TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN ELECTRICAL &ELECTRONIC ENGINEERING

EEP2206: POWER ELECTRONICS 1.

END OF SEMESTER EXAMINATION

SERIES: APRIL 2025

TIME: 2 HOURS

DATE: APRIL 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) Draw the circuit of UJT pulse generator and explain its operation **(6marks)**

(b) Derive the expression for time period T of the UJT pulse generator in Q1(a) above **(5marks)**

(c) The data sheet for a 2N2646 Unijunction Transistor gives the intrinsic stand-off ratio η as 0.65. If a 100nF capacitor is used to generate the timing pulses, calculate the timing resistor required to produce an oscillation frequency of 100Hz. **(5marks)**

(d) The R_{B1} for a UJT is 6kΩ. If the interbase resistance is 10kΩ, Determine the values of:-

(i) R_{B2}

(ii) The intrinsic stand-off ratio **(4marks)**

Question TWO

(a) With the aid of waveforms explain the Zero voltage switching firing techniques and how power control is achieved **(5marks)**

(b) For a centre tapped fully controlled rectifier show that the mean output voltage is given as:-

$V_{mean} = \frac{2V_m}{\pi}|cos\alpha|$ **(5marks)**

(c) A 50Ω resistance load is driven by $240\,V_{r.m.s}$ voltage single phase half controlled with a firing angle of 45^0, determine the average power output. **(5marks)**

(d) Explain the working of circuit fig Q2 **(5marks)**

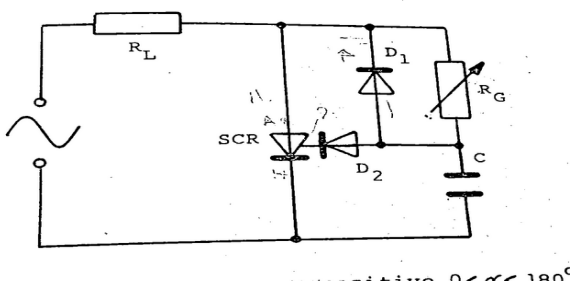

Fig Q2

Question THREE

(a) Explain the difference between controlled and uncontrolled rectification **(2marks)**

(b) Identify the circuit of FigQ3 and hence with the aid of input and output explain its operation **(7marks)**

(c)) Derive the expression for the mean output voltage of FigQ3 if the firing angle is 30^0 **(6marks)**

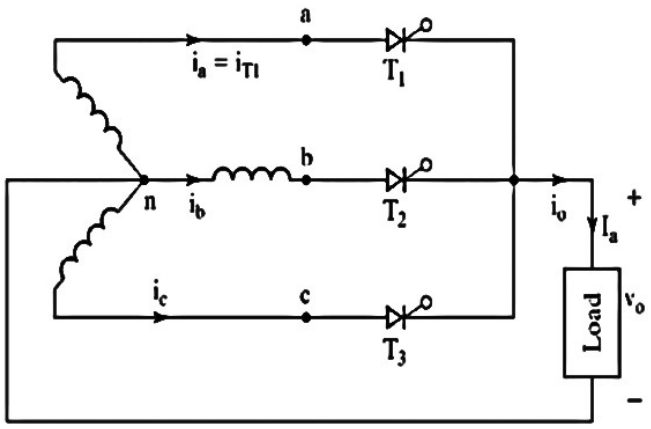

Fig Q3

(d) With the aid of a diagram explain any one application of Single-phase controlled rectifiers **(5marks)**

Question FOUR

(a) Explain the operation of the circuit of figure Q4 and hence derive the expression for its mean voltage **(7marks)**

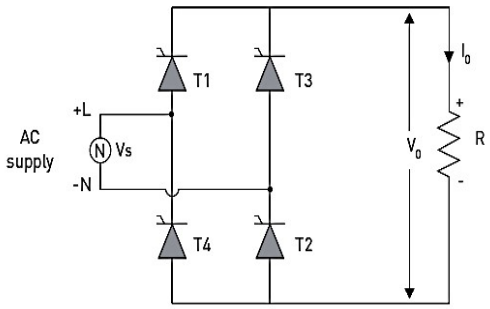

Fig Q4

(b) Describe any TWO methods of commutation in thyristors **(4marks)**
(c) Draw the circuit for two transistor analogy of silicon controlled rectifier and briefly describe the working **(5marks)**
(d) Derive the anode current I_A expression in terms of leakage currents I_{co1} and I_{co2} in the TWO transistor analogy circuit of the SCR **(4marks)**

Question FIVE

(a) Draw the circuit of thyristor inverse parallel connection and explain how it works **(4marks)**
(b) Using the four transistor analogy explain the construction and operation of a TRIAC **(6marks)**
(c) Draw the V-I characteristics of a DIAC and explain its shape. **(4marks)**
(d) With the aid of waveforms explain the operation of Fig Q5 circuit **(6marks)**

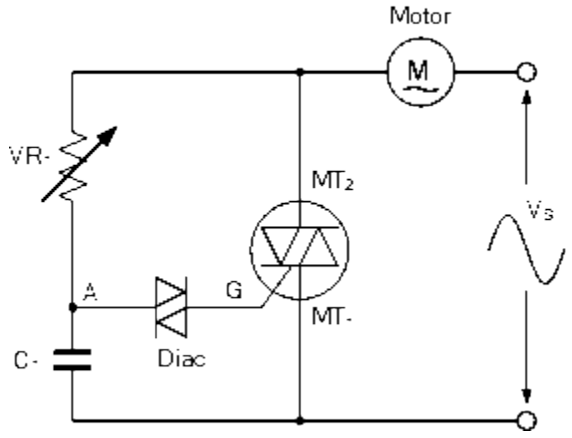

Fig Q5