



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN TECHNOLOGY (ELECTRICAL POWER ENGINEERING)(DEPE4)

EEP 2206 : POWER ELECTRONICS 1

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2 HOURS

DATE: DECEMBER 2016

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) With an aid of a circuit diagram explain the operation of half wave center-tapped controlled rectifier.

(ii) Draw the voltage and current output waveforms of the circuit in Q1(a)(i) assuming a firing angle of 60° and hence derive the expression of its mean output voltage. **(10marks)**

(b) The power brightness of a 100W, 240V lamp is to be varied by controlling the firing angle of an SCR full wave circuit. The r.m.s value of a.c voltage appearing across each thyristor is 240V. Assuming a firing angle of 30° Calculate:

(i) the r.m.s voltage in the lamp

(ii) the r.m.s current value in the lamp.

(7marks)

(c) Explain any **THREE** advantages of a thyristor as a switch over the mechanical one

(3marks)

Question TWO

(a)(i) Explain the operation of the TRIAC by use of figure 1 circuit below

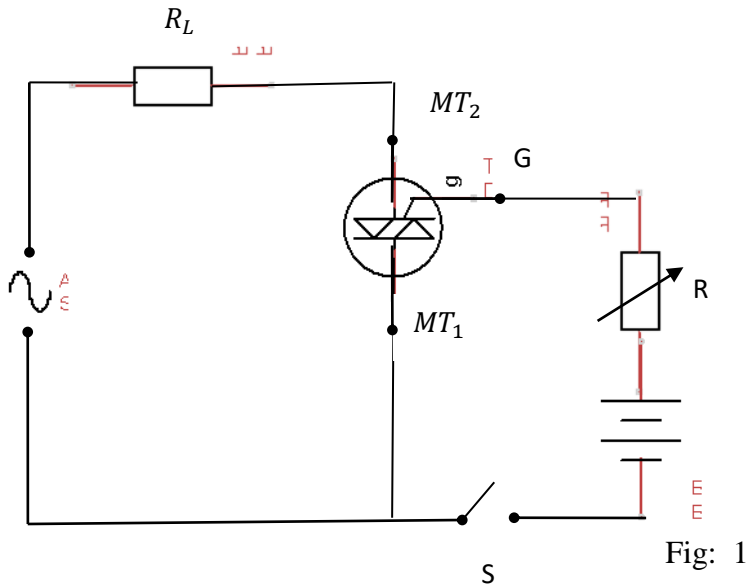


Fig: 1

(6marks)

(ii) With the aid of a circuit diagram and waveforms explain how a TRIAC can be used to control the average a.c power to a load. **(8marks)**

(c) (i) Draw the V-I characteristics of a DIAC and explain its shape.

(ii) Explain with aid of a diagram any ONE application of a DIAC **(6marks)**

Question THREE

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

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

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

(b) (i) State any TWO applications of UJT

(ii) With the aid of diagrams explain the operation of a UJT

(iii) Show that for a UJT pulse generator circuit the periodic time of the pulses is given by :

$$T=0.8RC \quad \textbf{(10marks)}$$

Question FOUR

- (a) Derive the output voltage equation of half-controlled rectifier for the three phase configuration
- (b) Sketch the load voltage waveforms of Q4 (a) above for the following firing

delay angles:

- (i) 0 degrees
- (ii) 45 degrees

(10marks)

- (b)(i) Explain the operation of figure 1 below

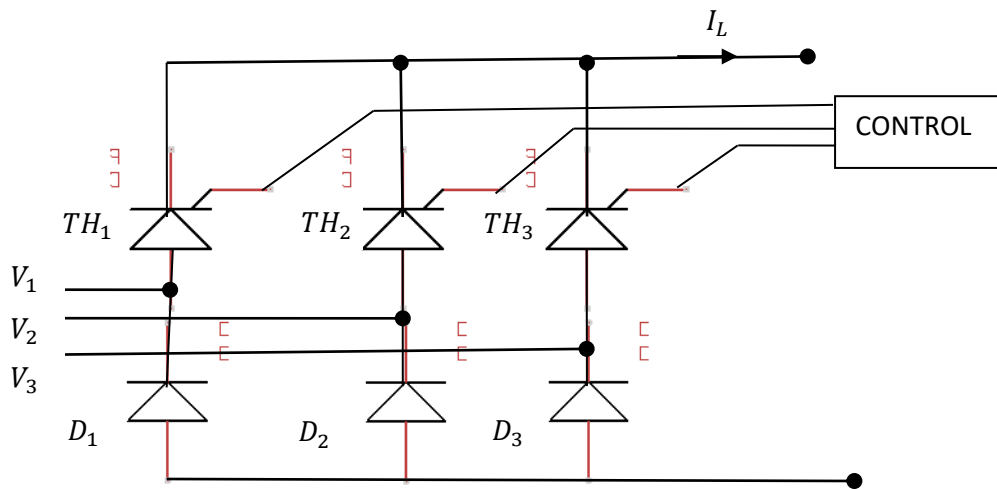


Figure1.

(6marks)

- (ii) With the a diagram and waveforms describe the effect of inductive loads in controlled rectification

(4marks)

Question FIVE

- (a) Define the following terms used in Thyristors

- i) Holding current
- ii) Latching current

(2marks)

- (b)(i) Describe using appropriate diagrams the operation of the thyristor.

- (ii) Sketch and explain the anode characteristics of (b)(i)

(10marks)

- (c) Draw and explain a diagram of a circuit which will produce a pulse train for firing a thyristor

(8marks)