Code : 031201

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 alternative (any *seven*) :

(a) If n resistances are connected in series and equivalent resistance is R_{es}, and if R_k ($k = 1, 2, \ldots, n$) is the kth resistance, then the voltage across R_k denoted by V_k is

(i) $V_k = \dfrac{R_{es}}{R_k} \cdot V$

(ii) $V_k = \dfrac{1}{V} \dfrac{R_{es}}{R_k}$

(iii) $V_k = \dfrac{R_k}{R_{es}} \cdot V$

(iv) $V_k = \dfrac{1}{V} \dfrac{R_k}{R_{es}}$

(b) Three parallel resistive branches are connected across a d.c. supply. What will be the ratio of the branch currents $I_1 : I_2 : I_3$ if the branch resistances are in the ratio of $R_1 : R_2 : R_3$ is equal to 2 : 4 : 6?

(i) 3 : 2 : 6

(ii) 2 : 4 : 6

(iii) 6 : 3 : 2

(iv) 6 : 2 : 4

(c) In the analysis of the transistor circuit, usually which of the following theorems is used?

(i) Norton

(ii) Thevenin

(iii) Superposition

(iv) Reciprocity

(d) A coil having a resistance of 6 Ω and inductive reactance of 6·908 Ω is connected across a supply voltage of $V = 100 \sin (314t)$. The expression for supply current will be

(i) $100 \sin (314t - 49°)$

(ii) $100 \cos (314t - 49°)$

(iii) $10 \cdot 92 \sin (314t - 49°)$

(iv) $10 \cdot 92 (314t - 49°)$

(e) An a.c. source of 200 V r.m.s. supplies active power of 600 W and reactive power of 800 VAR. The r.m.s. current drawn from the source is

(i) 10 A

(ii) 5 A

(iii) 3·75 A

(iv) 2·5 A

(f) For a series resonant circuit at low frequency, circuit impedance is —— and at high frequency circuit impedance is ——.

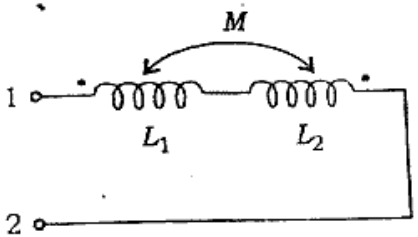
(i) capacitive, inductive

(ii) inductive, capacitive

(iii) resistive, inductive

(iv) capacitive, resistive

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



(i) $L_1 + L_2 + M$

(ii) $L_1 + L_2 - M$

(iii) $L_1 + L_2 + 2M$

(iv) $L_1 + L_2 - 2M$

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

(i) 60 kW

(ii) 20 kW

(iii) 40 kW

(iv) 180 kW

(i) The hysteresis and eddy current losses of a 1-ϕ transformer working on 200 V, 50 Hz supply are P_h and P_e respectively. The percentage decrease in these losses when operated at 160 V, 40 Hz supply are respectively

