



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: NOVEMBER 2024

TIME: 2 HOURS

DATE: NOVEMBER 2024

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) Identify the Fig Q1 and explain with the aid of waveforms how it works (7marks)
- (b) Derive the expression of v_o of the fig Q1 (5marks)
- (c) A single-phase half-wave controlled rectifier supplied from 230V a.c supply is operating at $\alpha = 60^\circ$. If the load resistor is 10Ω , determine:
- (i) The power absorbed by the load (P_{dc}).
- (ii) The power drawn from the supply (P_{ac}). (6marks)

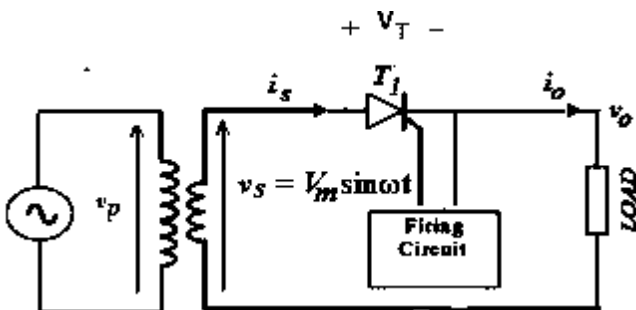


Fig Q1

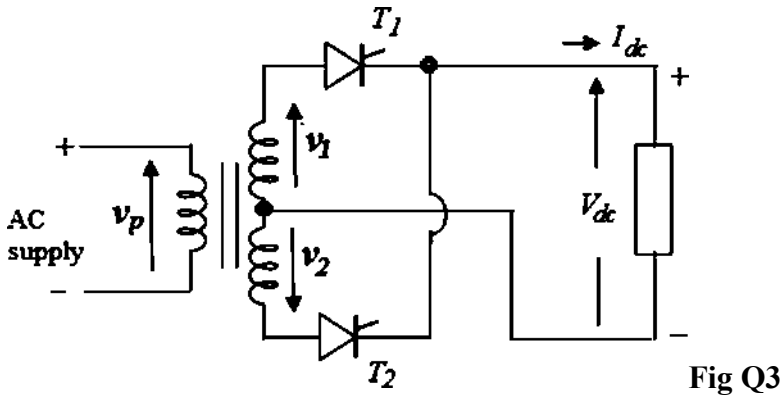
- (d)) Explain the difference between controlled rectification and uncontrolled rectification (2marks)

Question TWO

- Draw the V-I characteristics of a DIAC and explain its shape.
 - Explain with aid of a diagram any ONE application of a DIAC **(9marks)**
- Draw the circuit for four transistor analogy of the TRIAC and briefly describe the working **(7marks)**
- Explain with aid of a diagram any ONE application of a TRIAC **(4marks)**

Question THREE

- With the aid of waveforms explain the working principle of circuit Fig Q3 and hence derive its output expression V_{dc} **(10marks)**



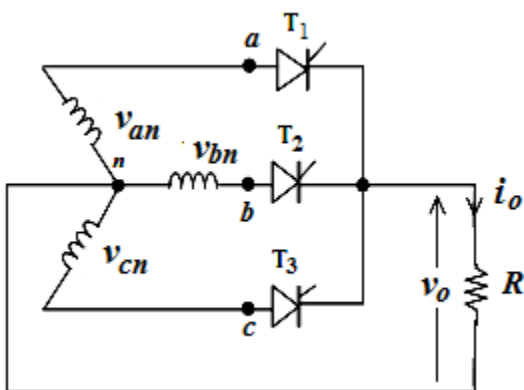
- For a single phase half controlled rectifier show that the mean d.c power output is:-

$$P_{mean} = \frac{V_{max}^2 (1 + \cos \alpha)^2}{4 \pi^2 R_L}$$

- A 100Ω resistance load is driven by $240 V_{r.m.s}$ voltage for firing angle of 60° , determine the average power output. **(10marks)**

Question FOUR

- Identify **Fig Q4** and explain with the aid of waveforms how it works **(6marks)**
- Derive the expression V_o in FigQ4 **(4marks)**



- (c) A three-phase full-wave fully-controlled rectifier supply a highly inductive load with $R = 10 \Omega$ the supply is a three-phase star-connected with 400 V rms , calculate:
- The load current when the firing angle $\alpha = 45^\circ$.
 - The power drawn from the supply. **(5marks)**
- (d) Draw the circuit for two transistor analogy of silicon controlled rectifier and briefly describe the working. **(5marks)**

Question FIVE

- (a) (i) Draw a labelled circuit diagram of a UJT relaxation oscillator and explain its operation. **(6marks)**

(ii) Sketch the output waveforms for the circuit in (a)(i) above and show that its expression of output frequency is given by:-

$$f = \frac{1}{RC \ln \left(\frac{1}{1-\eta} \right)}$$

where f = frequency of oscillation

η =intrinsic stand-off ratio **(5marks)**

- (b) (i) Draw and explain the characteristics of a UJT

(ii) The intrinsic stand off ratio for a UJT is determined to be 0.6. If the interbase resistance is $10 \text{ k}\Omega$, Determine the values of:-

- R_{B1}
- R_{B2} **(9marks)**