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Code No.: **10011**

FACULTY OF ENGINEERING

B.E. II/IV Year (ECE) I Semester (Supplementary) Examination, April 2006

BASIC CIRCUITS ANALYSIS

Time : 3 *Hours*] [*Max. Marks* : 75

Answer **all** *questions of* Part A.
Answer **five** *questions from* Part B.

Part A – (Marks: 25)

1. A series R-C network with R=10 ohms and C=1F is existed by a dc voltage of 10 volts. Determine the steady state value of the voltage across capacitor and approximate time required to reach this value. 3

2. An inductance of 2H is shunted by 1 ohm resistor and this combination is connected in series with a capacitance of 1F. Determine resonant frequency. 3

3. Two mutually coupled coils are connected in series such that mutual fluxes set up by them oppose each other. Determine the equivalent inductance if L_1 = 1H, L_2 = 4H and co-efficient of coupling K = 0.8. 2

4. Draw voltage - current characteristics of ideal and realistic voltage sources. Also, indicate their equivalent electrical circuits. 2

5. The applied voltage and the resulting current in an electrical circuit is given by $v = 14.14 \sin(wt + 60°)$ and $i = \sqrt{2} \sin(wt - 30°)$. Determine the power factor of the circuit and Volt-Amperes (VA) delivered to the circuit. 3

6. Define, (a) Q-factor (b) Selectivity (c) Band-width, with reference to resonant circuits. 3

7. An initially relaxed network consisting of 1 ohm resistor and a 2 Farad capacitor is existed by a voltage $v(t) = 3e^{-t}$. Determine the current immediately after the application of the voltage. What is the steady state value of this current? 3

8. The graph of electrical network has 'N' nodes and 'B' branches. The number of links with respect to choice of a tree is given by,

   (a) B–N+1 (b) B+N (c) N–B+1 (d) N–2B +1

   Select the correct answer and justify the same. 2

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9. How do you differentiate between first order and second order circuits? Give examples. 2

10. If the current in an electrical network is given by, $i(t) = 2e^{-3t}$, what is the time constant of the circuit? 2

Part B – (Marks: $5 \times 10 = 50$)

11. (a) Obtain the currents I_1 and I_2 for the circuit shown in Fig. 11(a) 5

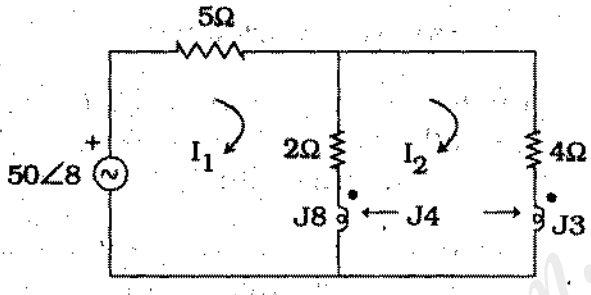

Fig. 11 (a)

(b) In the network of Fig. 11(b), the switch K is closed and a steady state is reached in the network. At $t = 0$, the switch is opened. Find an expression for the current in inductor, $i_2(t)$. 5

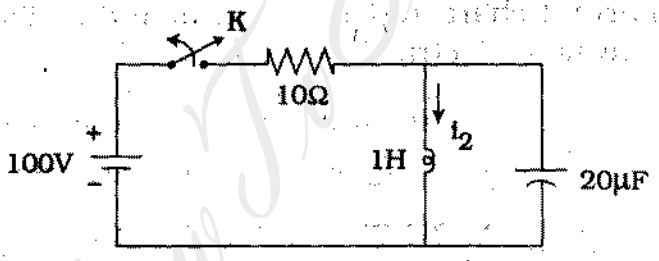

Fig. 11 (b)

12. (a) For the network shown in Fig. 12(a), select three meshes such that each mesh consists of a voltage source $v(t)$. Write equilibrium equations on Mesh basis. 5

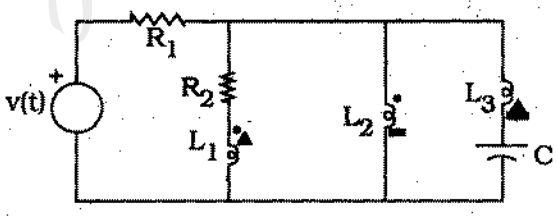

Fig. 12 (a)

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(b) The node equations of a network are given by, $(0.45 - j\,0.5)\,V_1 - 0.25\,V_2 = 10\,\angle 0°$ and $-0.25\,V_1 + (0.75 + j\,0.5)\,V_2 = 25\,\angle 90°$ 5

(i) Draw the network which has above node equations.

