THE OPEN UNIVERSITY OF SRI LANKA
DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING
DIPLOMA IN TECHNOLOGY

ECX 3234 – Electrical Technology
Final Examination – 2013/2014

Date: August 30th, 2014 Time: 0930 – 1230 hrs

This paper consists of two parts: ***part A*** *and* ***partB.***
Part A *contains five questions and* ***part B*** *contains three questions.*
Answer any ***three (3)*** *questions from* ***part A*** *and any* ***two (2)*** *questions from* ***part B.***

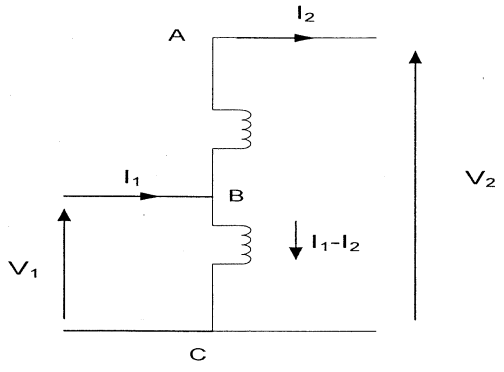
PART – A

Q1

a) Discuss the relative merits and demerits of an auto-transformer. **(3 marks)**

b) A single phase 100kVA, 2000/200Vtransformer has a core loss of 500W and full load copper loss of 1000W. Calculate its efficiency at full load 0.8 power factor. **(7 marks)**

c) The above 100kVA, 2000/200V two winding transformer is connected as an auto-transformer as shown in figure such that more than 2000V is obtained at the secondary. The portion AB is the 200V winding and portion BC is the 2000V winding. Compute the kVA rating as an auto-transformer and compare with the above two winding kVA rating. **(10 marks)**



Q2

a) List the different types of AC motors and briefly explain their applications. **(5 marks)**

b) A single-phase motor operating of a 415V, 50Hz supply is developing 10kW with an efficiency of 80% a power factor of 0.7lagging. Calculate, **(15 marks)**

i) The input kilovolt amperes.

ii) The active and reactive components of the current.

iii) The reactive kilovolt amperes (or kilovars).

Q3

a) With the help of the power triangle define the terms active power, reactive power, apparent power and power factor. **(4 marks)**

b) What are the causes of poor power factor? **(2 marks)**

c) What are the various methods for power factor improvement? **(2 marks)**

d) A 400V, 50Hz, 3-phase line delivers 200kW at 0.8 power factor lagging. It is desired to raise the line power factor to unity by installing shunt capacitors. Calculate the capacitance of each unit if they are **(12 marks)**

i) Star connected.

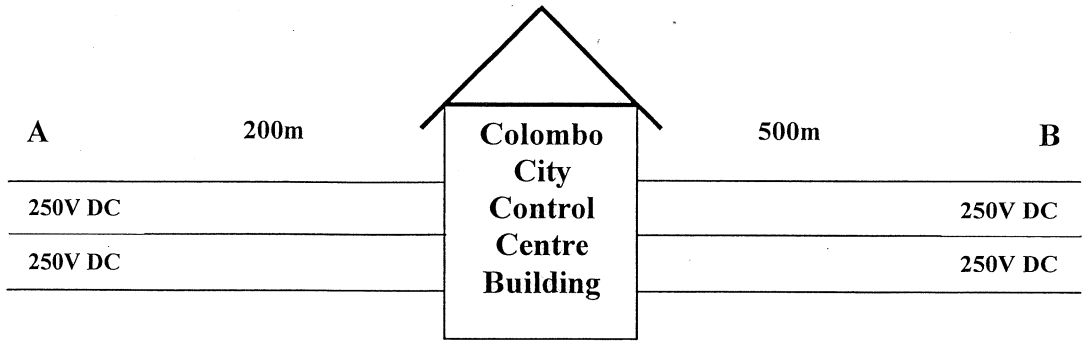
ii) Delta connected.

Q4

a) Briefly explain the types of DC distribution system? **(3 marks)**

b) What are the relative merits and demerits of DC distribution system in comparison with AC distribution system? **(3 marks)**

c) The cable of same cross sectional area connects the Colombo City Control Centre building to the feeding battery bank A and battery bank B. The Colombo City Control Centre building has a load of 400kW and is supplied from 2x250V DC network. The Colombo City Control Centre building is at a distance of 200m and 500m from the two feeding battery banks. Determine how the load on the feeding cables should be distributed that the total loss in cable shall be minimum. **(14 marks)**



Q5

a) State the classification of industrial drivers. **(2 marks)**

b) State the important factors affecting the selection of industrial drivers. **(2 marks)**

c) What are the advantages of industrial drivers? **(2 marks)**

d) Discuss how the methods of braking influence the selection of industrial drives. **(3 marks)**

e) Explain the advantages of electrical braking methods over mechanical braking. **(3 marks)**

f) What is meant by regenerative braking? Explain this with reference to an industrial application. **(4 marks)**

g) Operating speed and methods of controlling speeds of industrial drivers are very important. Explain how you would proceed to select to a motor in accordance with the above conditions. **(4 marks)**

