B 2155

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Second Semester

Electronics and Communication Engineering

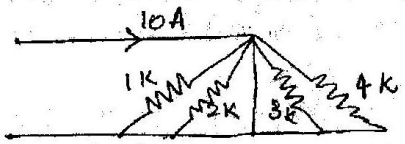
EC 142 — CIRCUIT THEORY

Time : Three hours Maximum : 100 marks

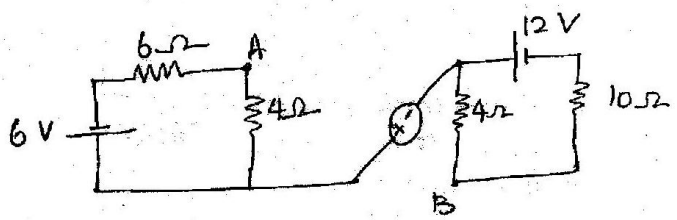
Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Determine the current in every branch.



2. What is the voltage across A and B in the circuit shown?



3. What is the condition for transfer of maximum power?

4. Define Tellegen's theorem.

5. Determine the upper cut off frequency and lower cut off frequency for the series circuit consisting of $R = 10\ \Omega$, $L = 0.1\ H$ and $C = 10\ \mu F$.

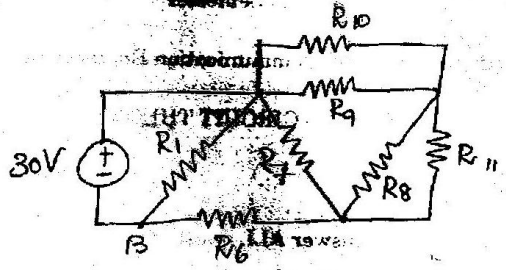
6. Draw the impedance versus frequency curve of a series resonant circuit.

7. Define the time constant for series RL circuit.

8. Define coupling coefficient.

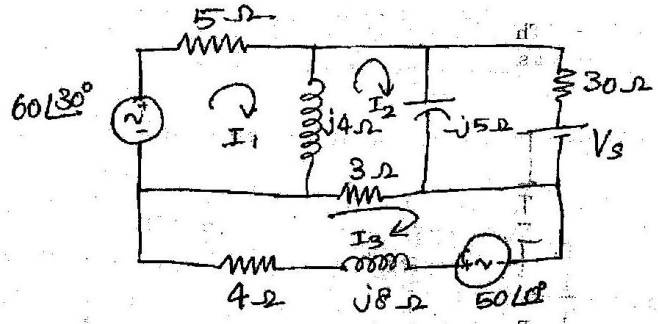
9. Define Tree and Cotree of a network.

10. Determine the current delivered by the source, if each resistor is 1Ω in value.

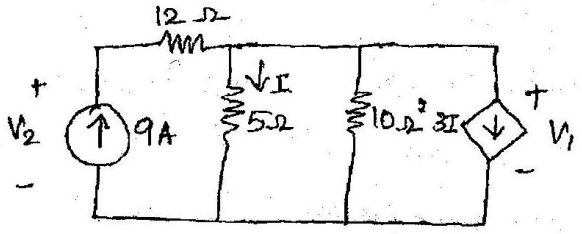


PART B — (5 × 16 = 80 marks)

11. (a) (i) Use Mesh analysis, determine the voltage V_S which gives voltage of $30\angle 0^\circ V$ across the 30 Ω resistor in the given circuit. (8)

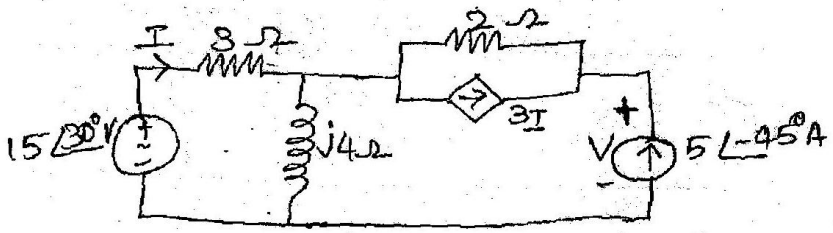


(ii) Calculate V_1 and V_2 in the circuit shown. (8)

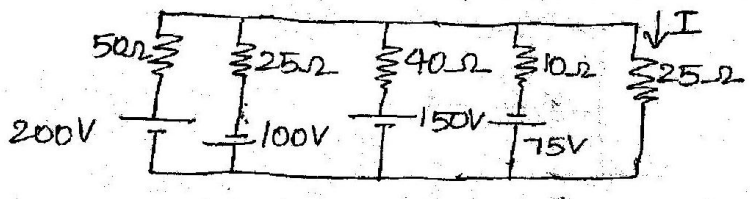


Or

(b) (i) Using superposition theorem, find V in the circuit shown. (8)



(ii) Using Millman's theorem, find I in the circuit shown. (8)