(ii) Draw the dual of this network.

13. (a) Prove that the resonant frequency of a parallel RLC circuit is the geometric mean of the two half power frequencies. 5

(b) For the network shown in Fig. 13 (b), (i) Determine resonant frequency (ii) If the voltage across capacitor is $v_c = 20\sqrt{2}\sin 0.5t$, find the instantaneous current through inductor and applied voltage. 5

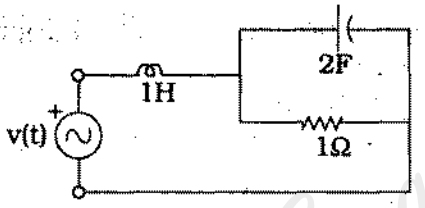

Fig. 13 (b)

14. (a) State and prove maximum power transfer theorem. 5

(b) In a linear RLC network, the following readings are taken

At 50Hz,

$v_1' = 5 \exp(j\,5°)$ $\quad i_1' = 12 \exp(j\,40°)$

$v_2' = 15 \exp(-j\,20°)$ $\quad i_2' = 8 \exp(j\,10°)$

$v_3' = ?$ $\quad i_3' = 10 \exp(j\,15°)$

At 100Hz

$v_1 = 10\,e^{j\,20°}$ $\quad i_1 = 2 \exp(j\,25°)$

$v_2 = 12\,e^{j\,35°}$ $\quad i_2 = 10 \exp(-j\,10°)$

$v_3 = 5\,e^{j\,5°}$ $\quad i_3 = 14.93 \exp(j\,68°)$

Determine v_3' as it has not been recorded. 5

15. (a) State and explain superposition theorem. Can this theorem be applied to find power in the circuit? 4

(b) Find the Thevenin's and Norton's equivalent circuit across terminals AB of the network shown in Fig. 15(b).

Hence, find the load impedance that should be connected across terminals AB

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of the network for maximum power transfer. What is the power supplied to this load? 6

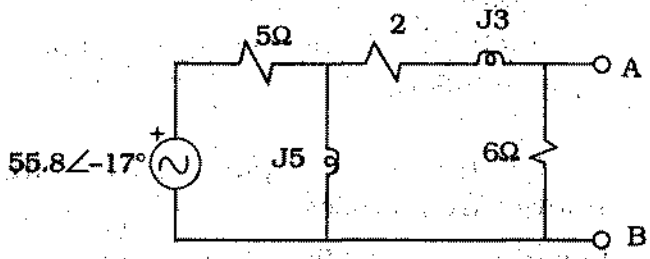

Fig. 15 (b)

16. (a) The current source connected to the network shown in Fig. 16(a) is described by the equation, $i_1 = 5\sqrt{2}$ Sin $1000t$. Determine the effective current in each element and also the complex power for each element in the network and total complex power for the network. 5

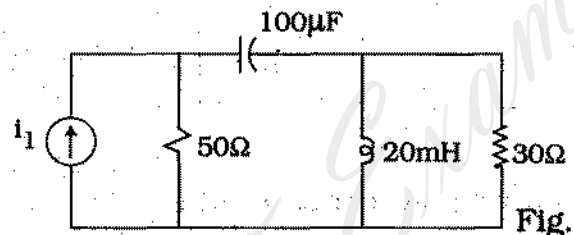

Fig. 16 (a)

(b) For the network shown in Fig. 16(b), find $v_a(t)$ in the steady state if $v_1 = 2 \sin 2t$. 5

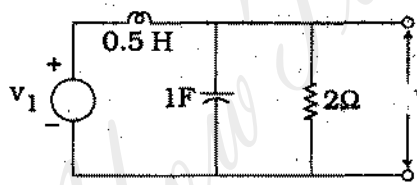

Fig. 16 (b)

17. (a) Explain the following terms, as they refer to Network Topology.
(i) Cutset (ii) Tree (iii) Chord. 4

(b) Obtain the fundamental circuit matrix for the graph shown in Fig. 17(b). Choose the tree consisting of branches 6, 7, 8, 9. Write KVL & KCL equations for the graph. 6

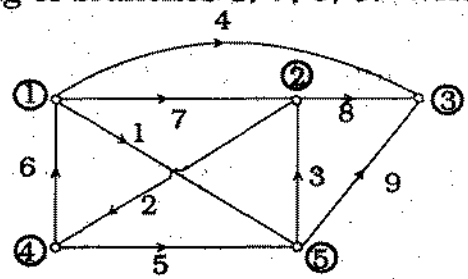

Fig. 17 (b)

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