Code : 031101

B.Tech. 1st Semester Exam., 2013

BASIC ELECTRICAL ENGINEERING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) All questions carry equal marks.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the correct answer (any *seven*) :

(a) A network contains linear resistors and ideal voltage sources. If the value of all the resistors are doubled, then the voltage across each resistor is

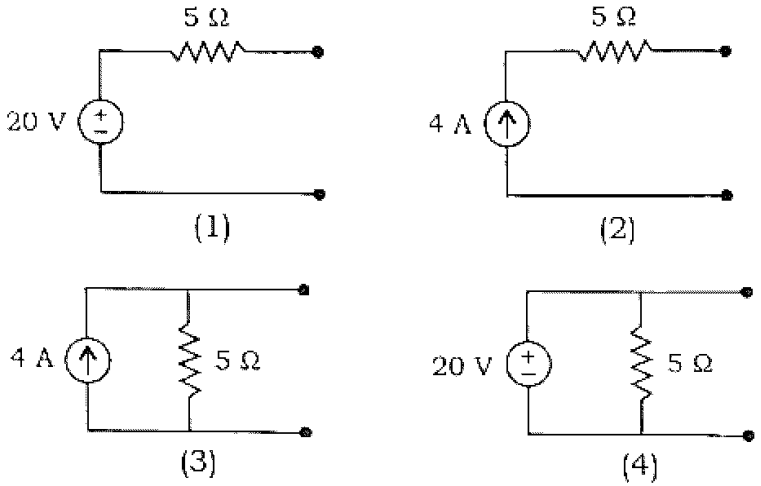
(i) halved

(ii) doubled

(iii) increased by four times

(iv) not changed

(b) Which pair of circuits are equivalent?



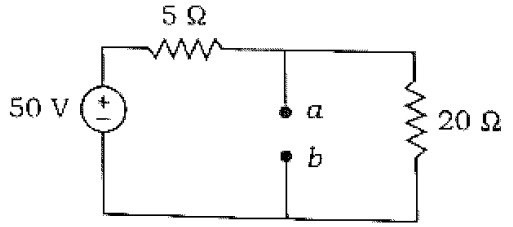
(i) (1) and (2)

(ii) (2) and (4)

(iii) (1) and (3)

(iv) (3) and (4)

(c)



The Norton current at terminal *a* and *b* of the above circuit is

(i) 10 A *(ii)* 2·5 A

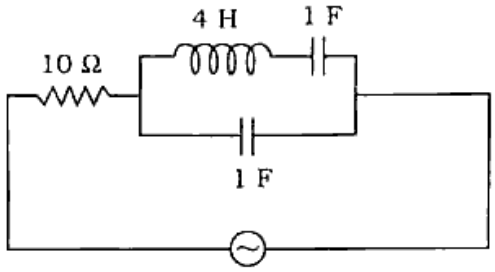
(iii) 2 A *(iv)* 0 A

(d) The current $i(t)$ through a 10 Ω resistor in series with an inductance is given by

(i) $\sqrt{41}$ A (ii) $\sqrt{35}$ A

(iii) 5 A (iv) 11 A

(e) The following circuit



resonates at

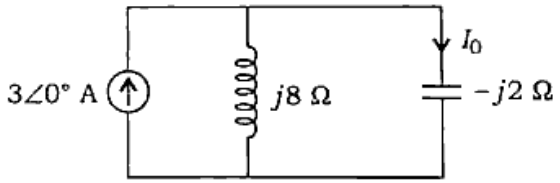
(i) all frequency

(ii) 0·5 rad/s

(iii) 1 rad/s

(iv) None of the above

(f) The value of the current I_0 in the following circuit

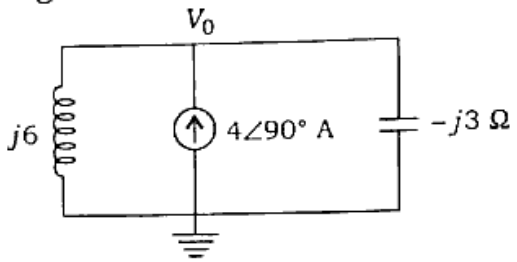


is

(i) 4∠0° A (ii) 2·4∠−90° A

(iii) 0·6∠0° A (iv) −1 A

(g) Using nodal analysis, the value of V_0 in the following circuit



is

(i) − 24 V

(ii) − 8 V

(iii) 8 V

(iv) 24 V

(h) A 3-phase load is balanced if all the three phases have the same

(i) impedance

(ii) power factor

(iii) impedance and power factor

(iv) None of the above

(i) Three delta-connected resistors absorb 60 kW when connected to a 3-phase line. If the resistors are connected in star, the power absorbed is

