F.E. (Semester – I) (RC 2007-08) Examination, May/June 2018
BASIC ELECTRICAL ENGINEERING

Duration : 3 Hours | Total Marks : 100

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

MODULE – I

1. a) State and explain :
   i) Kirchoff's current law
   ii) Kirchoff's voltage law. **6**

   b) In the circuit shown in fig. (1b), calculate the (i) total current (ii) current in 5Ω resistance (iii) power dissipated in 6Ω and 7Ω resistances. **6**

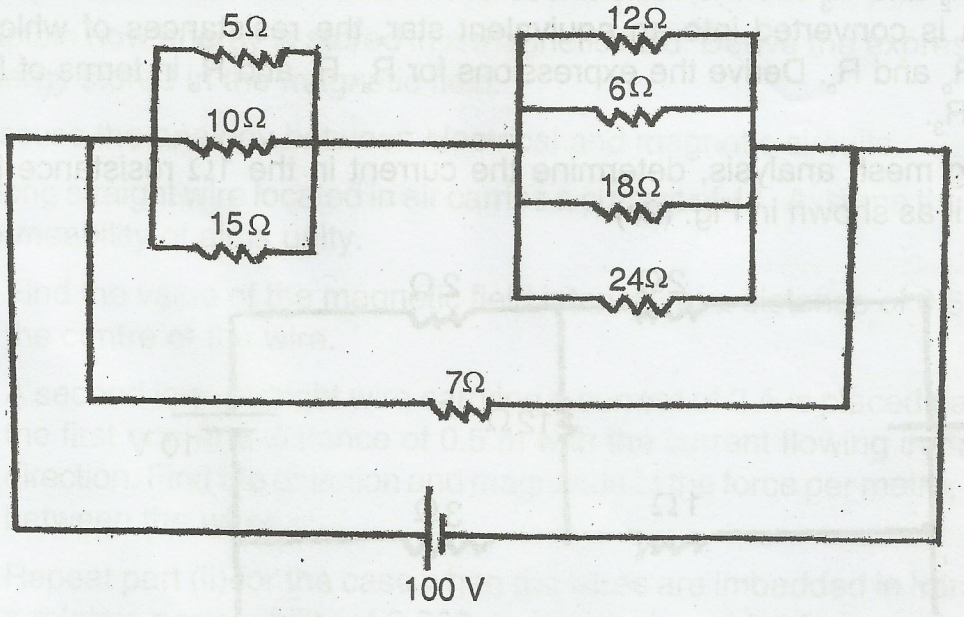

Fig. (1b)

c) Using Thevenin's theorem, find the current in the 6Ω resistance in the circuit shown in fig (1c). 8

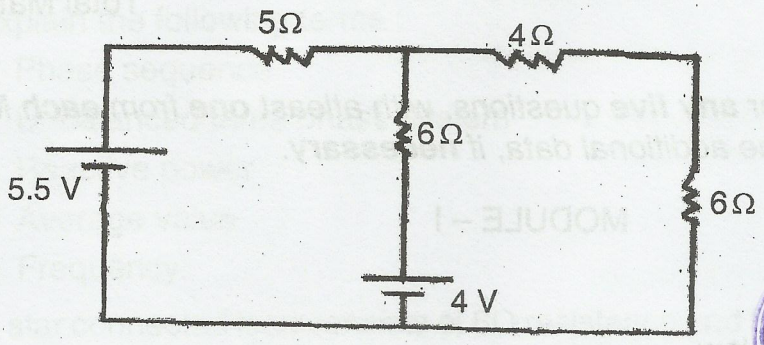

Fig. (1c)

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

b) R_1, R_2 and R_3 are the resistances of the three branches of a delta. The delta is converted into an equivalent star, the resistances of which are R_a, R_b and R_c. Derive the expressions for R_a, R_b and R_c in terms of R_1, R_2 and R_3. 6

c) Using mesh analysis, determine the current in the 1Ω resistance in the circuit as shown in Fig. (2c). 8

