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

ECX 3234 – Electrical Technology
Final Examination – 2011/2012

CLOSED BOOK

Date: 17.03.2012 Time: 1400-1700 hrs

Instructions:
*This paper consists of two part: **part A** and **part B**.*
***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) Explain briefly applications of Instrument Transformers. [4 marks]

b) A 200:5 current transformer is used along with a 5A ammeter to measure the current through a line. If the ammeter reads 4A, what is the line current? [2 marks]

c) A potential transformer has 2200 turns in the HV side and 22 turns on the LV side. If a (0-230) V voltmeter connected to the secondary reads 110V, find the supply voltage. [2 marks]

d) Primary and secondary rated voltages of an auto transformer are 400 V and 240 V respectively. The current delivered to the load is 100A. Neglect magnetizing current and losses. Calculate,

i. Transformation ratio.

ii. Primary current.

iii. Total VA transferred.

iv. Volt-ampere transferred inductively.

v. Volt-ampere transferred conductively.

[12 marks]

Q2

A 30 kW motor of a condensate pump has been burnt and found that it is not economical to repair. Instead, two alternatives (motors A and B with same rating) have been proposed. Techno-Economical characteristics of both motors are given below:

	Motor A	Motor B
Cost	Rs. 20,000	Rs. 15,000
Efficiency at full load (%)	90	86
Efficiency at half load (%)	85	80
Life time (years)	25	25
Salvage value (% of the initial cost)	10	10
Annual maintenance cost	1000	1150

The motor operates at full-load for 25% of time and at half-load for the remaining period. The energy rate is 10% per kWh.

Select most economical motor among A and B for the above purpose. [20 marks]

Hint:-

Annual depreciation charges = (Original cost – Salvage value) / (Life of motor in years)

Q3

a) Explain briefly types of distribution systems [5 marks]

b) A distribution substation is located 10 km far from the main substation and 11 kV overhead line connects them. The sending end active and reactive power flow during the period of maximum load is 1200 kVA and 1050 kVAR respectively. Per-phase, per-kilometer resistance and inductance of the overhead line are 0.5Ω/km and 0.3Ω/km respectively.

I. Calculate the voltage drop due to the line impedance if the supply voltage is 11.5 kV [7 marks]

II. Find the reactive power of the capacitor bank, which is needed to reduce voltage drop up to 6% of the nominal voltage. [8 marks]

Q4

a) What are the advantages and disadvantages of AC transmission system in comparison with DC transmission system? [5 marks]

b) A three-phase four-wire AC distribution system supplies three- phase power at 400 V and lighting loads at 230V.

I. If lightning loads of 70 A, 84 A and 33 A are connected to phases A, B and C what should be the current in the neutral wire? [5 marks]

II. If a three-phase motor is now connected, taking 100A from the lines at a p.f. of 0.5 lagging, calculate per-phase current and the current through neutral wire?\ [6 marks]

III. Determine the total power supplied to the lamps and the motor. [4 marks]

Q5

a) State the classification of industrial drivers. [4 marks]

b) What are the important factors affecting the selection of industrial drivers? [4 marks]

c) 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]

d) Discuss how the methods of braking influence the selection of industrial drives. [4 marks]

e) Explain the advantages of Electrical braking method over Mechanical braking. [4 marks]

PART – B

Q6

Consider the circuit shown in Figure-Q6.

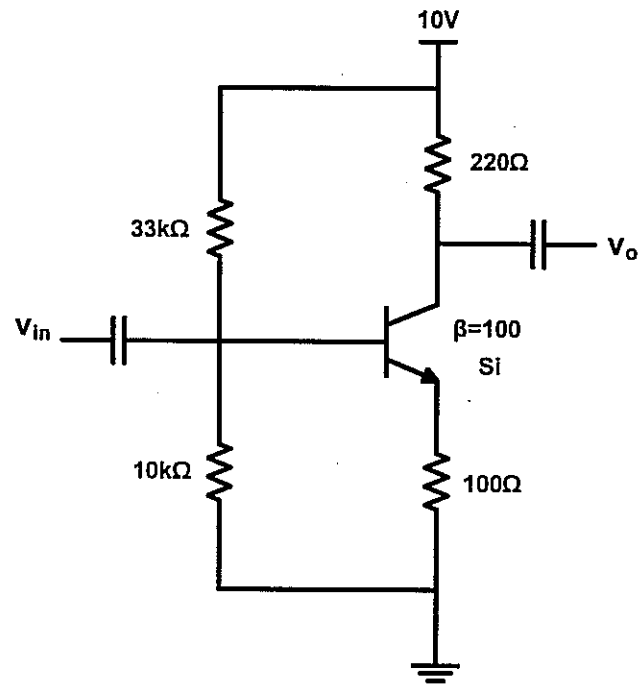

Figure –Q6

a) State the main function of the transistor. [4 Marks]
b) Find the base and emitter bias currents. [12 Marks]
c) Hence find V_{CE}. [4 Marks]

Q7

a) State four assumptions we make for an ideal operational amplifier. **(4Marks)**
b) Consider the circuit shown in figure Q7.

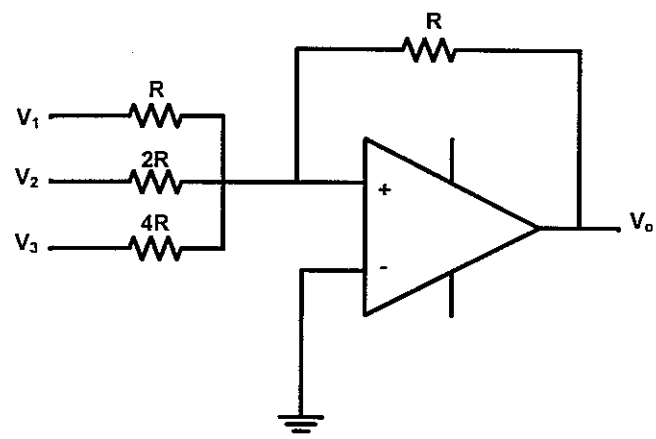

Figure –Q7

i. Derive an expression to show the relationship between V_O and V_1, V_2, V_3 of the circuit shown in figure Q7. Assume that the operational amplifier is an ideal one. [8Marks]

ii. If $V_1 = V_2 = +5V$ and $V_3 = 0V$, calculate the output voltage V_O. [4Marks]

iii. Suggest an application of the above circuit. [4Marks]

Q8

a) Draw the I-V characteristic curves for a practical Si diode and an ideal diode stating all your assumptions. [6Marks]

b) Two diodes D1,D2 and capacitors C1,C2 are connected to a sinusoidal source as shown in figure Q8. All diodes and capacitors are ideal ones.

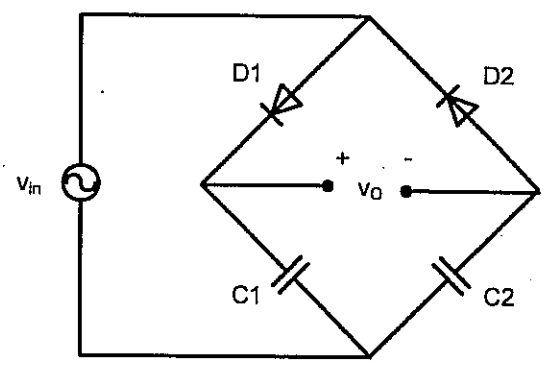

Figure –Q8

i. Explain the operation of the above circuit in Figure-Q8. [8Marks]

ii. If $v_{in} = 10sin\ 20\pi t$ volts, draw the waveform of v_o at steady state. [6Marks]