CBCS Scheme

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15ELE15/25

First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018
Basic Electrical Engineering

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. State and explain Kirchhoff's law. **(05 Marks)**

b. Refer Fig Q1(b). Find I_1, I_2 and I_3. **(07 Marks)**

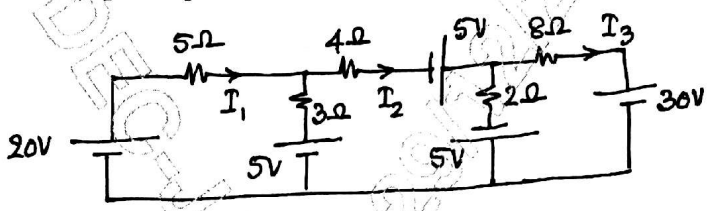

Fig. Q1(b)

c. Coil A of 230 turns and coil B of 240 turns share a magnetic circuit of mean length 0.8m and uniform cross section area 115cm^2. Relative permeability of the core material is 1350. Find the self inductances of the coils. Find the average emf induced in coil A when, in coil B, the current changes from 2A to 6.5A in 0.03s. Assume k = 1.0 between the coils. **(04 Marks)**

OR

2 a. Define 'Self Inductance' of a coil. Derive an expression for the self inductance of a coil in terms of its geometry and material properties. **(05 Marks)**

b. Refer Fig Q2(b) find I_1, I_2 and the power in the 6Ω resistor. **(07 Marks)**

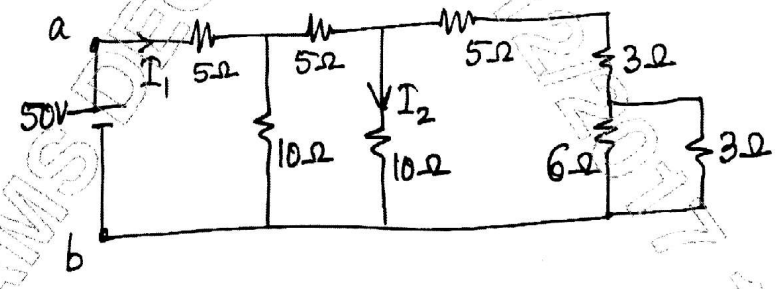

Fig. Q2(b)

c. Coil A of 600 turns and coil B of 500 turns have k = 0.2. A current of 8A in coil A produces 40mWb flux in it. Find : i) Inductance of coil A with coil B open circuited ; ii) the flux linking coil B ; iii) the emf induced in coil B if the flux linking it falls to zero from its full value in 2ms ; and iv) mutual inductance between the coils. **(04 Marks)**

Module-2

3 a. Deduce an expression for the armature torque, T_a, developed in a dc motor and hence show that $T_a \alpha \phi I_a$. **(02 Marks)**

b. A 100V short shunt dc generator supplies 200 lamps of 55W at 110V rating. $R_a = 0.06\Omega$; $R_{se} = 0.04\Omega$; and $R_{sh} = 25\Omega$. Sketch the circuit diagram and find the emf generated. **(07 Marks)**

c. With a neat sketch, explain the working of a 1ϕ energy meter. **(07 Marks)**

OR

4 a. "A dc series motor should never be run on light or no load". Justify. **(03 Marks)**

b. A shunt dc generator delivers 65kW at 250V and 500rpm. $R_a = 0.015\Omega$ and $R_{sh} = 85\Omega$. Find its speed when running as a motor taking 40kW from 240V supply. BCD = 1V/Brush. Sketch relevant circuit diagrams. **(07 Marks)**

c. With a neat schematic, describe the construction and working of a dynamometer type wattmeter. **(06 Marks)**

Module-3

5 a. Show that a pure inductor is lossless. **(03 Marks)**

b. Refer Fig. Q5 (b). Find the real power, reactive power and the apparent power supplied.

