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

ECX3234 – Electrical Technology
Final Examination – 2014/2015

Date: August 26th, 2015 Time: 0930 – 1230 hrs

This paper consists of two parts: ***part A*** *and* ***part B.***
Part A *contains five questions and* ***part B*** *contains three questions, covering 4 pages.*
Answer any ***three (3)*** *questions from* ***part A*** *and any* ***two (2)*** *questions from* ***part B.***

PART – A

Q1

a) What is an auto-transformer? **(3 marks)**

b) Describe why the auto-transformer are not used as distribution transformers. **(3 marks)**

c) What are the advantages & disadvantages of an auto-transformer, when compared with two winding transformer. **(4 marks)**

d) An auto-transformer is used to step-down voltage level from 230 V to 200 V, while the load of 15 kW at unity power factor is connected to the secondary side. Losses and magnetizing current are neglected. Determine the kVA rating and current in different sections of the winding of the auto-transformer. **(10 marks)**

Q2

a) Describe term "power factor". **(3 marks)**

b) Sketch power triangle and indicate active power, reactive and apparent power. **(3 marks)**

c) What are the causes of poor power factor? **(3 marks)**

d) What are the various methods for power factor improvement? **(3 marks)**

e) An alternator is supplying a load of 300 kW at a power factor of 0.6 lagging. If the power factor is raised to unity, how many more kilowatts can the alternator supply for the same kVA loading? **(8 marks)**

Q3

a) Briefly explain the two important electrical Performances of transformers. **(3 marks)**

b) Define all-day efficiency of a transformer. **(3 marks)**

c) What are the various methods for power factor improvement? **(4 marks)**

d) A 100 kVA, 23 kV/230 V, 50 Hz Transformer has a core loss P_c = 250 W at rated voltage and a copper loss P_{Cu} = 500W at full load. It has the following load cycle.

Load (%)	0.0 %	50 %	75 %	100%	110 %
Power Factor	-	1	0.8 lag	0.9 lag	1
Hours	5	5	10	2	2

Determine the all - day efficiency of the transformer. **(10 marks)**

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) Certain factory has DC distribution system as shown in figure Q4. The cables that are used are copper. The load at point B takes 50 A while at point C a motor is connected. The motor runs at its full load. Voltage at motor terminals and point B are 230 V and 235 V respectively. Determine the current taken by the motor and supply end voltage. Assume copper cable resistivity as 2 μΩ.cm **(14 marks)**

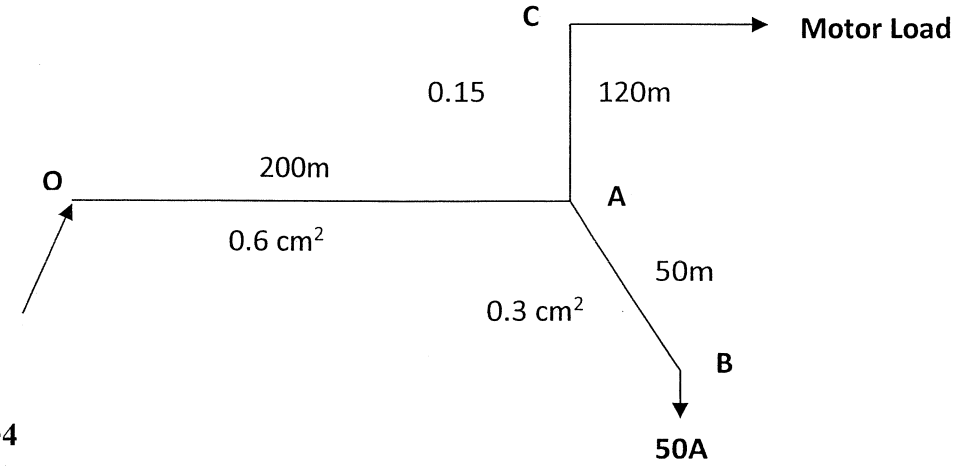


Figure Q4

Q5

a) Define & explain following terms

I. Feeder

II. Distributors

III. Service Mains. **(5 marks)**

b) With the help of sketches explain following distribution systems:

I. Radial System

II. Ring Main System

III. Interconnected System. **(5 marks)**

c) A single phase AC distributor AB 1km long is feed from end A and is loaded in flowing manner: -100 A at 0.7 power factor lagging 0.6 km from point A.