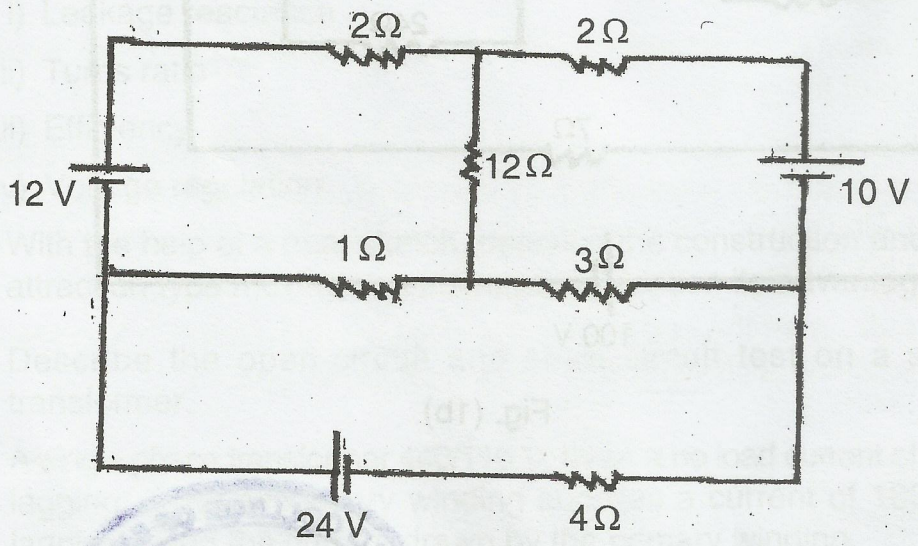

Fig. (2c)

MODULE – II

3. a) Explain the concept of electromagnetic induction. 4

   b) Explain the following as related to magnetism : 4

      i) Magnetomotive force

      ii) Self inductance

      iii) Permeability

      iv) Flemming's right hand rule.

   c) State and explain Ampere's law. 5

   d) Two magnetically coupled coils have a coefficient of coupling 0.85. When connected for series aiding, the total inductance is 100 mH and when connected for series opposing, the total inductance is 40 mH. Find the self inductance of both the coils and the mutual inductance between them. 7

4. a) Explain how energy is stored in a magnetic field. Derive the expression for energy stored in the magnetic field. 6

   b) Discuss the analogy between electrical and magnetic circuits. 7

   c) A long straight wire located in air carries a current of 4A. Assume the relative permeability of air is unity. 7

      i) Find the value of the magnetic field intensity at a distance of 0.5 m from the centre of the wire.

      ii) A second long straight wire carrying a current of 2 A is placed parallel to the first one at a distance of 0.5 m with the current flowing in the same direction. Find the direction and magnitude of the force per metre, existing between the wires.

      iii) Repeat part (ii) for the case when the wires are imbedded in iron having a relative permeability of 9,800 and a spacing of 0.05 m.

MODULE – III

5. a) Explain the concept of leading and lagging phase. Define power factor. 5

   b) Derive the relationship between phase and line quantities in a delta connected three phase system. 8

   c) A circuit consists of a resistance of 20Ω and an inductance of 0.05 H connected in series. A supply of 230 V at 50 Hz is applied across the circuit. Find the current, power factor and power consumed by the circuit. 7

6. a) Show that, in a single phase R-circuit, the current is in phase with the applied voltage. Draw the phasor diagram and the waveforms of instantaneous values of voltage and current. 7

b) Explain the following terms : 5

i) Phase sequence

ii) Unbalanced three phase system

iii) Reactive power

iv) Average value

v) Frequency.

c) A star connected load consists of 6Ω resistance and 8Ω inductive reactance in each phase. A supply of 440 V at 50 Hz is applied to the load. Find the line current, power factor and power consumed by the load. 4

d) The expressions for instantaneous values of two voltages are given by $V_1 = 12 \sin(\omega t - 40^\circ)$ and $V_2 = 8 \sin(\omega t - 55^\circ)$. Find the expression for the instantaneous value of resultant voltage by addition of the two voltages. 4

MODULE – IV

7. a) Explain the working principle of a single phase transformer. 6

b) Define the following terms related to single phase transformer : 4

i) Leakage reactance

ii) Turns ratio

iii) Efficiency

iv) Voltage regulation

c) With the help of a neat sketch, describe the construction and operation of attraction type moving iron instrument. Mention its advantages. 10

8. a) Describe the open-circuit and short circuit test on a single phase transformer. 7

b) A single phase transformer 440/110 V, takes a no load current of 4A at 0.25 PF lagging. If the secondary winding supplies a current of 100 A at 0.9 PF lagging. Find the current drawn by the primary winding. 7

c) A 3-phase, 400 V load takes an input of 40 kW at 0.45 PF lag. Find the reading of each of the two single phase wattmeters connected to measure the input. 6