SEM 1 – 4 (RC 07-08)

F.E. (Semester – I) (RC) Examination, May/June 2016
BASIC ELECTRICAL ENGINEERING

Duration : 3 Hours | Max. 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 voltage sources. **5**

   b) Two bulbs rated at 60 W and 100 W dissipate power according to their rating when connected to a 200 V supply individually. Find the power dissipated by them when they are connected in (i) series and (ii) parallel. **6**

   c) Find the value of R_L so that it will absorb maximum amount of power as shown in Fig. (1.c). **9**

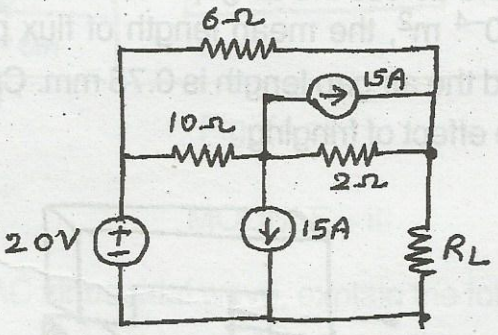

Fig. (1.c)

2. a) Derive star-delta and delta-star conversion equations. **6**

   b) State the equivalent of the following two-element combination :
   i) Ideal current sources in series.
   ii) Ideal voltage source and a resistor in parallel.
   iii) Ideal voltage source and current source in parallel. **6**

c) Find the current through the 2.2 kΩ resistance in Fig. (2.c) using Norton's theorem. 8

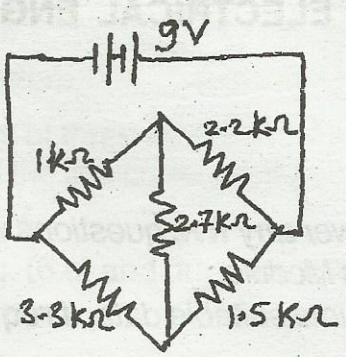

Fig. (2.c)

MODULE – II

3. a) State and explain Faraday's law. 5

b) Derive an expression for coupling coefficient between two coils. 8

c) An iron core with a small air gap is shown in Fig. (3.c). The coil wound in the circuit consists of 5000 turns carrying a current of I = 20 mA which sets up a flux within the iron and across the air gap. The cross section of the iron core is given as 0.8×10^{-4} m^2, the mean length of flux path in iron is 0.15 m, μ_r = 800 for iron and the air gap length is 0.75 mm. Calculate the air gap density. Neglect the effect of fringing. 7

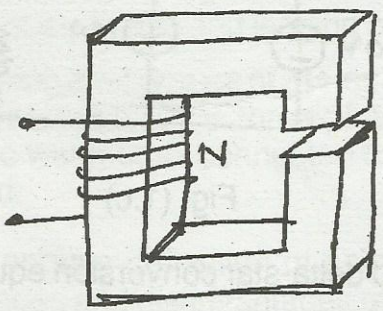

Fig. (3.c.)

4. a) Derive an expression for energy stored in magnetic field. What is the force on moving iron part placed in a magnetic field ? 8

b) A coil of 100 turns is uniformly wound over a wooden ring. The ring is having a mean circumference of 500 mm and a uniform cross-sectional area of 400 mm^2. A current of 4 A is passed through the coil. Calculate

i) The magnetic field strength H.

ii) The flux density B.

iii) The total flux ϕ. 6

c) Fig. (4.c) shows a double-legged core having two windings. The winding on the left leg of the core (N_1) has 400 turns and the winding on the right (N_2) has 300 turns. The direction of the coil windings and the dimensions of the core are shown in the figure. If the depth of the core is 10 cm, then find the flux produced by currents $I_1 = 0.5$ A and $I_2 = 0.75$ A. Assume $\mu_r = 1000$ and constant. 6

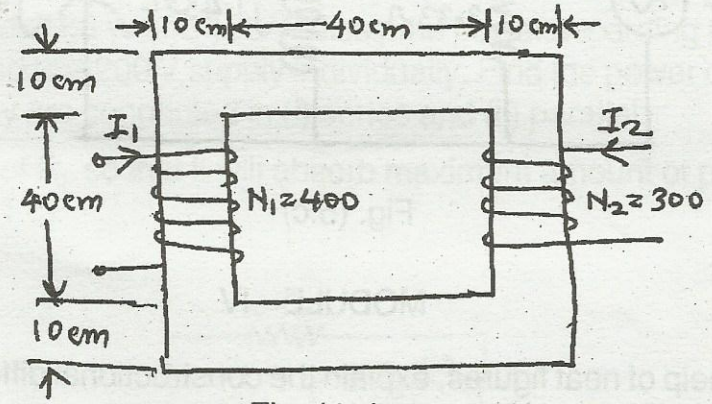

Fig. (4.c)

MODULE – III

5. a) With respect to AC sinusoidal wave, explain the following terms :

i) Time period

ii) Peak and peak-to-peak value

iii) RMS value. 6

b) A parallel RL circuit is connected across an AC voltage source $V \angle\theta$. Obtain an expression for the total current and power factor angle. Also draw the phasor diagram. 6

c) Two coils A and B are connected in series across a 250 V, 50 Hz supply. The resistance of A is 5 Ω and the inductance of B is 0.015 H. If the input from the supply is 4 kW and 3 kVAR, find the inductance of A and resistance of B. Calculate the voltage across each coil. 8

6. a) Explain the following terms :
   i) apparent power
   ii) power factor
   iii) balanced three phase system. 6

   b) A Y connected load consists of three identical coils each of resistance 20 Ω and inductance 127.3 mH. If the line current is 8 A, calculate the line voltage if the supply frequency is 50 Hz. 6

   c) Find the total current I in Fig. (6.c) and draw the phasor diagram. 8

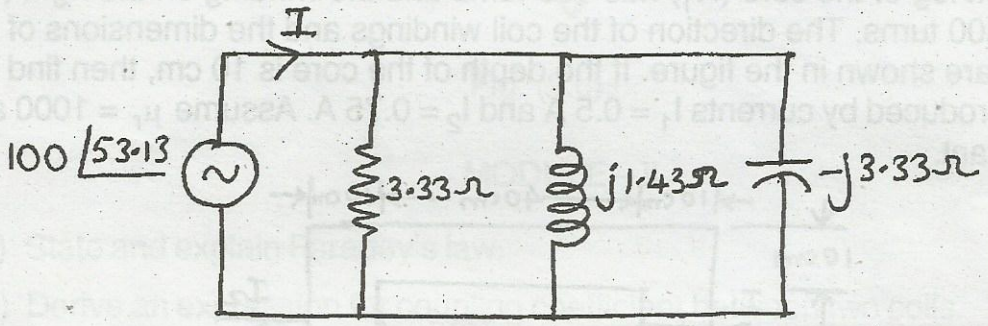

Fig. (5.c)

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) Define voltage regulation of a single phase transformer. Derive voltage regulation expressions for both lagging and leading power factor loads. 8

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

8. a) Derive an expression for angular deflection of pointer in moving iron type instruments. State advantages and disadvantages of moving iron type instruments. 8

   b) Derive the condition for maximum efficiency in a transformer. How efficiency of a transformer is related to its power factor ? 6

   c) A transformer rated 200 V/50 V, 10 KVA has a core loss of 100 watts. What is the maximum efficiency of the transformer at 0.8 lagging power factor ? Assume full-load copper loss as 200 watts. At what load this maximum efficiency is obtained ? 6