SEM 1 – 4

F.E. (Semester – I) (RC) Examination, Nov./Dec. 2013
BASIC ELECTRICAL ENGINEERING

Duration : 3 Hours | Total Marks : 100

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

MODULE – I

1. a) State and explain Norton's theorem. **6**

   b) Using Kirchoff's laws find the current in the different resistances in the circuit given in fig. (1b). **7**

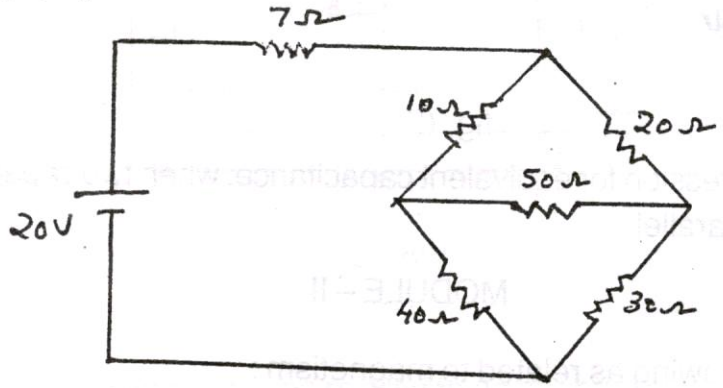

fig. (1b)

   c) Define inductance from its geometrical view point. Three inductors of inductance 10 H, 2.5 H and 2 H are connected in parallel. If the rate of change of current in 2 H inductor is 2A/s then find,
      i) Voltage across each inductor
      ii) Equivalent inductance
      iii) Total energy stored if the current in the coil is 4 A. **7**

2. a) Define resistance from circuit, energy and geometrical view point. **6**

   b) Using Thevenin's theorem find the current in the 6Ω resistance in the circuit given in fig. (2b). **6**

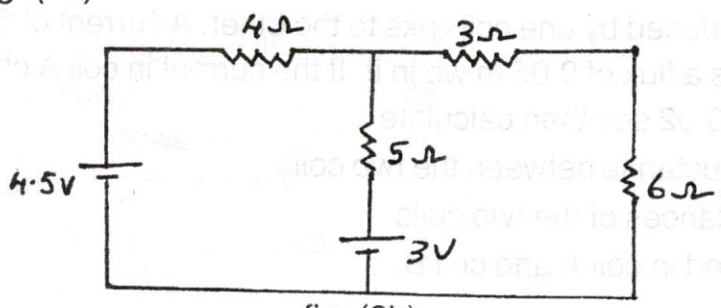

fig. (2b)

P.T.O.

c) For the given current waveform, fig (2c), plot the voltage as a function of time in a resistance of 10Ω. 5

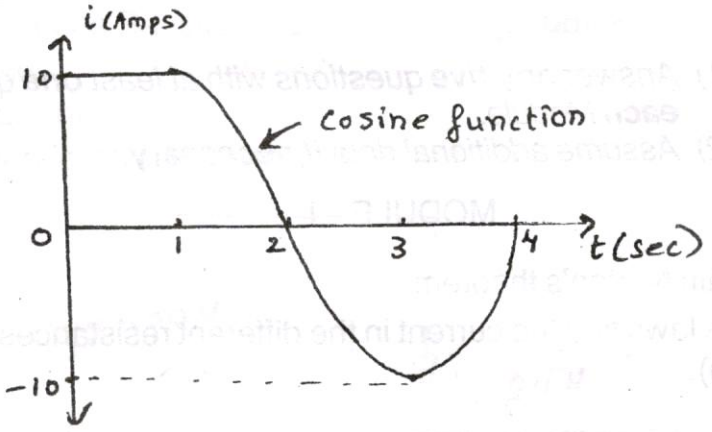

fig. (2c)

d) Derive the expression for equivalent capacitance, when two capacitances are connected in parallel. 3

MODULE – II

3. a) Explain the following as related to magnetism : 7
   i) Fleming's right hand rule
   ii) Ampere's law
   iii) Self inductance
   iv) Magnetically coupled coils
   v) Permeability
   vi) Reluctance
   vii) Magneto motive force.

