Code : 031101

B.Tech. 1st Semester Exam., 2014

BASIC ELECTRICAL ENGINEERING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) *All question carry equal marks.*

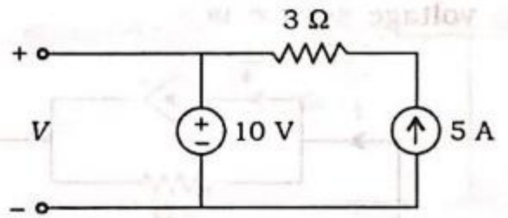
(ii) *There are **NINE** questions in this paper.*

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

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

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

(a) The voltage V in the figure given below is



(i) 10 V

(ii) 15 V

(iii) 5 V

(iv) None of the above

(b) The 'nodal analysis' method is based on

(i) KVL and Ohm's law

(ii) KCL and Ohm's law

(iii) KCL and KVL

(iv) KCL, KVL and Ohm's law

(c) If each branch of a delta circuit has resistance $\sqrt{3}R$, then each branch of the equivalent star circuit has resistance

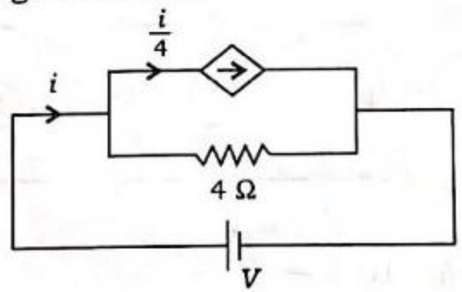
(i) $\frac{R}{\sqrt{3}}$

(ii) $3R$

(iii) $3\sqrt{3}R$

(iv) $\frac{R}{3}$

(d) In the network shown in the figure given below, the effective resistance faced by the voltage source is



(i) 4 Ω

(ii) 3 Ω

(iii) 2 Ω

(iv) 1 Ω

(e) The power in a series *R-L-C* circuit will be half of that at resonance when the magnitude of the current is equal to

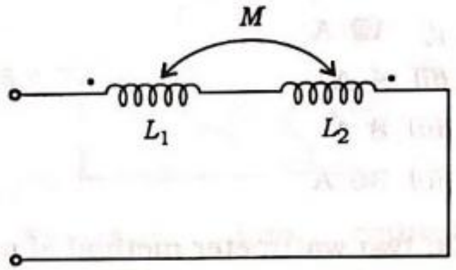
(i) $\dfrac{V}{2R}$

(ii) $\dfrac{V}{\sqrt{3}R}$

(iii) $\dfrac{V}{\sqrt{2}R}$

(iv) $\dfrac{\sqrt{2}V}{R}$

(f) The equivalent inductance measured between the terminals 1 and 2 for the circuit shown in the figure below is



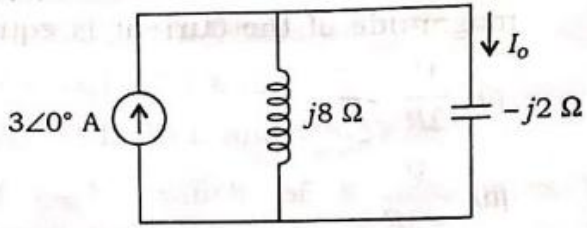
(i) $L_1 + L_2 + M$

(ii) $L_1 + L_2 - M$

(iii) $L_1 + L_2 + 2M$

(iv) $L_1 + L_2 - 2M$

(g) The value of current I_o for the circuit given below is



(i) $4\angle 0°$ A

(ii) $2 \cdot 4\angle -90°$ A

(iii) $0 \cdot 6\angle 0°$ A

(iv) -1 A

(h) Three identical resistances connected in star, carry a line current of 12 A. If the same resistances are connected in delta across the same supply, the line current will be

(i) 12 A

(ii) 4 A

(iii) 8 A

(iv) 36 A

(i) In two-wattmeter method of measurement, if one of the wattmeters reads zero, the power factor will be

(i) zero

(ii) unity

(iii) 0·5

(iv) 0·866

(j) The moving coil instrument has resistance of 3 Ω and reads 150 mA. The resistance needed to enable it to be used as voltmeter and reading up to 15 V is

(i) 100 Ω

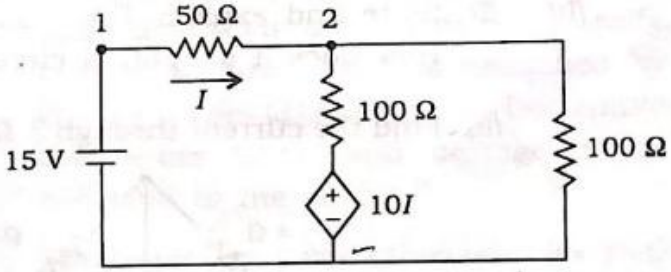
(ii) 95 Ω

(iii) 99 Ω

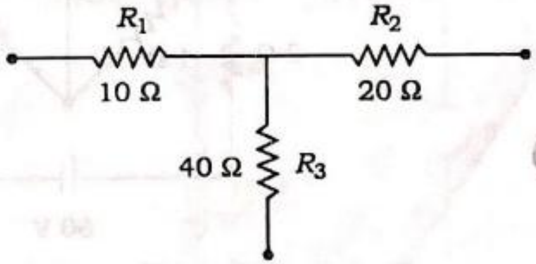
(iv) 97 Ω

2. (a) What do you mean by linear and non-linear elements? Explain Kirchhoff's law.

