SEM 1 – 4 (RC 07-08)

F.E. (Semester – I) (RC) Examination, November/December 2015
BASIC ELECTRICAL ENGINEERING

Duration : 3 Hours

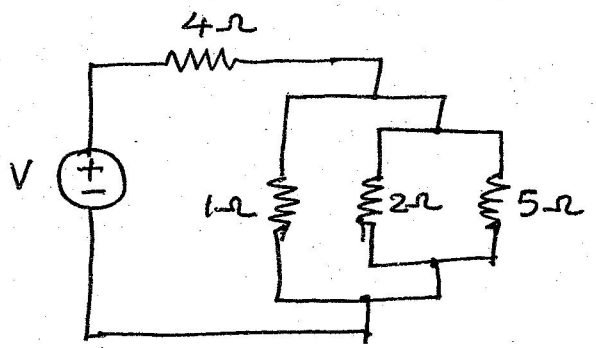
Total Marks : 100

Instructions : *1) Answer* ***any five*** *questions with* ***atleast one*** *question from* ***each*** *Module.*
2) Assume suitable data, ***if required.***

MODULE – I

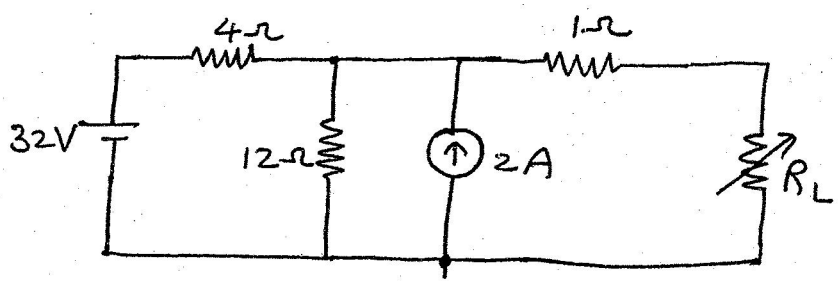
1. a) With the help of V-I characteristics, define ideal and practical current sources. **5**

   b) For the circuit in Fig. 1-b, if current through the 5Ω resistor is 1A, find the current through all other resistors. **5**



(Fig 1-b)

   c) Find the current through load resistor $R_L = 11\Omega, 16\Omega$ and 36Ω using Thevenin's theorem for the circuit given in fig 1-c. **10**



(Fig 1-c)

P.T.O.

2. a) State and prove maximum power transfer theorem. 6

b) Obtain the node voltage matrix for the circuit given in fig. (2-b). 7

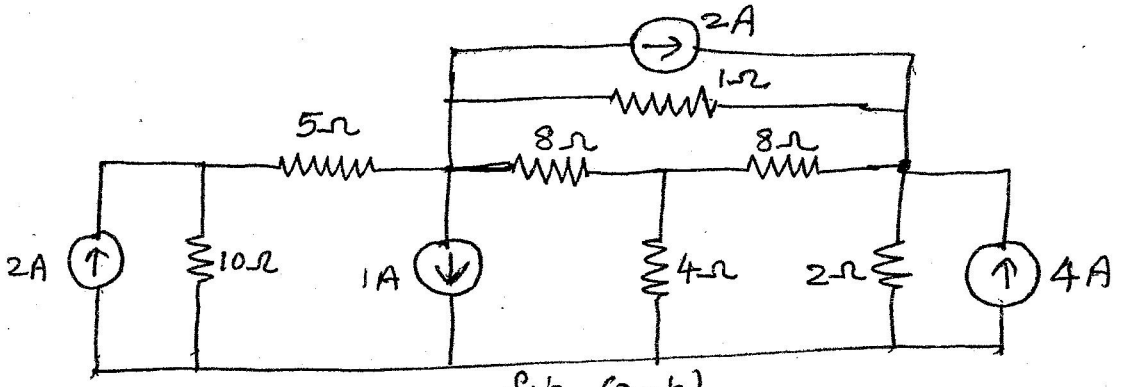


fig. (2-b)

c) Find the equivalent resistance between points A and B shown in fig. (2-c). 7

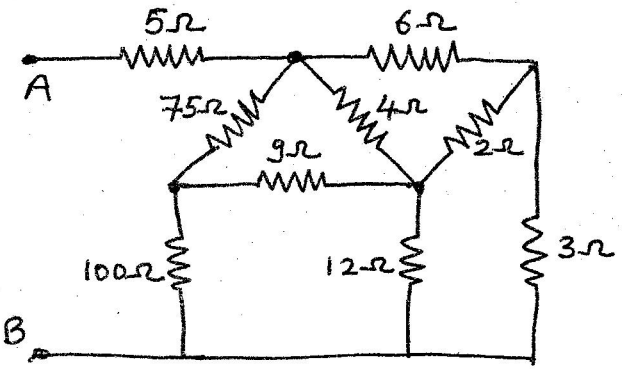


fig. (2-c)

