The Open University of Sri Lanka
Diploma in Technology
ECX 3234 - Electrical Technology
Final Examination 2008/2009

Duration Three hours

Date: 3rd April 2009   Time: 0930-1230

This paper contains 8(eight) questions each question have equal marks.
Answer 5(five) questions. Select at least 1(one) question from section B.

Section A

Q1)
    a. Name the three important factors that must satisfy the fundamental requirement of safety in a consumer premises?   (3 marks)
    b. Clearly explain why the transformers are required to cool while they are in operation.
    (3 marks)
    c. What are the cooling methods that are applicable for transformers, Describe briefly two of them.
    (4 marks)
    d. A 60 kVA single phase transformer has full load secondary current of 300 A and total resistance referred to secondary is 0.008 ohms. If the total iron loss amounts to 280W, find the efficiency on full load and half load at;
        i. Unity power factor.   (5 marks)
        ii. 0.8 power factor lagging.   (5 marks)

Q2)
    a. What are the advantages and disadvantages of AC transmission system in comparison with DC transmission system?   (4 marks)
    b. Explain the most important factors in a good distribution system.   (6 marks)
    c. A single phase ac ring distributor ABC fed at point A at 415 V as shown in Figure A. The load at B and C are 40 A at 0.8 p.f lagging and 60 A at 0.6 p.f lagging respectively. Both power factors expressed are referred to the voltage at point A. The total impedance of section AB, BC and CA are (2+j1), (2+j3) and (1+ j2) ohms respectively. Determine the current in each section and bus bar voltages at point B and C.   (10 marks)

A ↓ 415V

2+j1   1+j2

2+j3   C

B   Figure A   60 A @ 0.6 pf lagg

40 A @ 0.8 pf lagg

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Q3)
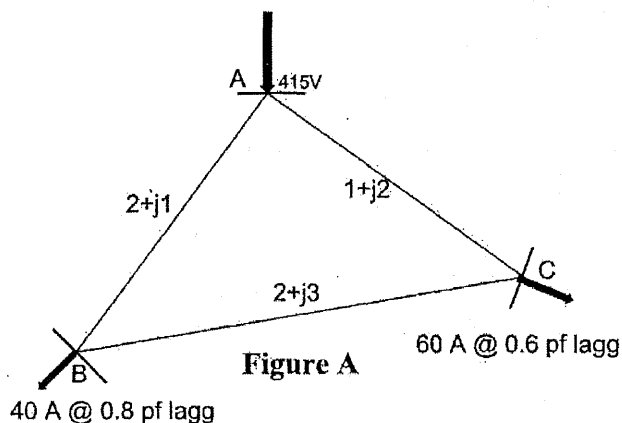
   a. Briefly explain the advantages and disadvantages of an auto transformer, when compared with two winding transformer. (5 marks)

   b. An ideal auto transformer has its secondary windings labeled as a, b, c as shown in the Figure B. The primary has 100 turns. The number of turns on the secondary side is 400 between a, b and 200 between b, c. The transformer supplies a load of 6 kVA at 0.8 pf lagging between a and c. In addition, a load of impedance $1000\angle 45°$ (or $707.1 + j707.1$) ohms is connected between a and b for a primary voltage of 240 V.
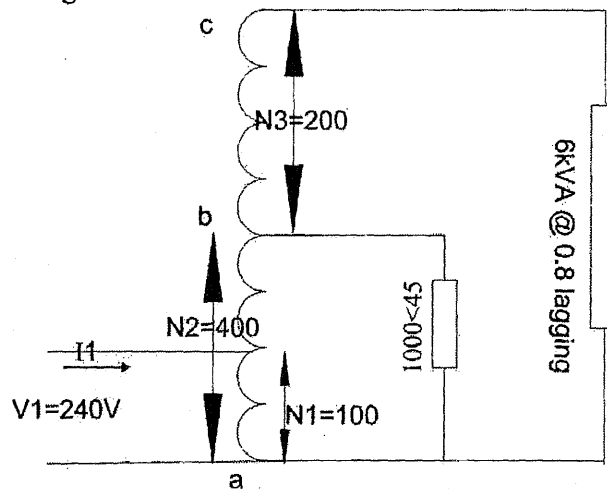