(i) 60 kW

(ii) 20 kW

(iii) 40 kW

(iv) 180 kW

(j) The lack of which force causes the pointer to oscillate?

(i) Controlling force

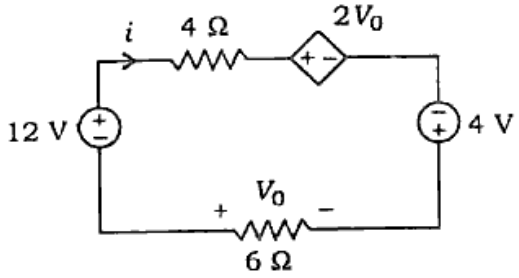
(ii) Deflecting force

(iii) Damping force

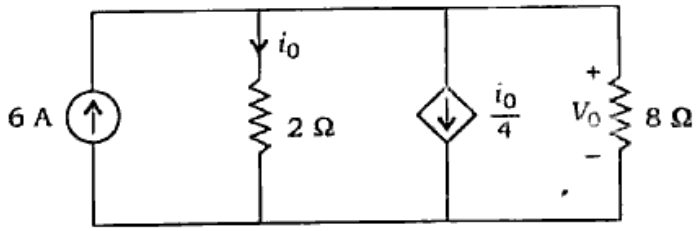
(iv) None of the above

2. (a) What do you mean by active and passive elements? Explain Kirchhoff's laws.

(b) (i) Determine V_0 and i in the circuit shown below :

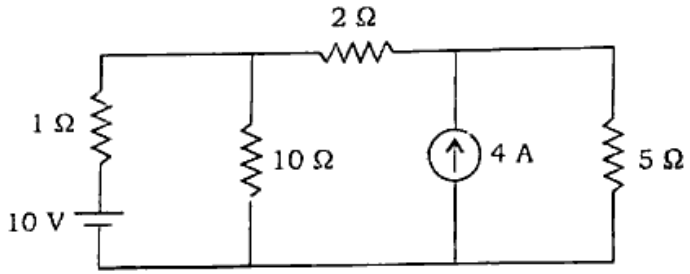


(ii) Find V_0 and i_0 in the circuit given below :



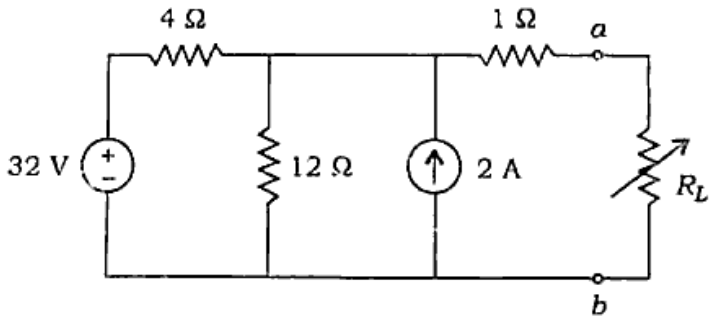
3. (a) (i) State and explain the superposition theorem. Can superposition theorem be applied to power calculation?

(ii) Determine the current in the 10 Ω resistor :



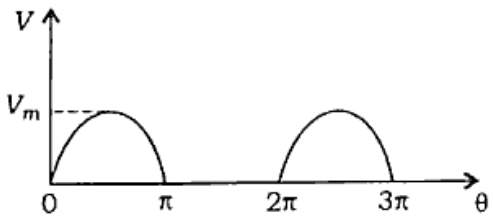
(b) (i) State and explain Thevenin's theorem. What is the importance of Thevenin's theorem in circuit analysis? Explain.