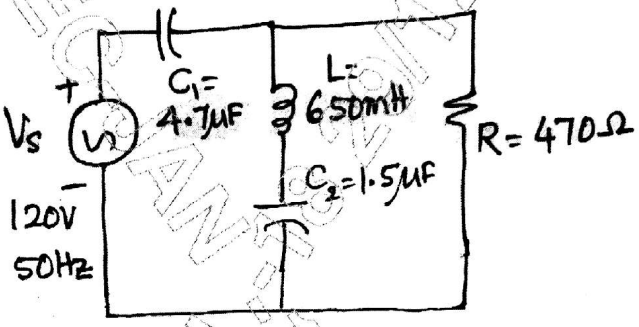

Fig. Q5(b) **(06 Marks)**

c. With a neat circuit diagram and truth table, explain the working of a 3-way control of a device. **(07 Marks)**

OR

6 a. Show that an R-C series circuit takes a leading current. Sketch a phasor diagram indicating the supply emf, the current and the two drops. **(07 Marks)**

b. A resonant series circuit with R = 5Ω, L = 1mH and C = 0.001μF is connected to a 100V supply. Find :

i) the drop across L ; and

ii) drop across C. Take the supply as the reference phasor. **(05 Marks)**

c. For a fuse, define i) Rated current, ii) Fusing current ; and iii) Fusing factor. Why is the fusing factor greater than unity? **(04 Marks)**

Module-4

7 a. Sketch a 4-wire STAR supply and identify the phase and line voltages. With balanced supply taking $E_R = E_P \angle 0^\circ$, obtain the relationship between the phase and line voltages. Hence, sketch a phasor diagram indicting all phase and line voltages. **(08 Marks)**

b. 2 wattmeters connected to measures 3ϕ power of a balanced Δ load read 2.5 kW and 0.5kW. Find the load pf if i) both readings are positive; and ii) the latter reading is obtained after reversing the connections of the potential coil. **(04 Marks)**

c. In a 3ϕ alternator, why is it advantageous to have the armature on the stator and the excitation on the rotor? **(04 Marks)**

OR

8 a. With a neat circuit diagram, show how 3ϕ power can be measured using two Wattmeters. State the NECESSARY CONDITION clearly. **(07 Marks)**

b. A balanced Δ load of (8+j6) Ω/phase is connected to a 400V supply. Find i) the phase current ii) the line current. If the same impedances are connected in STAR, what is the reactive power consumed and at what pf? **(04 Marks)**

c. A 4-pole, 3ϕ alternator driven at 1800rpm has 42 slots with 4 conductors/slot. Average flux/pole is 0.36 Wb, sinusoidally distributed. $K_p = 0.956$ and $K_d = 0.952$. Find the line voltage on no-load if connected in i) Δ ; and ii) STAR. **(05 Marks)**

Module-5

9 a. Starting from expression for the efficiency of a transformer derive the condition for maximum efficiency and the expression for maximum efficiency. **(05 Marks)**

b. A 135 kVA, 1ϕ transformer has primary of 2kV, 50Hz. Primary and secondary number of turns are 162 and 48 respectively. Neglecting losses, find i) no-load secondary emf ; ii) full load primary and secondary currents, and iii) maximum core flux. **(04 Marks)**

c. With a neat sketch, explain the working of a STAR - Δ starter, for a 3ϕ induction motor. Show that the starting inrush current is reduced by 66.7%. **(07 Marks)**

OR

10 a. "A 3ϕ induction motor can never run at N_s". Justify. **(04 Marks)**

b. A single phase transformer has a maximum efficiency of 98% at 75% load, upf. The copper loss at maximum efficiency is 314W. Find its efficiency at 50% load, 0.9 pf. **(04 Marks)**

c. A 6-pole, 3ϕ alternator running at 1200rpm feeds a 4-pole, 3ϕinduction motor having slips of 3% at full load and 2.5% at half load. The rotor induced emf/phase at stand still is 160V. At full load and half load, find each of the following: i) the motor speed ; ii) frequency of the rotor induced emf and (iii) the rotor induced emf/phase. **(08 Marks)**

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