Figure B

Calculate the followings;
      i. kVA input of the transformer (5 marks)
      ii. Primary current (I_1) (5 marks)
      iii. Primary power input in kW (5 marks)

Q4)

   a. What are the two main power losses occur in an ordinary transformer? Briefly explain each of them? (4 marks)

   b. Give all the conditions that must be satisfied to operate two, three phase transformers in parallel (6 marks)

   c. Two transformers, 600kVA with a percentage impedance of (3+j2) and 400kVA with a percentage impedance of (1+j3) are connected in parallel. The no load secondary voltages of both the transformers are same. Find the load shared by each transformer and its power factors if the connected load is 800kVA at 0.8 p.f lagging. (10 marks)

Q5)

   a. State the important factors affecting the selection of industrial drives. (4 marks)

   b. Briefly explain the operation principle of a three phase induction motor? (4 marks)

   c. Clearly explain why the three phase induction motor is the most commonly used motor in industrial applications. (4 marks)

   d. What are the commonly available starting methods of induction motor? (4 marks)

   e. What are the advantages of a squirrel-cage motor compared to phase-wound induction motor? (4 marks)

Q6)
a. Explain briefly the two basic methods of exciting a DC machine. (4 marks)
b. Why is the electric breaking of an electric motor superior to mechanical breaking? (4 marks)
c. Briefly explain the methods of electrical breaking of DC motors. (6 marks)
d. What are the applications of DC Shunt and Series motors? Give the reasons? (6 marks)

Section B

Q7)
a. Sketch the V-I Characteristics of a practical zenor diode. (3 marks)
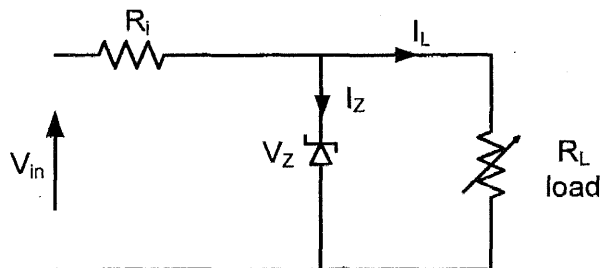b. Consider the zenor regulator circuit shown in Figure C.

Figure C

i. What is the region in which the zenor diode is expected to operate in this circuit? (3 marks)
ii. The input voltage Vin can vary between V_L and V_H. The load current I_L varies between zero and I_H. Assuming the minimum zenor current is I_Z, find the following in terms of V_L, V_H, I_H, I_Z.
  (1) R_i and its power dissipation. (5 marks)
  (2) Power dissipation of the zenor diode (5 marks)
c. State the drawback of this circuit. Give a solution to overcome this drawback. (4 marks)

Q8)
a. State the advantages of the operational amplifier when comparing with a transistor amplifier. (5 marks)
b. An application of operational amplifier is given in Figure D
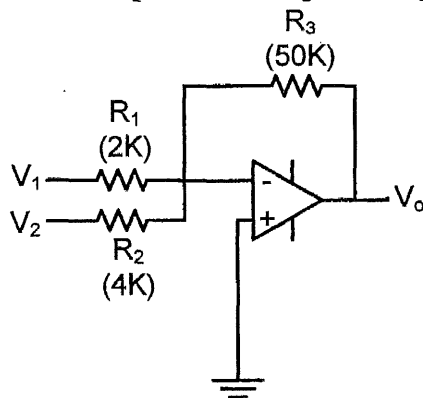

Figure D

i) Derive an expression for the output voltage (Vo) (5 marks)
ii) Calculate the out put Voltage if V1 = 5V and V2 = -3V. (5 marks)
iii) What is the application of this circuit? (5 marks)