Reg. No. :

# Question Paper Code : X 10388

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020 AND APRIL/MAY 2021

Second Semester

Electrical and Electronics Engineering

EE 8251 – CIRCUIT THEORY

(Common to Electronics and Instrumentation Engineering/Instrumentation and Control Engineering)

(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What are the classifications of circuit elements ? Write the examples of each.

2. Determine the power being generated by the circuit element as shown in Fig. 1

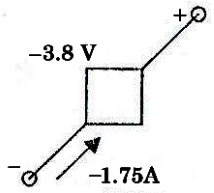


Fig. 1

3. Convert the given Fig. 2 in to the transformed source/resistor combination.

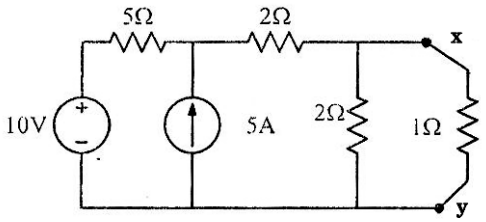


Fig. 2

4. Write the statements of reciprocity theorem.

5. A coil having a resistance of 10Ω and inductance of 1H is switched on a direct voltage of 100V. Calculate the rate of change of current at the instant of closing the switch.

6. Determine the voltage at the terminals of the coil having R = 10 Ω and L = 15H at the instant when the current is 10A and increasing at 5A/sec. Also find the stored energy in the inductor.

7. Define :

   a) Form factor.

   b) Peak factor.

8. A symmetrical three phase, 400V system supplies a balanced mesh connected load. The current in each branch circuit is 20A and the phase angle is 40° lag. Find the

   a) Line current

   b) Total power.

9. What is the maximum possible mutual inductance of the two inductively coupled coils with self-inductance of $L_1$ = 25 mH and $L_2$ = 100 mH.

10. Find the expression for the mutual inductance in the series connection of two coupled coils, when the flux of the two coils assist each other, the net equivalent inductance being $L_1$ and when the flux of the two coils oppose each other, the equivalent inductance being $L_2$.

PART – B **(5×13=65 Marks)**

11. a) Using mesh analysis to determine the mesh current as given in Fig. 3.

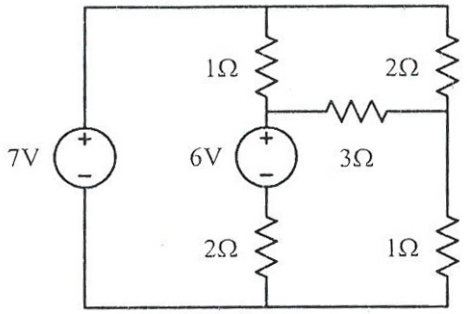


Fig. 3

(OR)

b) Determine the nodal voltages for the circuit of Fig. 4, as referenced to the bottom node.

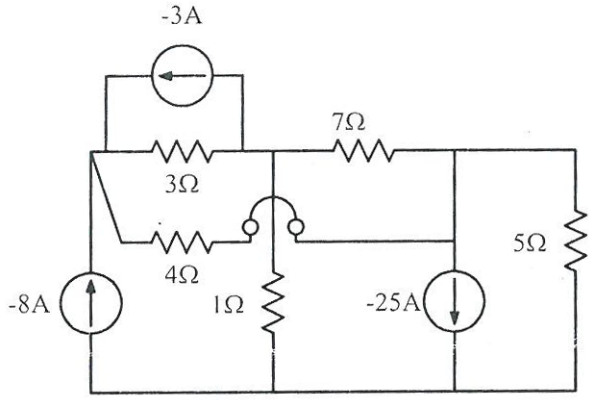


Fig. 4.

12. a) Using superposition theorem, find the current through a link that to be connected between terminals a-b is as shown in Fig. 5. Assume the link resistance to be zero.

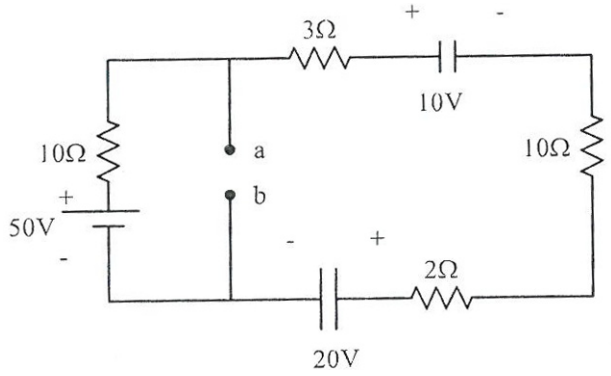


Fig. 5

(OR)

b) Find the power loss in the 1 Ω resistor using Norton's theorem is given in Fig. 6.

