KUMARAGURU
college of technology
character is life

B.E DEGREE EXAMINATIONS: JUNE 2017

(Regulation 2015)

Second Semester

U15ECT201: CIRCUIT THEORY

(Common to ECE / EIE)

COURSE OUTCOMES

CO1: Able to model passive elements & sources

CO2: Apply circuit theory concepts to compute voltage, current & resistance in DC& AC circuits.

CO3: Use SPICE as a simulation tool to analyze electric circuits.

CO4: Estimate the transient response of simple RL, RC & RLC circuits.

CO5: Predict the frequency response of resonance circuits.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

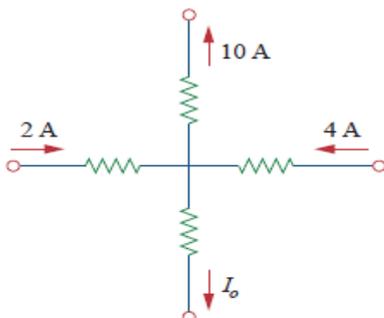1. Match the following.   CO1 [K_2]

Response	Actions
A) Short circuit to DC	1) Capacitor
B) Maximum Current	2) Open Circuit
C) Open Circuit to DC	3) Short Circuit
D) Maximum Voltage	4) Inductor

	A	B	C	D
a)	iv	i	ii	iii
b)	i	ii	iii	iv
c)	ii	iii	iv	i
d)	iv	iii	i	ii

2. The current I_0 of Fig. is: CO1 [K_2]

a)   -4 A   b)   -2 A

c)   16 A   d)   4 A

3. The maximum current that a 2W, 80 kΩ Resistor can safely conduct is: CO2 [K$_2$]

   a) 160 KA   b) 40 KA

   c) 5mA   d) 25 µA

4. Match the following. CO4 [K$_2$]

A) $Z=x+jy$	i) Polor form
B) $Z=r\angle\theta$	ii) Exponential form
C) $Z=re^{j\emptyset}$	iii) Sinusoidal form
D) $Z=r(\cos\emptyset+j\sin\emptyset)$	iv)Rectangular form

	A	B	C	D
a)	iv	iii	i	ii
b)	i	ii	iii	iv
c)	iv	i	ii	iii
d)	iii	ii	i	iv

5. The following item consists of two statements, one labeled as the "Assertion (A)" and the CO2 [K$_2$] other as "Reason (R). You are to examine those two statements carefully and select the answers to these items using the codes given below:

   Codes:
   a. both A and R are individually true and R is the correct explanation of A
   b. both A and R are individually true but R is not the correct explanation of A
   c. A is true but R is false
   d. A is false but R is true.

   Assertions: For superposition, it is not required that only one independent source be considered at a time; any number of independent sources may be considered simultaneously.
   Reason: The superposition principle applies to power calculation.

6. The following item consists of two statements, one labeled as the "Assertion (A)" and the CO5 [K$_2$] other as "Reason (R). You are to examine those two statements carefully and select the answers to these items using the codes given below:

   Codes:
   a. both A and R are individually true and R is the correct explanation of A
   b. both A and R are individually true but R is not the correct explanation of A
   c. A is true but R is false
   d. A is false but R is true.

   Assertion : Inductor Open circuit at high frequencies.
   Reason: Capacitor short circuit at low frequencies

7. Consider the following statements and state which are true. CO2 [K_2]

   1) The voltage across parallel elements is always different.

   2) Parallel resistors can be interchanged without affecting the total resistance.

   3) The total resistance of parallel resistors will always drop as new resistors are added in parallel

   4) The total resistance of parallel resistors is always more than the value of the smallest resistor.

a) 1 & 4   b) 1 & 3

c) 2 & 3   d) 2 & 4

8. Consider the following procedure for Mesh analysis. CO5 [K_2]

1. Solve the equations.

2. Apply KVL to each mesh.

3. Assign mesh currents.

4. Use Ohm`s law to express voltages in terms of mesh currents.

The correct sequence of the procedure is

a) 3,2,1,4   b) 1,2,3,4

c) 3,4,2,1   d) 4,1,2,3

9. $V_1 = 30\sin(\omega t + 10^0)$ & $V_2 = 20\sin(\omega t + 50^0)$ for the above two sinusoids which of the following statements are true? CO4 [K_2]

   i) V_1 leads V_2

   ii) V_2 leads V_1

   iii) V_2 lags V_1

   iv) V_1 lags V_2

   v) V_1 & V_2 are inphase.

a) ii & iv   b) i & ii

c) v   d) ii & iii

10. To find the effective value of a periodic signal x(t), CO4 [K_2]

   1) Take square root

   2) Square x(t)