13. (a) (i) Derive the frequencies at which the voltage across inductor and the voltage across capacitor reaches its maximum value in a series RLC circuit. (8)

(ii) A series RLC circuit consists of a 50 Ω resistance, 0.2 H inductance and 10 μF capacitor with an applied voltage of 20 V. Determine the resonant frequency, Q factor, upper and lower frequency limits. Also find the bandwidth of the circuit. (8)

Or

(b) (i) Calculate the effective inductance of the circuit shown Fig. A1 across AB. (10)

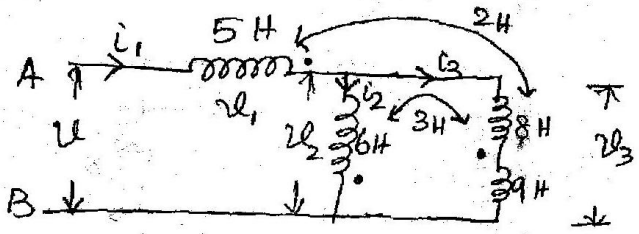


Fig. A1

(ii) The tuned frequency of a double tuned circuit shown Fig. A2 is 10^4 rad/sec. If the source voltage is 2 V and has a resistance of 0.1Ω. Calculate the maximum output voltage at resonance if $R_1 = 0.01\,\Omega$, $L_1 = 2\,\mu H$, $R_2 = 0.1\,\Omega$ and $L_2 = 25\,\mu H$. (6)

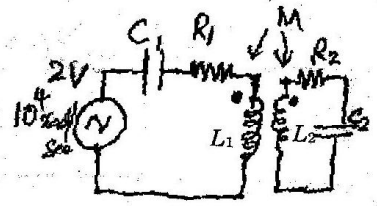
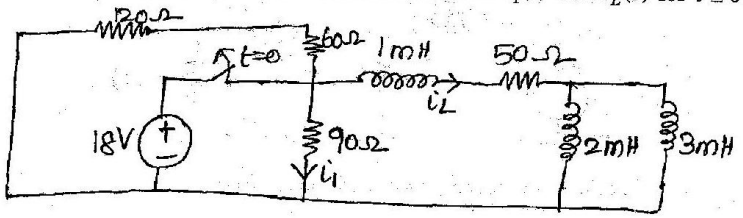
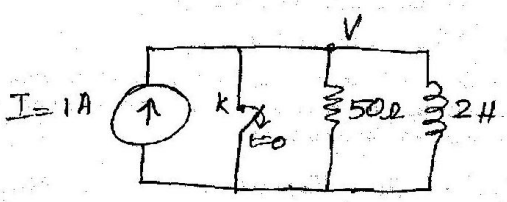


Fig. A2

14. (a) (i) In the circuit shown, initially switch was closed for a long time. At $t = 0$, switch is opened. Find currents $i_1(t)$ and $i_L(t)$ for $t \geq 0$. (8)

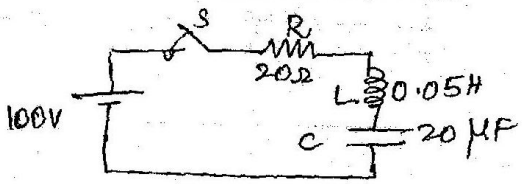


(ii) For the circuit shown, the switch K is opened at $t = 0$. Find the values of $V, \frac{dV}{dt}$ and $\frac{d^2V}{dt^2}$ at $t = 0^+$. (8)

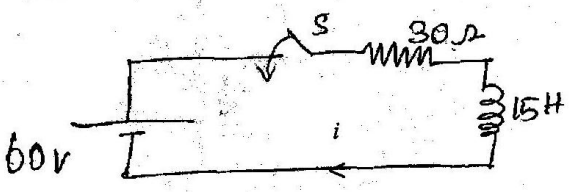


Or

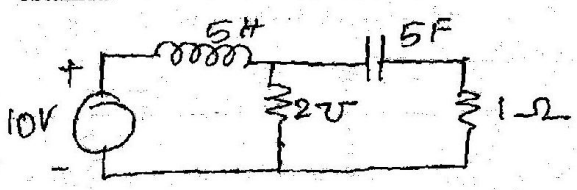
(b) (i) The circuit shown consists of resistance, inductance and capacitance in series with a 100 V constant source when the switch is closed at $t = 0$. Find the current transient. (8)



(ii) A series RL circuit with $R = 30\,\Omega$ and $L = 15\,H$ has a constant voltage $V = 60\,V$ applied at $t = 0$ as shown in figure. Determine the current i, the voltage across resistor and the voltage across the inductor. (8)



15. (a) (i) Define duality and explain how the dual of the following network is obtained. (8)



(ii) Explain the properties of incident matrix. (8)

Or

(b) (i) Write short notes on the following with example. (6)

(1) Planar and non planar graph

(2) Tie set and cut set of graph.

(ii) For the electrical network shown, draw its topological graph and write its incident matrix, tie set matrix, link current transformation equation and branch currents. (10)