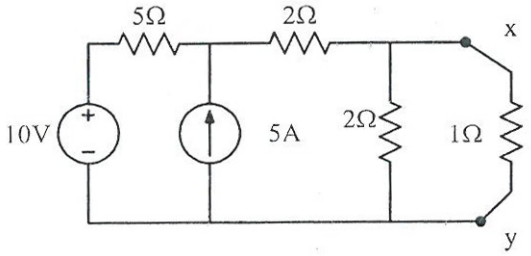


Fig. 6

13. a) Calculate the form factor and peak factor of the half wave rectified sine wave.

(OR)

b) A 4 Ω resistor is connected to a 10 mH inductor across a 100 V, 50 Hz voltage source. Find.

i) Impedance of the circuit. **(2)**

ii) Input current. **(2)**

iii) Drop across the resistor and inductance. **(3)**

iv) Power factor of the circuit. **(3)**

v) Real power consumed in the circuit. **(3)**

14. a) A three phase delta connected load has $Z_{ab} = (100 + j0)\Omega$ , $Z_{bc} = (-j100)\ \Omega$ and $Z_{ca} = (70.7 + j70.7)\ \Omega$ and is connected to a balanced 3 phase 400 V supply. Determine the line currents $I_a$, $I_b$ and $I_c$. Assume the phase sequence abc.

(OR)

b) Three identical coils each having a resistance of 20 Ω and a reactance of 20 Ω are connected in

(i) star **(6)**

(ii) delta across 440V 3 phase supply. **(7)**

Calculate for each phase line current and reading in each of the watt meters connected to measure power.

15. a) Two coupled coils with respective self-inductances $L_1 = 0.8$ H and $L_2 = 0.2$ H have a coupling coefficient of 0.6. Coil 2 has 500 turns. If the current in coil 1 is $I_1(t) = 10\sin 200t$. Determine the voltage at coil 2 and the maximum flux set up by the coil 1.

(OR)

b) In a series fed double tuned circuit a maximum voltage gain of 20 was obtained at a resonance frequency of 106 rad/sec. The capacitance in the primary circuit is 2μF. The maximum output voltage at resonance is 50 V. Calculate

(i) supply voltage. **(4)**

(ii) the primary and secondary self – inductances. **(3)**

(iii) the critical coefficient of coupling. **(3)**

(iv) the capacitance in the secondary circuit. Assume that the primary and secondary resistances are 1 Ω and 4 Ω respectively. **(3)**

PART – C **(1×15=15 Marks)**

16. a) Plot the power dissipation of the load resistance, for several values between 1 K Ω and 20 K Ω is as shown in Fig. 7

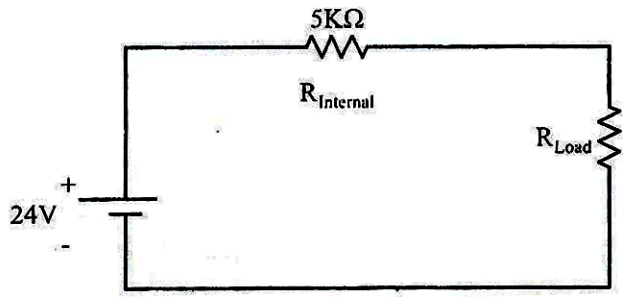


Fig. 7

At what load resistance value is the load's power dissipation maximized ?

(OR)

b) Consider an automobile ignition system as a charging system. The system is modelled by the circuit shown in Fig. 8. The 12V source is due to the battery and alternator. The 4 Ω resistor represents the resistance of the wiring. The ignition coil is modeled by the 8mH inductor. The 1μF capacitor is in parallel with the switch. Determine how the RLC circuit is used in generating high voltage. Assume that the switch is closed prior to $t = 0^-$, find the inductor voltage $V_L$ for $t > 0$.

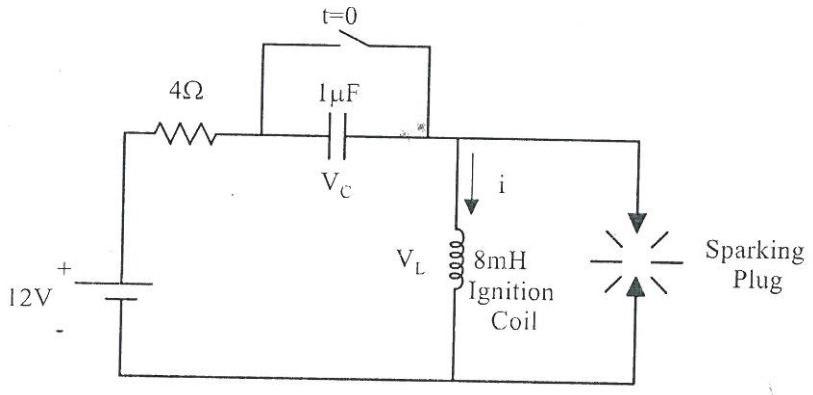


Fig. 8