   3) Find the mean

    Which of the sequence is correct?

a) 1,2,3   b) 2,3,1

c) 3,2,1   d) 1,3,2

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

11. Determine v_o and i in the circuit shown in Fig.   CO1 [K$_2$]
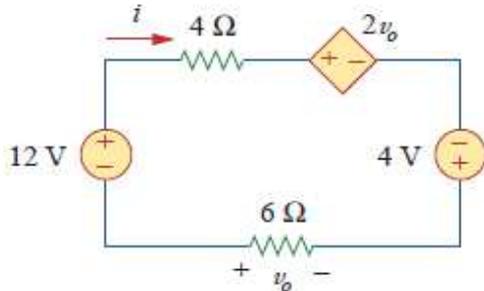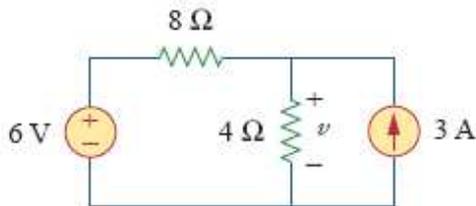

12. Calculate the equivalent resistance R_{ab} in the circuit in Fig   CO1 [K$_2$]
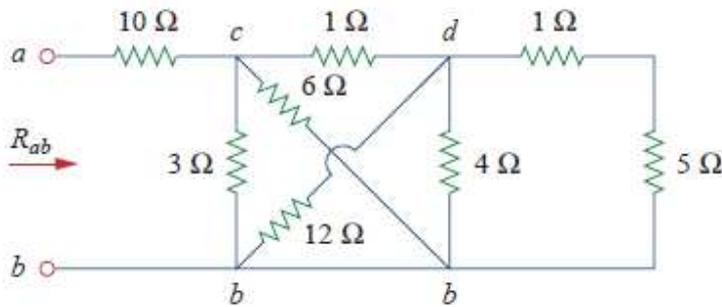
13. Use the superposition theorem to find v in the circuit of Fig.   CO2 [K$_1$]

14. Recall the equation for Maximum power transfer in both ac and dc circuits.   CO2 [K$_2$]

15. Compare apparent power and complex power.   CO2 [K$_2$]

16. State natural response.   CO4 [K$_3$]

17. Draw the current response of source free RL circuit   CO4 [K$_2$]

18. What is the use of step input in circuit analysis.   CO4 [K$_2$]

19. Define resonance and Quality factor   CO5 [K$_2$]

20. Give examples for magnetically coupled devices.   CO5 [K$_2$]

Q.No. 21 is Compulsory

21. Find current i in the circuit of Fig.   CO1 [K$_2$]
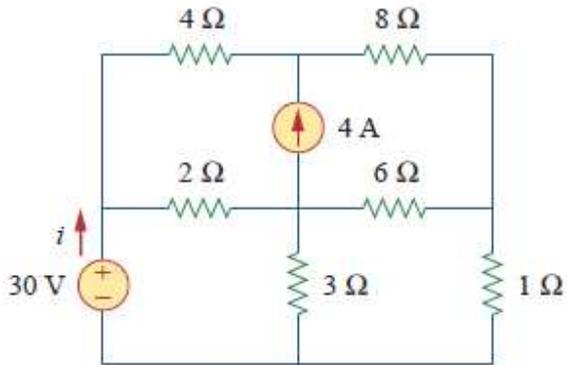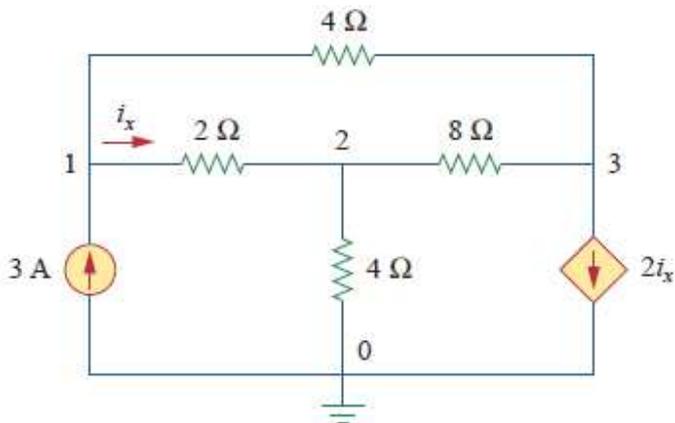

