B.E. Electronics and Telecommunication Engineering
1st Year 2nd Semester Examination 2019 (old)
Circuit Theory

Time: 3 hours **Full Marks: 100**

Answer all the parts of a question in the same place
All questions carry equal marks
Answer any <u>ten</u> questions

1. a) A 20 μF capacitor is connected in parallel with a 40 μF capacitor and the combination is connected across a time-varying voltage source. At a particular time, the current supplied by the source is 5A. Obtain the magnitude of currents through the individual capacitors.
   b) In an inductive circuit the applied voltage is $V_m \sin(\omega_m t)$. Obtain the expression for instantaneous power.
   c) Find the condition under which the maximum current will be obtained for the circuit shown in Fig. 1.

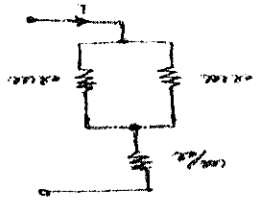


Fig- 1

(3+4+3)

2. a) In the circuit shown in Fig. 2, find I and I_L.

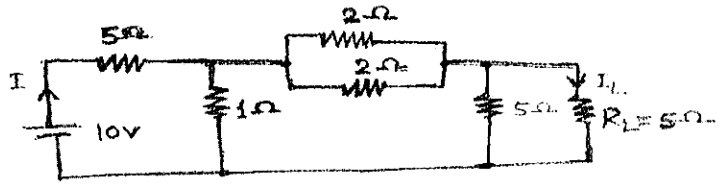


Fig 2

b) A voltage source *v(t)* is connected across a capacitor of 2F. Find the energy stored in the capacitor from t= 0 to 10 sec, if $v(t) = t^2e^{-2t}$. (6+4)

3. a) State maximum power transfer theorem.
   b) In the network configuration shown in Fig. 3, find the voltage drop and current through the 5Ω resistor.

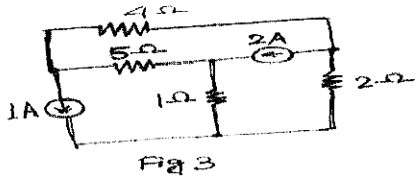


Fig 3

(2+8)

4. Find v using the principle of superposition in Fig. 4.

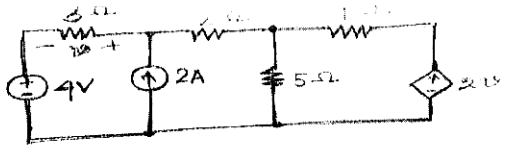


Fig. 4

(10)

5. Obtain the open circuit impedance parameters of the network shown in Fig. 5.

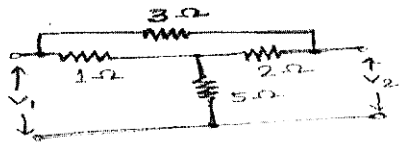


Fig. 5

(10)

6. a) Obtain the Laplace transform of $f(t) = 1 - e^{-\alpha t}$, where α is a constant.
   b) In Fig. 6, the battery voltage is applied for a steady state period. Determine the complete expression for the current after closing the switch K, where $R_1 = 1\Omega$, $R_2 = 2\Omega$, L = 1 H, and E = 10 V.

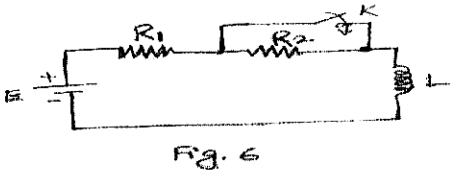
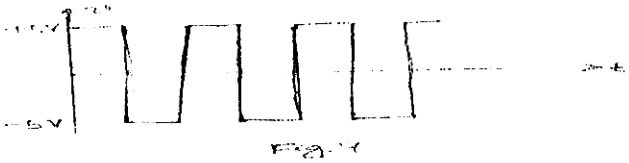


Fig. 6

(3+7)

7. A periodic square wave voltage as shown in Fig. 7 is applied across a 5Ω resistance. Find the expression for current using Fourier series method.



(10)

8. a) Explain under what conditions an R-C circuit behaves as an integrator and a differentiator.
   b) Calculate the series and parallel resonant frequencies of a capacitor of capacitance 0.005 μF and an inductor of inductance 100 mH and a resistance of 250 Ω. Also calculate impedances at series resonance and parallel resonance.

(4+6)

9. a) Determine the response of a series R-C circuit for a sinusoidal input voltage.
   b) An R-L series circuit draws a current of 1A when connected across a 10V, 50Hz A.C. supply. Assuming the resistance to be 5 Ω, find the inductance of the circuit and power factor.

(5+5)

10. a) Write the expression for convolution integral and explain its application in circuit analysis.

    b) In the network shown in Fig. 8, the switch S is closed and the steady state is attained. At $t = 0$, the switch is opened. Determine the current through the inductor using Laplace transform method.

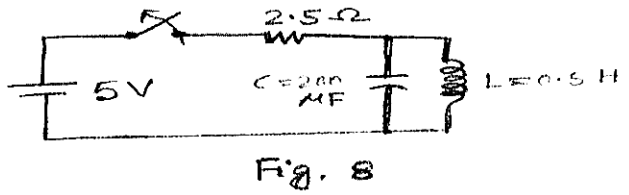


Fig. 8

(5+5)

11. a) Calculate the transient response of a series R-L circuit under a D.C. excitation voltage.
    b) In the circuit shown in Fig. 9, find $v_c(t)$ across the capacitor after switching at t = 0, where R1 = R2 = 10 Ω, R3 = 5 Ω, C = 100 μF and V = 20 volts.

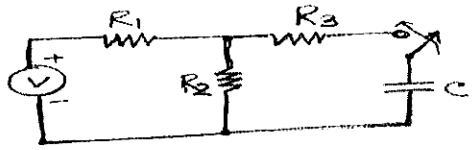


Fig. 9

(6+4)

12. a) What do you mean by incidence matrix? Write the steps to obtain reduced incidence matrix from a graph. Develop the tie-set matrix for the graph shown in Fig. 10.

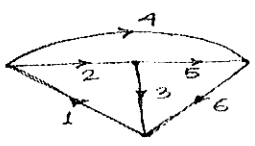


Fig 10

(2+4+4)