THE OPEN UNIVERSITY OF SRI LANKA
DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING
DIPLOMA IN TECHNOLOGY
ECX 3234 – Electrical Technology
Final Examination – 2012/2013

Date: 17.08.2013 Time: 0930-1230

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 merits and demerits of an auto-transformer when compare with two winding transformer. **(4 marks)**

b) A 2500 V/250 V, 25 kVA transformer has a core loss of 150W and full load copper loss of 300W. If the transformer delivers full load at 0.8 power factor lagging calculate the efficiency. **(6 marks)**

c) The above transformer is now connected as an autotransformer to give 2500V/2750V.

i. Determine the rating of auto-transformer
ii. Calculate efficiency at rated load with 0.8 power factor lag
iii. Compare the rating and efficiency with two winding transformer and give your comment.

(10 marks)

Q2

a) Briefly explain the types of distribution systems available **(6 marks)**

b) What are the most important factors in a good AC distribution system? **(6 marks)**

c) A three-phase, delta connected, 50 Hz, 415V AC motor, develops power of 30 kW.
The efficiency of motor is 87% and a power factor equals to 0.8. Calculate:

I. line current
II. phase current

(8 marks)

Q3

a) Use power triangle to explain terms "active", "reactive" and "apparent" power. What are the unit of measurement of above quantities **(4 marks)**

b) What are the causes of poor power factor? Explain the disadvantages of having poor power factor **(5 marks)**

c) Explain the use of static capacitors in improving power factor. **(4 marks)**

d) A three-phase 5kW induction motor has a power factor of 0.7 at full load. Determine the kVAr rating of the capacitor that is to be connected in parallel with the motor to improve the power factor up-to 0.9. **(7 marks)**

Q4

a) Briefly explain the types of DC distribution system? **(5 marks)**

b) What are the merits and demerits of DC distribution system in comparison with AC distribution system? **(5marks)**

c) XYZ industrial factory has DC distribution system with copper cable as shown in figure Q4. The load B consumes current of 50A. At point C a motor is connected which is running at full load. The motor voltage is 230V and the voltage at point B is 235V. Determine the motor load current and the supply end voltage. Assume copper cable resistivity as 1.73μΩ.cm **(10 marks)**

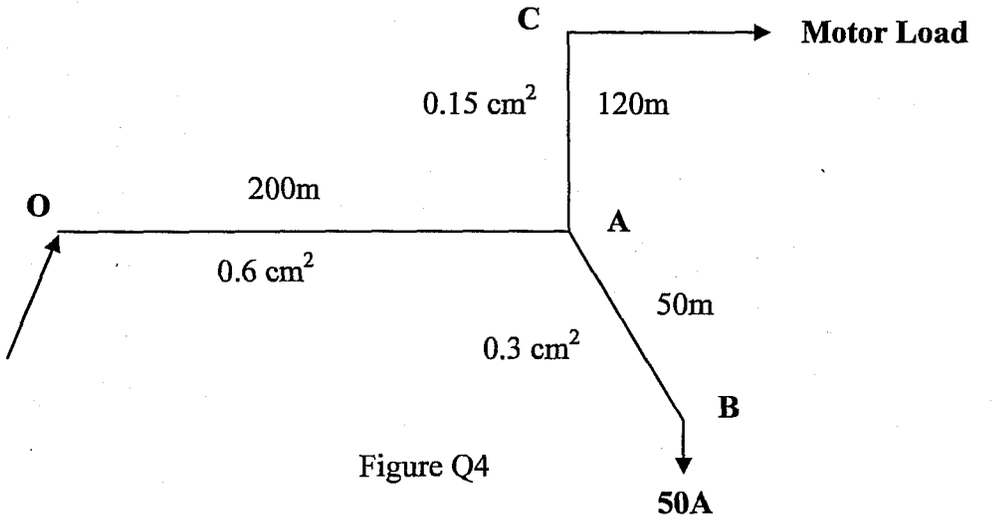

Figure Q4

Q5

a) State the classification of industrial drivers. **(3 marks)**

b) State the important factors affecting the selection of industrial drivers. **(4 marks)**

c) What are the advantages of industrial drivers? **(3 marks)**

d) What are the different types of DC motors? Explain their applications. **(5 marks)**

e) Draw the mechanical characteristic of all types of DC motors in the same diagram **(3 marks).**

f) Explain the advantages of electrical braking methods over mechanical braking. **(2 marks)**

PART – B

Q6. (a) Draw the $I - V$ characteristic curves for a **(4Marks)**

i. Practical diode

ii. Ideal diode

(b) Consider the following circuit.