MODULE – II

3. a) State and explain Ampere's Law. 5

b) Describe the concept of self Inductance. 5

c) Fig. (3-c) shows a magnetic circuit with air gaps $lg_1 = lg_2 = lg_3 = 1$ mm and coils $N_1 = 100$ turns and $N_2 = 200$ turns. The cross sectional area A of the circuit is 100 mm^2. Assume that the permeability of the core material approaches infinity and the ringing effect is negligible. Calculate

i) the self and mutual inductances

ii) the total magnetic energy stored in the system, if the currents in the coils are $I_1 = I_2 = 1$A.

iii) the mutual inductance between N_1 and N_2, if the air gap lg_3 is closed. **10**

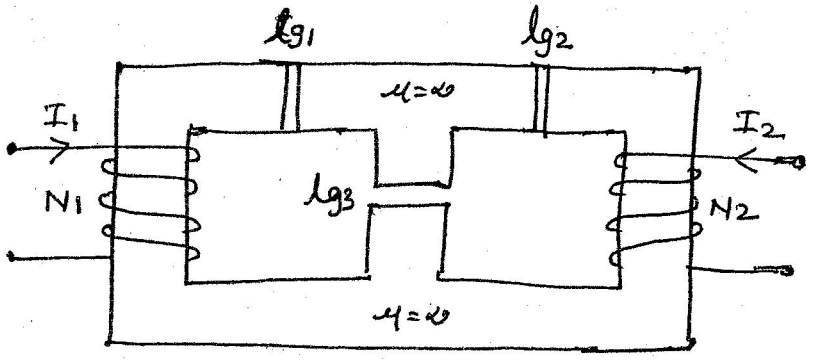


Fig. (3-c)

4. a) Derive an expression for energy stored in a magnetic circuit. **6**

b) A mild steel ring is having a mean circumference of 400 mm and cross sectional area of 500 mm^2. It is uniformly wound with a coil of 100 turns around it. Calculate

i) the reluctance of the ring

ii) the current required to produce a flux of 800 μwb in the ring. (Given that μ_r is 380). **6**

c) An iron core has a mean cross-sectional area of 0.005 m^2 and a mean circumference of 0.2 m. The iron core has a relative permeability of 20000. It is wrapped with 300 turns carrying 0.5 A of current.

i) What is the reluctance of the core ?

ii) What is the inductance of the core and coil ?

iii) What is the magnetic field intensity ?

iv) What is the magnetic flux density ? **8**

MODULE – III

5. a) With respect to AC sinusoidal wave explain the following terms. **6**

i) Frequency ii) Instantaneous value iii) Average value.

b) A series RC circuit is fed by a voltage source $V\angle\theta$. Find the expression for current in the circuit and the power factor of the circuit. Draw the phasor diagram. **6**

c) A current of 4A flows through a non-inductive resistor of 25 Ω in series with a choking coil when supplied at 250 V, 50 Hz. If the voltage drop across the resistance is 100 V and across the coil is 200 V, calculate (i) impedance, reactance and resistance of the coil (ii) power absorbed by the coil, and (iii) total power. Draw the phasor diagram. 8

6. a) Explain the following terms : 6

i) Reactive power ii) Phase sequence

iii) Unbalanced three phase system.

b) A Δ connected load consists of three identical coils each of 20 Ω and 127.3 mH. It is supplied by a 400 V, 50 Hz, 3-ϕ supply. Determine (i) the phase current (ii) the line current. 6

c) Two inductive coils A and B are in parallel across a 100 V, 50 Hz single phase supply. Coil A takes a current of 10 A at 0.9 power factor and the total current for both the coils is 18 A at 0.8 power factor. Determine the equivalent resistance and equivalent reactance, the individual resistances of both the coils and the power factor of the coil. 8

MODULE – IV

7. a) Explain the theory of operation of a single phase transformer. Hence derive emf equation of it. 6

b) What are different losses in a single phase transformer ? Define efficiency of a transformer and derive the condition for maximum efficiency. 8

c) Three similar coils, each having a resistance of 3 Ω and an inductive reactance of 4 Ω are connected in Y across a 400 V, three-phase supply. Calculate the readings on each of the two wattmeters connected to measure the power by the two-wattmeter method. 6

8. a) Show how a dynamometer type wattmeter measures DC as well as AC power. State the advantages and disadvantages of this instrument. 8

b) A 500 KVA single phase transformer has an efficiency of 95% at full load and also at 60% of full load both at upf.

i) separate out the losses of the transformer.

ii) determine the efficiency of the transformer at $\frac{1}{4}$ of the full load. 6

c) Define voltage regulation of transformer. A 100 KVA, 2200/220 V transformer has leakage reactance drop of 8% and resistance drop of 2%. Find its voltage regulation at full load and 0.8 pf lagging. Find also the power factor at which the regulation will be zero. 6