(ii) Find the Thevenin equivalent circuit shown in the figure, to the left of terminal *a-b*. Then find the current through $R_L = 6\ \Omega$:



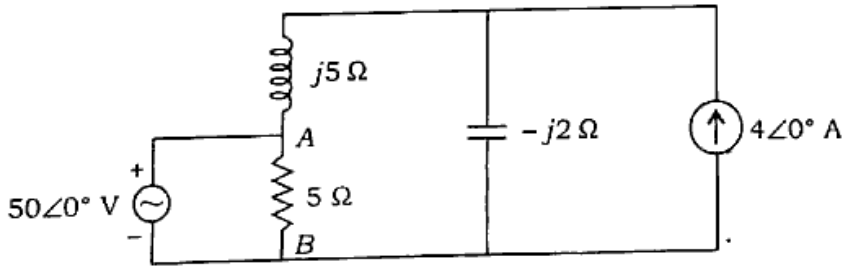
4. *(a)* Define RMS value and average value of sinusoidal waveform.

(b) Find the average and RMS values of the waveform as shown in the figure :

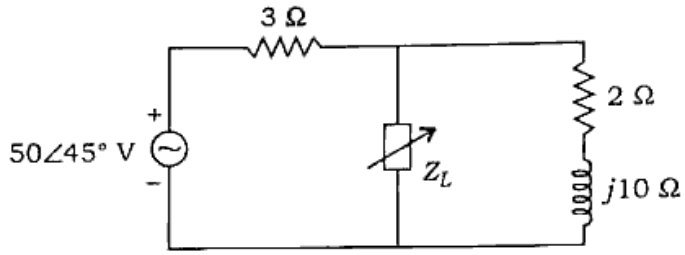


5. *(a)* *(i)* An alternating voltage of $80 + 60j$ V is applied to a circuit and the current flowing is $4 - j2$ A. Find (1) impedance, (2) power consumed and (3) power factor.

(ii) Determine voltage V_{AB} for the network shown in the figure :



(b) Find the value of load impedance Z_L so that maximum power can be transferred to it in the network of the figure given below. Find maximum power :



6. *(a)* What are the advantages of a three-phase system? Compare between star and delta connections.

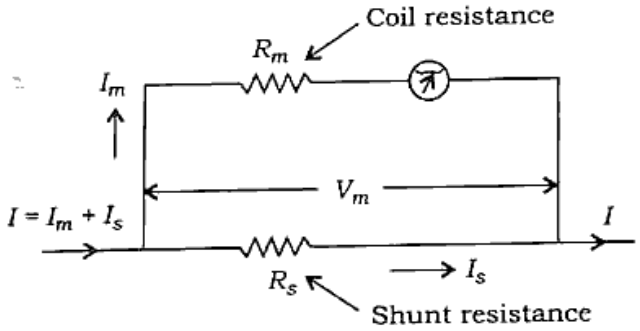
(b) Three equal impedances, each of $8 + j10\ \Omega$ are connected in star. This is further connected to a 440 V, 50 Hz, three-phase supply. Calculate the active and reactive powers, and line and phase currents.

7. *(a)* Compare between electric circuit and magnetic circuit.

(b) The measured values of iron loss of a magnetic specimen of weight 13 kg are 17·2 W and 28·9 W at 40 Hz and 60 Hz respectively, at a constant peak flux density. Determine the value of hysteresis and eddy current losses in W/kg at 50 Hz for same value of flux density.

8. *(a)* List the three forces involved in moving system of PMMC (Permanent Magnet Moving Coil) instrument. Explain the function of each force. How is it typically produced?

(b) An ammeter (shown below) has a PMMC instrument with a coil resistance of $R_m = 99\,\Omega$ and FSD (Full Scale Division) current of 0·1 mA. Shunt resistance $R_s = 1\,\Omega$. Determine the total current passing through the ammeter at FSD :



9. Write short notes on any *two* of the following :

(a) Star-delta conversion

(b) Resonance and *Q*-factor

(c) Linear and non-linear magnetic circuits

(d) Energy insulation resistance

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