F.E. (Semester – I) (R.C. 2007-08) Examination, November/December 2012
BASIC ELECTRICAL ENGINEERING

Duration : 3 Hours Total Marks : 100

Instructions : *1) Answer **5** questions in **full**, with atleast **one** question from **each** Module.*
*2) Missing data, if any may be **suitably** assumed.*

MODULE – I

1. a) Derive the expression for equivalent capacitance, when two capacitances are connected in : **6**

   i) Series and

   ii) Parallel.

   b) Using Thevenin's theorem, find the current flowing in the 10 Ω resistor. **7**

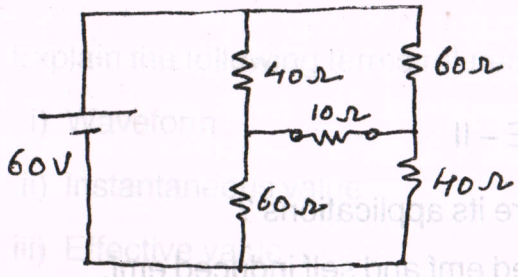

Figure (1b)

   c) Calculate the current supplied by the source, in the series-parallel circuit shown. Also find the voltage drops across the 2 Ω resistances. **7**

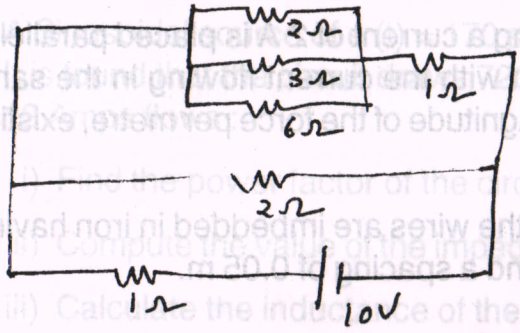

Figure (1c)

2. a) State and explain Norton's theorem. 6

b) Calculate the resistance of 100 m length of wire having a uniform cross-sectional area of 0.1 mm^2, if the wire is made of manganin having resistivity of $50 \times 10^{-8}\ \Omega - m^2$. If the wire is drawn out to three times its original length, by how many times would its resistance increase ? 6

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

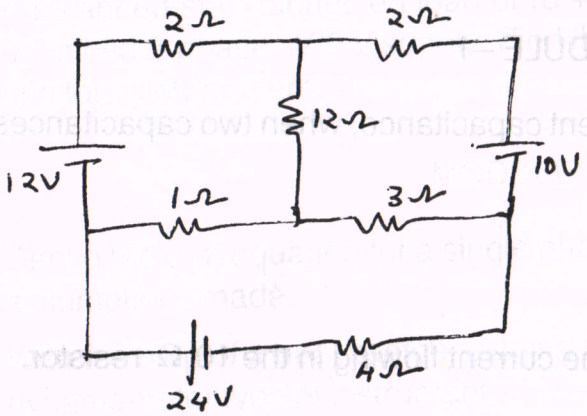

Figure (2c)

MODULE – II

3. a) State and explain Lenz's Law. What are its applications ? 6

b) Explain the concept of mutually induced emf and self induced emf. 7

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

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 10,000 and a spacing of 0.05 m. 7

4. a) Derive the expression for magnetic field strength at a distance r, for a long straight current carrying conductor. Hence derive expression for flux density. 6

   b) Distinguish between : 7

      i) Mutually induced emf and self induced emf.

      ii) Statically induced emf and dynamically induced emf.

   c) The total inductance of two coils A and B when connected in series is 0.5 H or 0.2 H depending on the relative directions of the current in the coils. Coil A when isolated from coil B, has a self inductance of 0.2 H. Calculate : 7

      i) The mutual inductance between the two coils

      ii) The self inductance of coil B

      iii) The coupling factor between the coils

      iv) The two possible values of the induced emf in coil A, when the current is decreasing at 1000 A/S in the series circuit.

MODULE – III

5. a) Explain the following terms related to ac quantities : 5

      i) Waveform

      ii) Instantaneous value

      iii) Effective value

      iv) Frequency

      v) Cycle.

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

   c) A Sinusoidal source of e (t) = 170 sin 377 t is applied to an RL series circuit. It is found that the circuit draws 720 w power, when an effective current of 12 Amps flows : 7

      i) Find the power factor of the circuit.

      ii) Compute the value of the impedance.

      iii) Calculate the inductance of the circuit in Henrys.

6. a) With a neat sketch explain how an alternating voltage is produced, when a coil is rotated in a magnetic field. Derive an expression for the instantaneous value of alternating sinusoidal emf in terms of its maximum value, angular frequency and time. 7

b) Derive a relationship between current and voltage in a pure inductive and in a pure capacitive circuit. Draw the waveforms of instantaneous values of voltage and current. 7

c) A balanced star connected load of (8 + j6) Ω per phase is connected to a balanced 3-phase, 400 V supply. Find the line current, power factor, power and total volt-amperes. 6

MODULE – IV

7. a) Derive the emf equation for a single phase transformer. Mention the assumptions made. 6

b) With the help of a neat sketch, explain the construction and working of dynamometer type of instrument. 9

c) A single phase, 50 Hz transformer is required to step down from 1900 V to 240 V. It is to have 1.5 V per turn. Calculate the required number of turns on primary and secondary windings respectively. The peak value of the flux density is required to be not more than 1.2 wb/m^2. Calculate the required cross-sectional area of the steel core. If the output is 10 KVA, calculate the secondary current. 5

8. a) Explain the two Wattmeter method of measurement of power in a three- phase circuit. 6

b) Write a short note on the following : 8

i) Rating of a single phase transformer

ii) Losses in a single phase transformer.

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