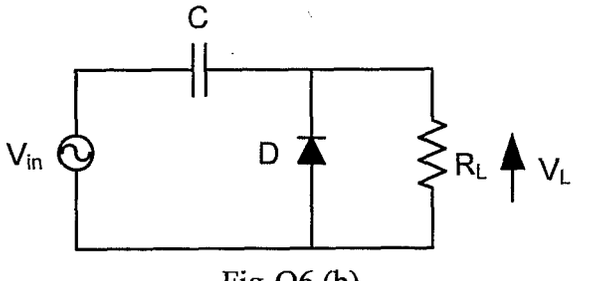

Fig-Q6 (b)

Assume the diode to be a silicon diode and the capacitor behaves ideally. If a sinusoidal signal $V_{in} = (2 \sin 20\pi t) Volts$ is supplied at the input, draw the waveform of V_L. (You have to clearly show all the important values in your plot.) **(8Marks)**

(c) The transistor in the circuit in Fig-Q6 (c) is having a common emitter current gain of 100. Find I_B, I_C and V_{CE}. **(8Marks)**

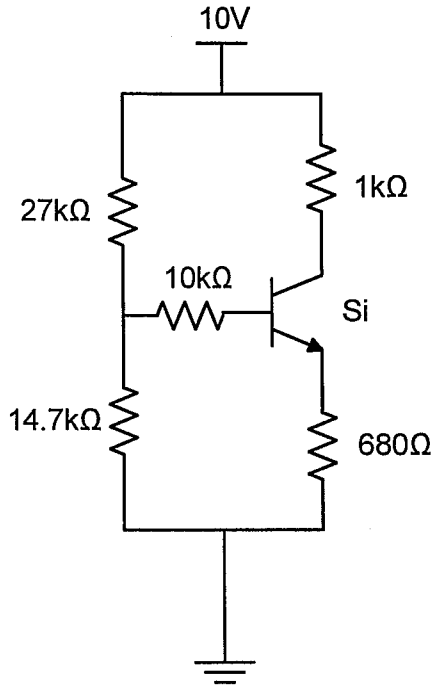

Fig-Q6 (c)

Q7. (a) Write down three assumptions that you would make for an idea operational amplifier. **(3Marks)**

(b)

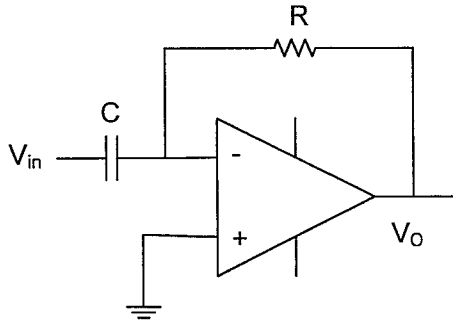

Fig-Q7 (b) i

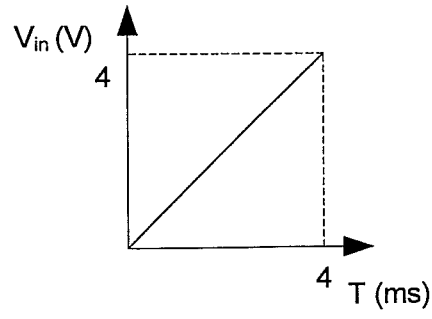

Fig-Q7 (b) iii

i. Derive the input-output relationship for the above circuit. **(6Marks)**
ii. What is the main function of the above circuit? State one practical application of this circuit. **(4Marks)**
iii. If a ramp signal shown in fig 7 (b)iii is applied as the input, draw the output waveform. ($R = 330\Omega$ and $C = 100\mu F$) **(4Marks)**

(c) Briefly discuss the applications of FETs stressing why BJTs are not suited for these applications. **(3Marks)**

Q8.

(a) Differentiate combinational and sequential logic circuits. **(3Marks)**

(b) You are assigned to design a combinational logic circuit to input a four bit binary number and to output logic "1" only if the input number is a prime number (can be exactly divided only by 1 or by itself).

i. Draw the truth table. **(4Marks)**
ii. Draw the Karnough map. **(3Marks)**
iii. Provide the simplified Boolean expression. **(3Marks)**
iv. Show the circuit in terms of common logic gates. **(3Marks)**

(c) What is the advantage of implementing logic circuits in terms of NOR or NAND gates only? Convert the above circuit in (b) iv. to NOR logic. **(4Marks)**