22. (i) Obtain the R$_{ab}$ equivalent resistance for the circuit in Fig. and use it to find current i.   (7) CO1 [K$_3$]
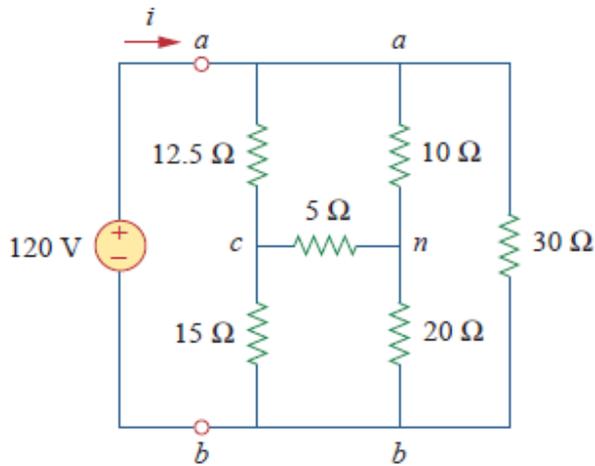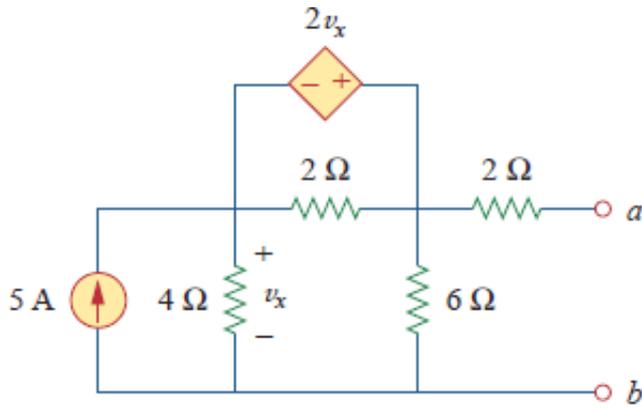

(ii) Determine the voltages at the nodes in Fig.   (7) CO1 [K3]

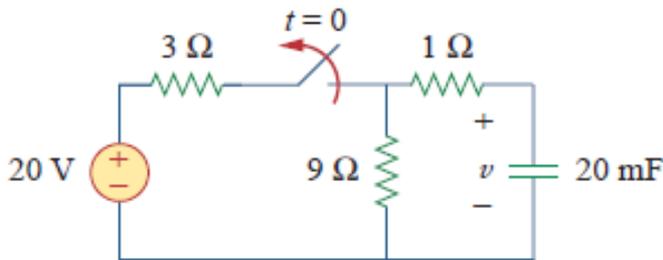23. Find the Thevenin and Norton equivalent of the circuit in Fig. at terminals a-b. (7+ CO2 [K$_2$]
7)

24. (i) Explain and derive the expression for unit step driven RC circuit. (7) CO4 [K$_2$]

(ii) The switch in the circuit in Fig. has been closed for a long time, and it is opened at (7) CO4 [K$_2$]
t=0.Find v(t) for t>=0. Calculate the initial energy stored in the capacitor.

25. (i) Determine the load impedance that maximizes the average power drawn from the (7) CO4 [K$_3$]
circuit of Fig. What is the maximum average power?
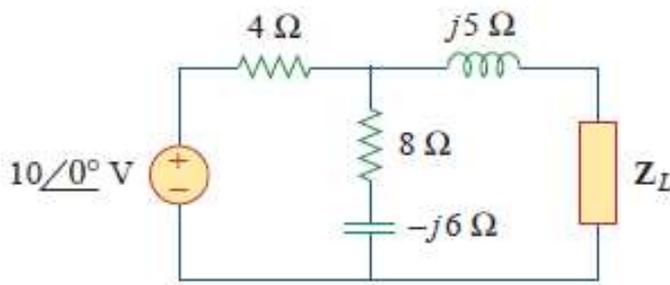
(ii) A series-connected load draws a current i(t)=4 cos(100$\prod$t+10)A when the applied (7) CO4 [K3]
voltage is v(t)=120cos(100$\prod$t-20)V. Find the apparent power and the power factor of
the load. Determine the element values that form the series-connected load.

26. (i) A parallel resonant circuit has R=100KΩ, L=20mH and C=5nF. (7) CO5 [K$_2$]
Calculate $\omega_0, \omega_1, \omega_2$, Q, and B.

(ii) Explain and derive the Mutual Inductance of the Magnetically coupled devices. (7) CO5 [K$_2$]

27. Determine I_0 current in the circuit of Fig. using mesh analysis.

$5\underline{/0°}$ A · I_3 · $4\ \Omega$ · $-j2\ \Omega$ · I_o · $j10\ \Omega$ · I_2 · $20\underline{/90°}$ V · $8\ \Omega$ · I_1 · $-j2\ \Omega$

****