(b) (i) Find the voltage at Node 2 :

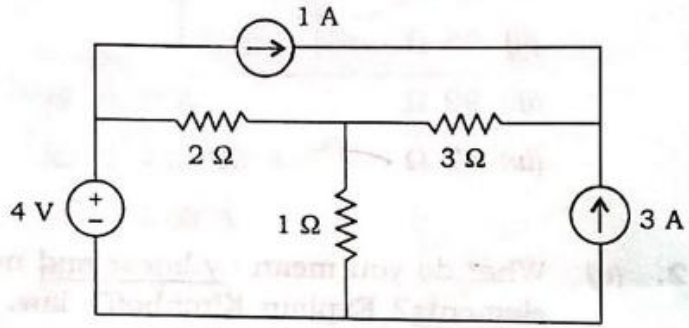


(ii) Transform into equivalent delta network :



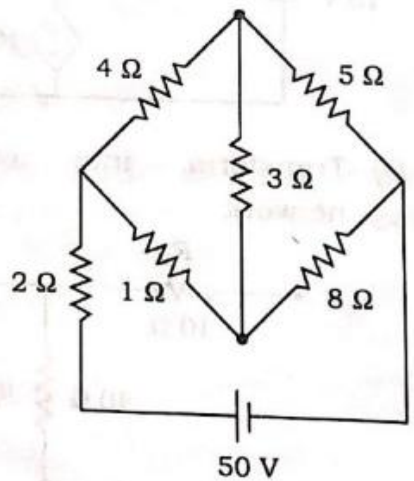
3. (a) (i) State and explain superposition theorem. Can it be applied to power calculation?

(ii) Find the current in 1 Ω resistor :



(b) (i) State and explain Thevenin's theorem. How does it simplify a circuit?

(ii) Find the current through 3 Ω resistor :



4. (a) Define the following :

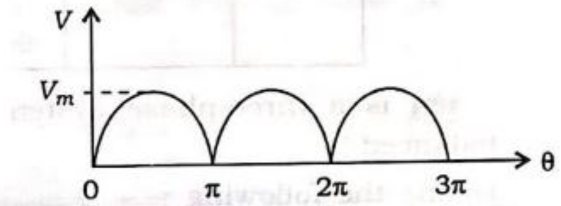
(i) RMS value

(ii) Average value

(iii) Peak factor

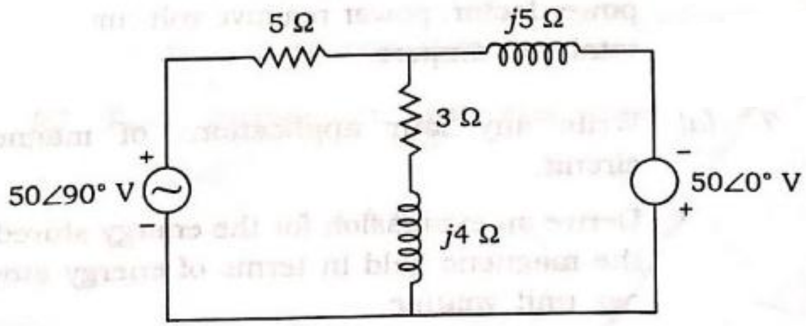
(iv) Form factor of sinusoidal wave

(b) Find average value and RMS value of the waveform shown below :

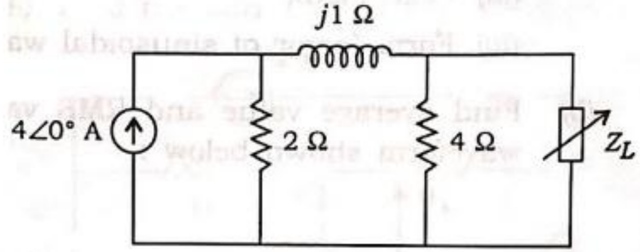


5. (a) (i) A voltage $V(t) = 177 \sin(314t + 10°)$ is applied to a circuit. It causes a steady current to flow, which is described by $i(t) = 14 \cdot 14 \sin(314t - 20°)$. Determine the power factor and average power delivered to the circuit.

(ii) Determine current through $3 + j4\ \Omega$ impedance :



(b) Determine the Z_L (load) required to be connected in the network for maximum power transfer. Determine the maximum power drawn :



6. (a) When is a three-phase system said to be balanced?

Define the following :

(i) Phase voltage

(ii) Phase sequence

(iii) Phase current

(iv) Line voltage and line current

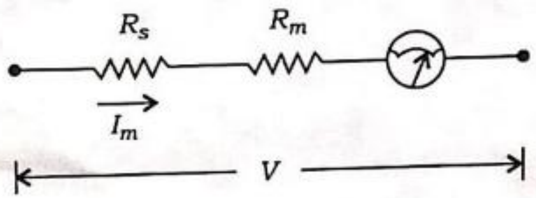
(b) Three coils, each having resistance and inductance of 8 Ω and 0·02 H respectively, are connected in star across a 3-phase, 230 V, 50 Hz supply. Find line current, power factor, power reactive volt-ampere and total volt-ampere.

7. (a) Write any four applications of magnetic circuit.

(b) Derive an expression for the energy stored in the magnetic field in terms of energy stored per unit volume.

8. *(a)* Describe the basic operation of PMMC (permanent magnet moving coil) instrument. Develop the torque equation for PMMC instrument and show that its scale is linear.

(b) A PMMC instrument with FSD (full-scale division) of 100 μA and a coil resistance of 1 kΩ is to be converted into a voltmeter. Determine the required multiplier resistance if the voltmeter is to measure 50 V at full scale :



R_s—Multiplier resistance

R_m—Coil resistance

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

(a) Norton's theorem

(b) Phasor diagram

(c) Active and passive elements

(d) Eddy current and hysteresis losses

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