(i) 32, 36

(ii) 20, 36

(iii) 25, 50

(iv) 40, 80

(j) PMMC instruments can be used for

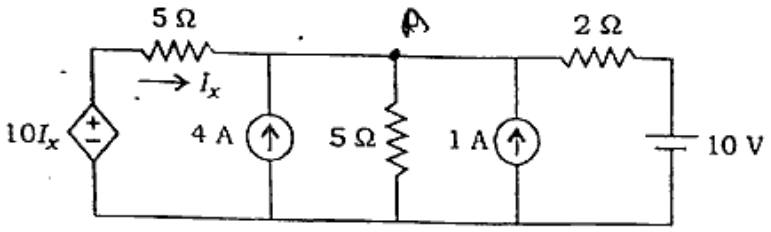
(i) a.c. work only

(ii) d.c. work only

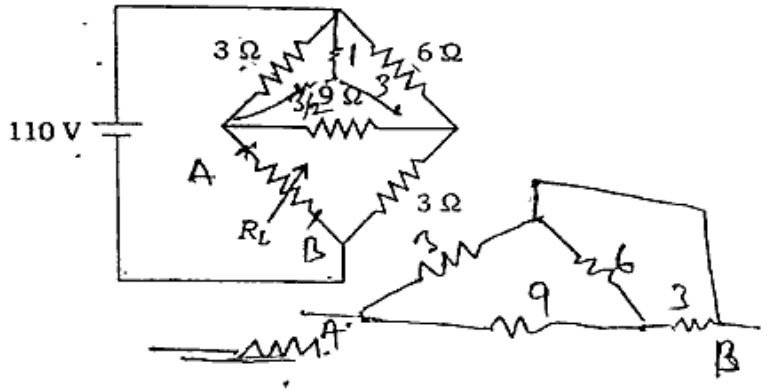
(iii) neither a.c. nor d.c. work

(iv) both a.c. and d.c. work

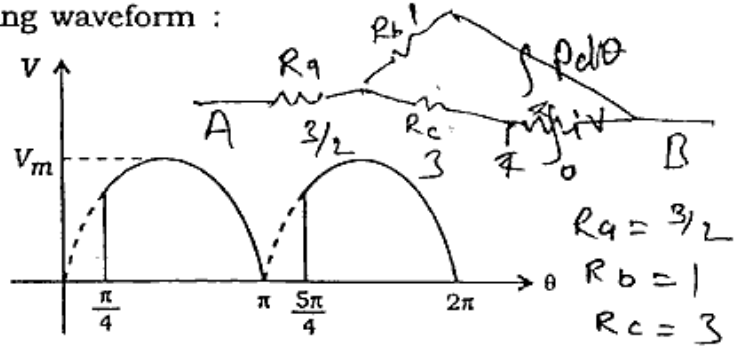
2. Find the current I_x :

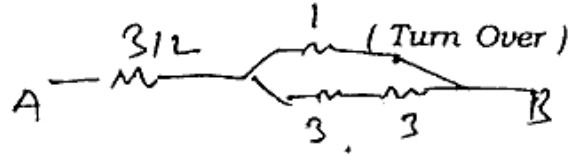


3. Find the value of R_L for maximum power transfer and calculate the maximum power :



4. Find the average value and r.m.s. value of the following waveform :





(Turn Over)

5. A series *R-L-C* circuit has the parameters— $R = 10\ \Omega$, $L = 10$ mH, $C = 100\ \mu$F. Compute :

   (a) Resonant frequency

   (b) Quality factor

   (c) Bandwidth

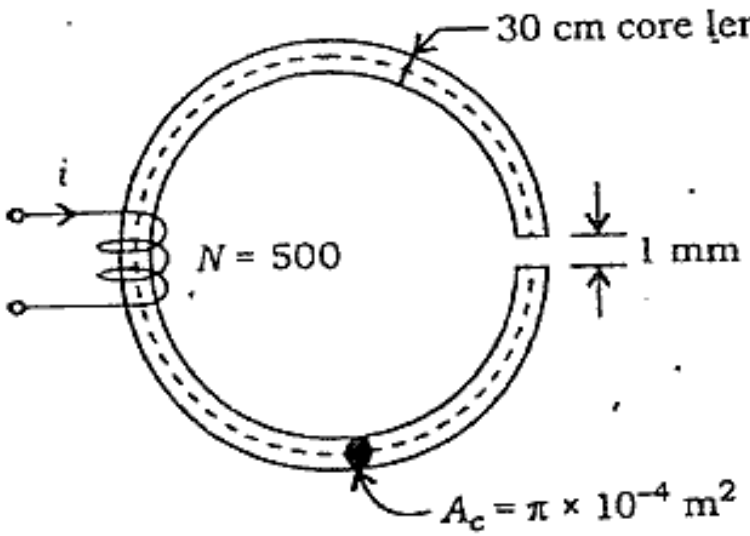
   (d) Lower and upper cut-off frequencies

6. Three similar choke coils are connected in star to a 3-ϕ supply. If the line current is 15 A, the total power consumed is 11 kW and the volt-ampere input is 15 KVA, find the line and phase voltages, the VAR input and reactance and resistance of each coil. If these coils are now connected in delta to the same supply, calculate phase and line currents, active and reactive powers.

7. A moving-coil instrument gives full-scale deflection of 15 mA and has a resistance component in the order that the instrument may be used as *(i)* a 2 A ammeter and *(ii)* a 100 V voltmeter.

(Continued)

8. A wrought iron bar 30 cm long and 2 cm in diameter is bent into a circular shape as shown in the figure. It is then wound with 600 turns of wire :



Calculate the current required to produce a flux of 0·5 mWb in the magnetic circuit in the following cases :

(a) No air gap

(b) With an air gap of 1 mm; μ_r (iron) = 1000

(c) With an air gap of 1 mm

Assume the following data for the magnetization of iron :

H (At/m)	2500	3000	3500	4000
B (T)	1·55	1·59	1·6	1·615

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

Maximum power transfer theorem

Star-delta conversion

Eddy and Hystersis losses

Insulation resistance

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