



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR**

FOURTH YEAR SECOND SEMESTER EXAMINATIONS

**FOR THE DEGREE
OF
BACHELOR OF TECHNOLOGY EDUCATION
IN
ELECTRICAL AND ELECTRONICS ENGINEERING**

COURSE CODE: TEE 424

COURSE TITLE: POWER ELECTRONICS

DATE : 26TH APRIL 2023

TIME: 8:00 AM - 10:00 AM

INSTRUCTIONS TO CANDIDATES:

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.
QUESTION ONE CARRIES 30 MARKS AND ALL OTHERS 20 MARKS EACH.

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

SECTION A: COMPULSORY

QUESTION ONE

- a) Analyze the input, output and switching characteristics of power MOSFET and hence, identify the region of operation **(6marks)**
- b) state TWO industrial application of TRIACs **(2 marks)**
- c) With the aid of a well labelled diagram, explain the Basic Structure of a Thyristors **(5 marks)**
- d) With the aid of well labelled diagrams, explain the Construction and V-I Characteristics of Power Bipolar Junction Transistor (BJT) **(6 marks)**
- e) Classify and explain the phase controlled rectifiers **(5marks)**
- f) With the aid of diagrams, explain the Circulating Current Mode of Operation of Dual Converter DC to DC chopper **(6 marks)**

SECTION A: ANSWER ANY TWO OF THE FOUR QUESTIONS

QUESTION TWO

State and explain two methods of turning on Silicon Controlled Rectifiers.

(6 marks)

State and explain two types of signals used for Silicon Controlled Rectifier gate triggering.

(6 marks)

Define the term commutation as used in connection with Silicon Controlled Rectifiers

(4 marks)

Explain forced commutation as used in connection with Silicon Controlled Rectifiers

(4 marks)

QUESTION THREE

I State five Differences between BJT and MOSFET **(5marks)**

II State and explain the three modes of operation of an SCR **(9marks)**

III With the aid of a diagram, explain the V-I characteristics of a typical SCR **(6marks)**

QUESTION FOUR

a. State **FOUR** industrial applications of SCRs **(4 marks)**

b. Explain the following Terms as used in the V-I Characteristics of SCR **(6marks)**

1. *Holding Current*
2. *Break over Voltage*
3. *Peak Reverse Voltage (PRV)*

- c. With the aid of a diagram, explain the basic structure of a TRIAC
- d. Explain the safe operating area of a GTO thyristor.

(6 marks)

(4 marks)

QUESTION FIVE

State four linear circuit elements

(4 marks)

Differentiate between static and drive applications of power electronics

(4 marks)

With the help of a block diagram, explain what power electronics is all about. **(6 marks)**

With the help of a block diagram and a suitable example, explain drive applications of power electronics

(6 marks)

