TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN ELECTRICAL &ELECTRONIC ENGINEERING

EEP2303 : POWER ELECTRONICS 2

END OF SEMESTER EXAMINATION

SERIES: MARCH 2025

TIME: 2 HOURS

DATE: MARCH 2025

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Attempt **ANY THREE Questions**

Do not write on the question paper.

Question ONE

(a)(i) State any TWO advantages of using thyristor for motor speed control.

(ii) Draw a three phase controlled convertor circuit diagram and explain the process of regenerative breaking of a d.c motor. **(8marks)**

(b)(i) Explain the principle of operation of a basic D.C chopper circuit.

(ii)For the chopper circuit of figure Q1 employing parallel-capacitor commutation and operating at 200Hz ,determine:-

I the thyristors T1 and T2 ratings

II its capacitor value

III the value of the inductance **(12marks)**

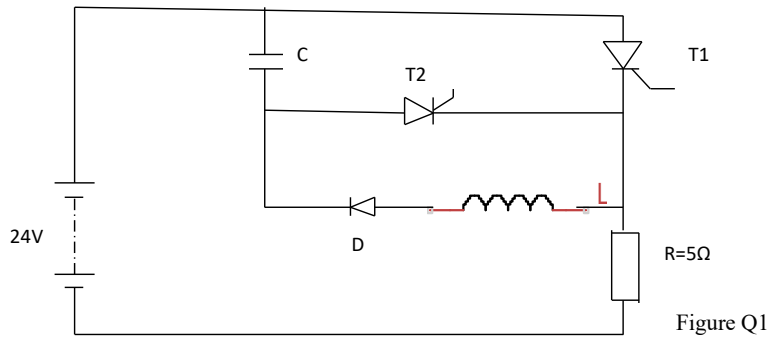

Figure Q1

Question TWO

(b) (i) Draw the circuit diagram of a single phase cycloconvertor using a centre-tapped transformer and explain its working **(6marks)**

(ii) Draw the output waveforms of the circuit b(i) above. **(3marks)**

c) A cycloconvertor designed for industrial application starts conducting from

$$\left\{\frac{-\pi}{P}+\alpha\right\} \text{ to} \left\{\frac{+\pi}{P}+\alpha\right\}$$

Given the general equation for a cycloconvertor to be:

$$V_O = \frac{1}{\frac{2\pi}{P}} \int V_{max} \cos wt \, dwt$$

Derive the expression for the mean voltage**.** **(5marks)**

(a) An invertor supplies a 4-pole cage induction motor rated at 24rated at 240V,50Hz. If the motor speed is 900rev/s, Determine the invertor output frequency **(6marks)**

Question THREE

(a) Explain the following power conversions done by power converters

(i) Rectifiers

(ii) Inverters

(iii) Cycloconverters **(6marks)**

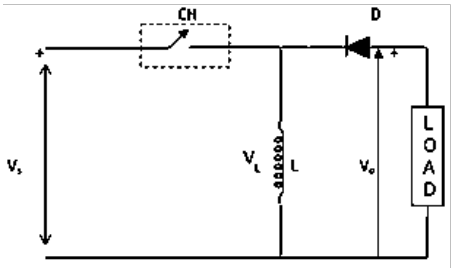

Fig Q3

(b) Identify Fig **Q3** and explain with the aid of waveforms how it works **(8marks)**

(c) By use of waveforms describe how power control is achieved in Pulse Width Modulation (PWM) highlighting its advantages over phase controlled techniques **(6marks)**

Question FOUR

a) (i) Explain the FOUR basic elements of industrial robots

(ii) With the aid of a block diagram describe the CAPP(Computer Aided Part Program) system in a manufacturing industry **(8marks)**

(b) (i) Explain the THREE main techniques used in programming industrial robots **(6marks)**

(ii) State:

I. Any TWO advantages of computer aided design (CAD)
II. The main roles of the following in CAD:-

-Computer

- Designer **(6marks)**

Question FIVE

(a) Sketch the relationship of the characteristic impedance and the frequency of the following networks:

i. π- filter
ii. T-filter **(4marks)**

(b) (i) For the T-section of **figure Q5a** define the characteristic impedance Z_{OT} of the section and show that:-

$$\text{Cosh P} = 1 + \frac{Z_1}{2Z_2}$$ **(7marks)**

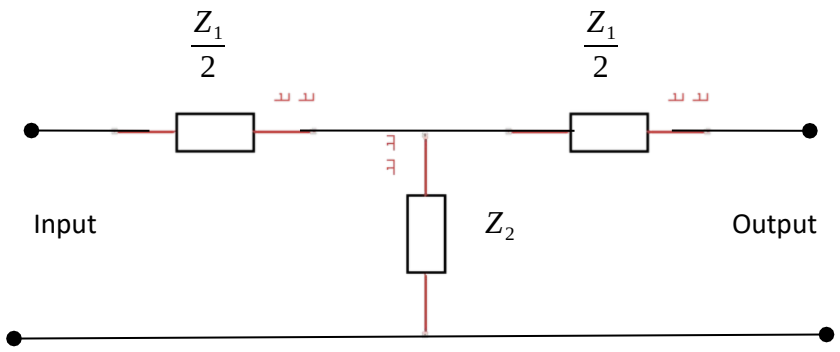

Figure Q5a

(ii) Deduce the relationship between the impedance of a symmetrical π-network and that of the equivalent T-network **(3marks)**

c) For the circuit of figure **Q5c** determine from the first principles the iterative impedance of the equivalent T-network for a frequency of 1kHz **(6marks)**

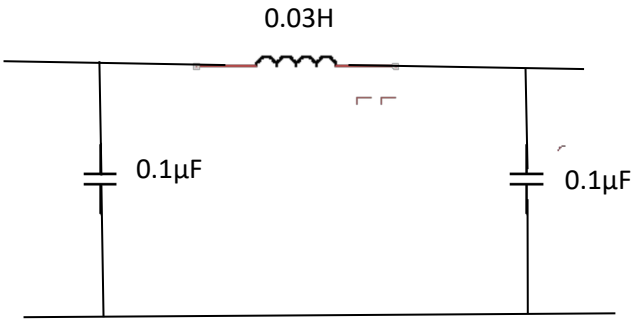

figure Q5c