

SEM 1 – 4 (RC 07-08)

F.E. (Semester – I) (RC 2007 – 08) Examination, November/December 2017
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) Define Inductance from its circuit, energy and Geometrical viewpoint. 6
- b) A piece of silver wire has a resistance of $1\ \Omega$. What will be the resistance of a manganin wire half the length and half the diameter, if the specific resistance of manganin is 30 times that of silver. 6
- c) Calculate the current in the $100\ \Omega$ resistor for the circuit given in fig (1c), using Thevenin's theorem. 8

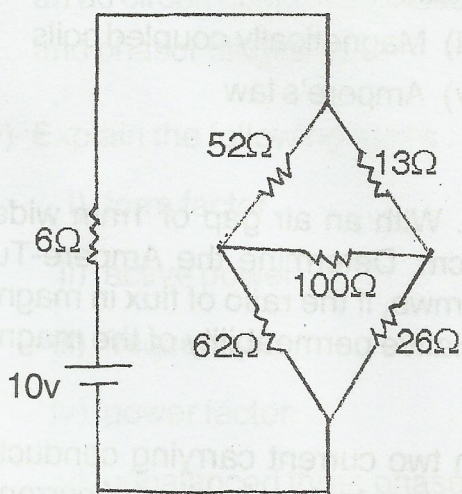


Fig (1c)

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



- c) Using mesh analysis, determine the currents in all the branches of the network shown in fig (2c).

8

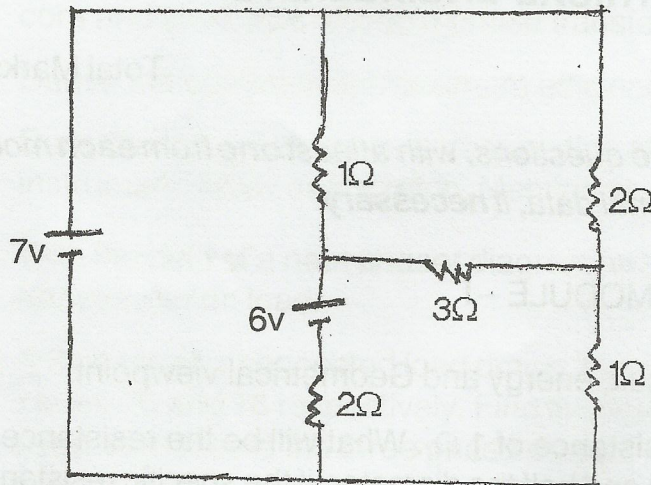


Fig (2c)

MODULE – II

3. a) Distinguish between mutually induced emf and self induced emf. 4
- b) Explain the following as related to magnetism. 4
 - i) Reluctance ii) Magnetically coupled coils
 - iii) Mutual inductance iv) Ampere's law
- c) State and explain Lenz's law. 5
- d) A magnetic ring of inner diameter 24cm. With an air gap of 1mm wide, is made out of a round rod of diameter 1cm. Determine the Ampere-Turns necessary to create an air gap flux of 0.1 mwb, if the ratio of flux in magnetic material to flux in air gap is 1.2 and the relative permeability of the magnetic material of the ring is 500. 7
4. a) Derive the expression for force between two current carrying conductors. Comment on the direction of force with respect to the direction of current in the conductors. 6
- b) Derive the expression for coupling coefficient between two coils. 7
- 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 mwb in it. If the current in coil A changes from



12 A 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

MODULE – III

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

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b) Explain the concept of phasors. Show graphically, how an ac quantity can be represented by a phasor.

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c) An emf given by $100 \sin \left(\omega t - \frac{\pi}{4} \right) \text{V}$ is applied to a circuit and the current is $20 \sin (314t - 1.5708) \text{A}$.

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Find the i) Frequency ii) circuit elements.

6. a) Derive the expression for instantaneous current and instantaneous power in an ac circuit containing inductance only. Draw neat and labelled waveforms and phasor diagrams.

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b) Explain the following terms :

6

i) form factor

ii) active power

iii) frequency

iv) power factor

v) unbalanced three phase system

vi) waveform.

c) A delta connected load consists of a resistance of 10Ω and a capacitance of $100 \mu\text{F}$ in each phase. A supply of 410V at 50Hz is applied to the load. Find the line current, power factor and power consumed by the load.

6



MODULE – IV

7. a) With the help of neat figures, explain the constructional difference between core and shell type of single phase transformer. 6
- b) Derive the condition for maximum efficiency in a transformer. 4
- c) Describe the construction and operation of Repulsion type moving iron instrument. Draw neat sketch. Mention its advantages. 10
8. a) With the help of a neat phasor diagram, explain the working of a single phase transformer on load. 8
- b) A 3 phase star connected load draws a line current of 25A. The load KVA and kw are 20 and 16 respectively. Find the reading of each of the two wattmeters used to measure the three phase power. 6
- c) The primary winding of a 25kVA transformer has 200 turns and is connected to 230v, 50Hz supply. The secondary turns are 50. Calculate i) no load secondary induced emf ii) Full load primary and secondary currents and iii) The flux density in the core, if the cross-section of the core is 60 cm^2 . 6