- 200 A at 0.8 power factor lagging 1 km from point A.

The resistance and reactance of the distributor is 0.2 Ω/km and 0.3 Ω/km. Calculate the total voltage drop in the distributor. The load factors refer to the voltage at the far end. Assume voltage at point A is 230V. **(10 marks)**

PART – B

Q6

a) Convert $13D_{16}$ to equivalent decimal form. **(1 mark)**

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

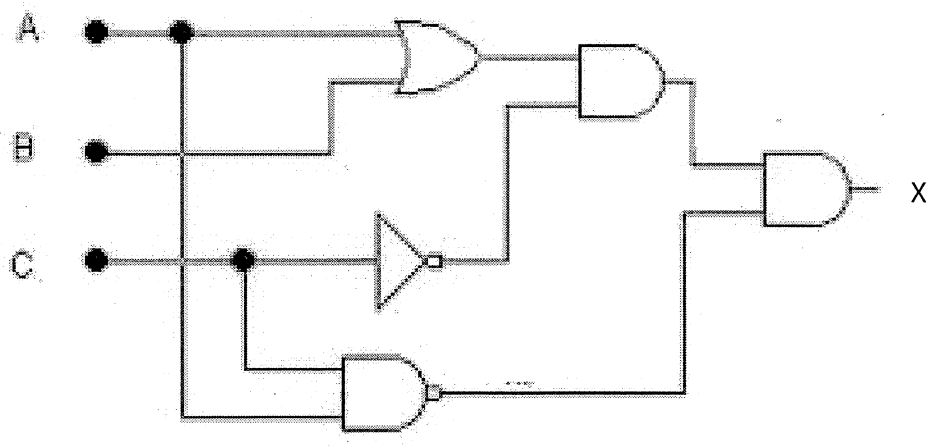
c) Convert $372C.1B_{16}$ to the equivalent binary form. **(2 marks)**

d) Perform the following binary operations.

i) $1100101_2 \times 1111_2$ ii) $10010011_2 \div 1100_2$ **(5 marks)**

e) Find the value of m when $345_m = 412_{10}$. **(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 zener stabiliser circuit reacts when :

i. there is a fluctuation of the source (input) voltage.

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

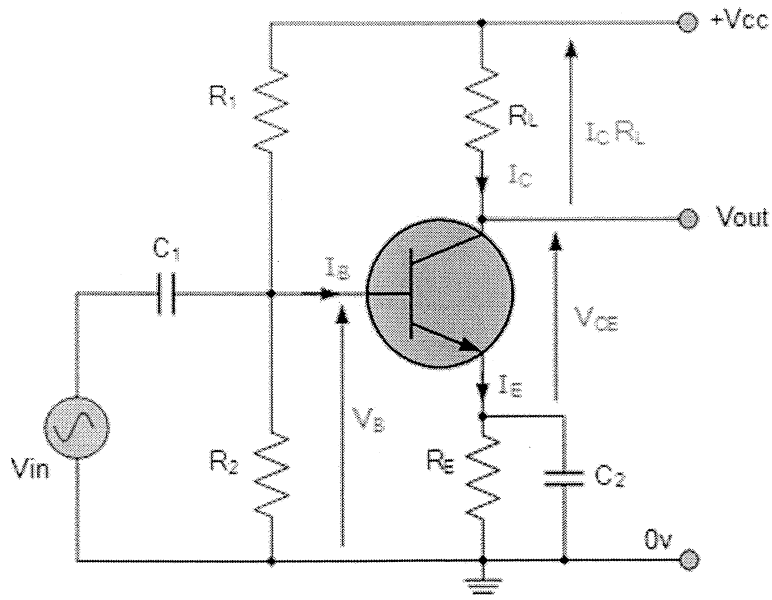
c) Zener diode of a stabiliser circuit is given as 8 V / ½ W. I_{Zmin} is given as 250 µA. What is a suitable series resistor value, for this resistor to stabilise a fluctuation of the load between the values 10 kΩ – 20 kΩ? The source voltage is fixed at 20 V. **(8 marks)**

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. Give its name and describe how it keeps the output Vout steady 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)