b) Discuss the analogy between electric and magnetic circuits. 6

c) Two identical coils A and B of 1000 turns each lie in parallel planes such that 80% of flux produced by one coil links to the other. A current of 5A flowing in coil A produces a flux of 0.05 m wb in it. If the current in coil A changes from 12A to zero in 0.02 sec then calculate :
   i) Mutual inductance between the two coils
   ii) Self inductances of the two coils
   iii) Emf induced in coil A and coil B. 7

4. a) Derive the expression for coefficient of coupling between two magnetically coupled coils. 6

   b) Explain the concept of electromagnetic induction. Define : self inductance and mutual inductance. 6

   c) The magnetic circuit shown in fig. (4c) has a uniform cross-sectional area of $4cm^2$ and relative permeability of 1200. If a coil of 1000 turns carrying current of 2 A is wound on central limb then, find flux in the different sections of the magnetic circuit. 8

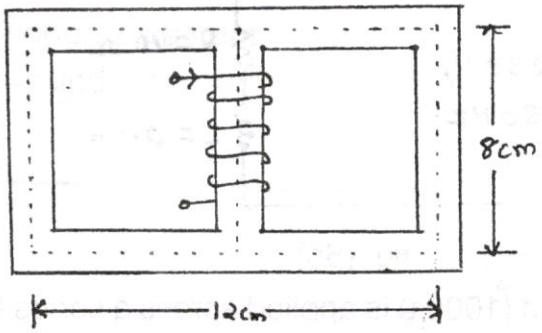

fig. 4(c)

MODULE – III

5. a) Define the following terms as related to ac quantities : 5
   i) Phase angle
   ii) Form factor of a sinusoidal current
   iii) Frequency
   iv) Apparent power
   v) Power factor.

   b) Derive the expression for instantaneous current and instantaneous power in an ac circuit containing capacitance only. Draw neat and labelled waveforms and phasor diagram. 8

   c) A delta connected 3-phase balanced load $(3 + j4)\ \Omega$ is connected across 230 V, 50 Hz supply. Find :
   i) Phase voltages and line voltages
   ii) Phase currents and line currents
   iii) Per phase power consumed
   iv) Total power consumed.

   The supply is 3-phase ac supply. 7

6. a) In a star connected, three phase system, derive the relation between line voltage and phase voltage, line current and phase current and the expression for total power consumed. 8

   b) For the given series R-L circuit, as shown in fig. (6b). Find :
      i) Impedance
      ii) Circuit current
      iii) Expression for total voltage and current. 5

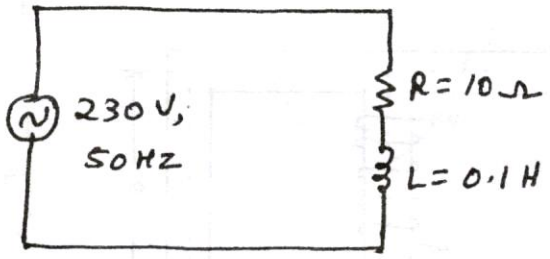

fig. (6b)

   c) A voltage e(t) = 150 sin (1000 t) is applied across a series RLC circuit where R = 40 Ω , L = 0.13H, C = 10 μ F. 7
      i) Compute the RMS value of current.
      ii) Find the expression for instantaneous voltage across capacitor and inductor.

MODULE – IV

7. a) Describe the construction and working of moving iron instrument. Mention its advantages. 9

   b) Explain the two wattmeter method of power measurement in a 3-phase ac circuit. 6

   c) A Single phase 100 kVA, 440/220 V, 50 Hz transformer is operating at a maximum flux density of 1.2 Wb/m^2 in the core. The effective cross-sectional area of the transformer core is 180 cm^2. Calculate the number of turns in the primary and secondary winding. 5

8. a) With the help of a neat phasor diagram, explain the working of a single phase transformer on no-load. 6

   b) Derive the emf equation in a single phase transformer. 6

   c) Write short notes on the following : 8
      i) Efficiency of a transformer
      ii) Voltage regulation of a transformer.