PART – B

Q6

a) Convert $14B_{16}$ to the decimal form. **(1 mark)**

b) Convert 123.125_{10} to the binary form. **(2 marks)**

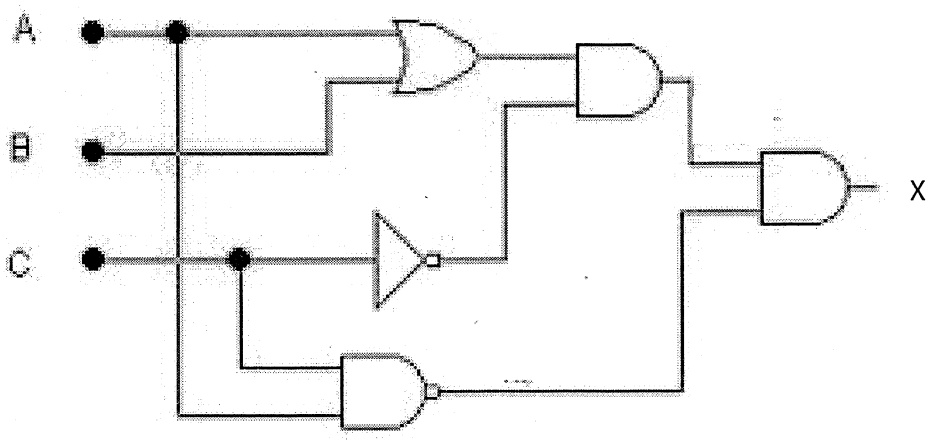
c) Convert $371C.2A_{16}$ to the binary form. **(2 marks)**

d) Perform the following binary operations.

i) $1101011_2 \times 1111_2$ ii) $10001101_2 \div 1100_2$ **(5 marks)**

e) Find the value of m when $345_m = 284_{10}$. **(2 marks)**

f)



Schematic diagram of a combinatorial logic circuit is presented in the figure above.

i) Determine the truthtable of this circuit. **(2 marks)**

ii) Represent the logic function x canonical sum-of products form. **(2 marks)**

iii) Minimise the function x using a Karnaugh map. **(4 marks)**

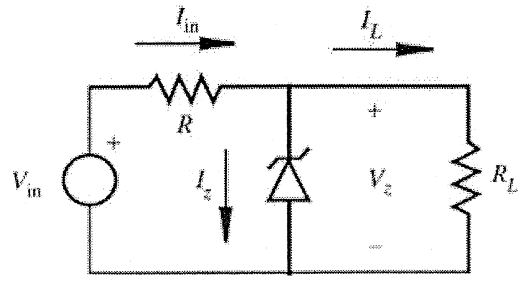
Q7

a) Describe the Zener breakdown of a pn-junction, and compare this to the avalanche breakdown. **(5 marks)**

b) Describe how the shown zener stabiliser circuit reacts when :

i. there is a fluctuation of the source (input) voltage v_{in}.

ii. there is a fluctuation of the output resistance R_L (load). **(7 marks)**

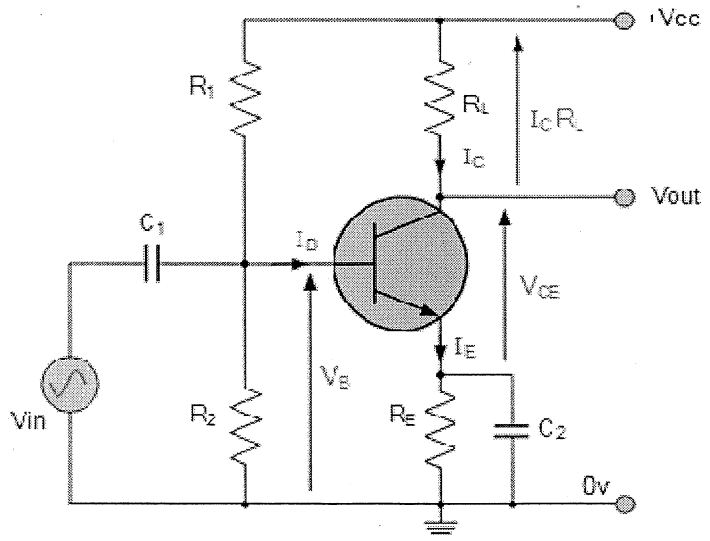


c) Zener diode of a stabiliser circuit is given as 8 V / ½ W. $I_Z$min is given as 250 µA. What is a suitable series resistor value, for this resistor to stabilise a fluctuation of the load between the values 10 kΩ – 20 kΩ? The source voltage is fixed at 20 V.**(8 marks)**

Q8

a) Compare the functioning and characteristics of FETs and BJTs, giving two examples for suitable practical uses for each type. **(4 marks)**

b) The figure below represents a common amplifier. Describe how it keeps the dc operating point steady with help from R_E even when there are fluctuations at the input side. **(8 marks)**



c) Assuming the use of a Silicon based transistor, with R_1 = 27 kΩ, R_2 = 14.7 kΩ, R_E = 680 Ω, R_L = 1 kΩ, V_{CC} = 10 V and β = 100, calculate the Currents I_B, I_C and the Voltage V_{CE}. **(8 marks)**