i. Calculate the complex power of the load.

ii. Calculate the impedance of the load. **[5 Marks]**

Q.4.b) Using Thevenin's equivalent circuit, derive an expression for the condition of maximum power transfer to a load impedance z_L. **[5 Marks]**

Q.4.c) The sinusoidal current source in the circuit shown produces the current $i_s = 8\cos(200000t)A$

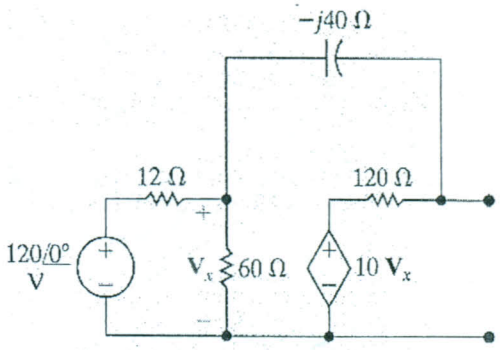


i. Construct the frequency domain equivalent circuit.

ii. Fin d the steady state expressions for v, i_1, i_2, i_3

[10 Marks]

Q.5.a) Find the Thevenin equivalent circuit with respect to terminals a, b for the circuit shown **[10 Marks]**



Q.5.b) The independent current source in the circuit shown generates *zero* current for $t < 0$ and a pulse $10te^{-5t}A$ for $t > 0$.

i. At what instant of time is the current maximum?

ii. Express the voltage across the terminals of the 100 mH inductor as a function of time.

iii. Sketch the current, voltage, energy, and power waveforms.

iv. Are the voltage and the current at a maximum at the same time?

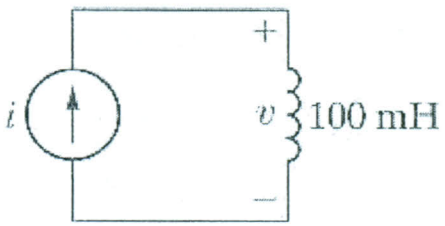
v. At what instant of time does the voltage change polarity?

vi. Is there ever an instantaneous change in voltage across the inductor? If so, at what time?

vii. In what time interval is energy being stored in the inductor?

viii. In what time interval is energy being extracted from the inductor?

ix. What is the maximum energy stored in the inductor? **[10 Marks]**



My best wishes to all of you!

Assis. Prof. Hossam El-Din Moustafa