



# Technical University of Mombasa

*Faculty of Engineering and Technology*  
**DEPARTMENT OF MEDICAL ENGINEERING**

DIPLOMA IN MEDICAL ENGINEERING  
(DME 111/112P Y3 SI)

**EHL 2304**  
**MEDICAL ELECTRONICS IV**

SUPPLEMENTARY/SPECIAL EXAMINATIONS

**SERIES:** OCTOBER, 2013  
**TIME:** 2 HOURS

**INSTRUCTIONS TO CANDIDATES:**

-Answer any **THREE** questions of the **FIVE**.  
This paper consists of **3 PRINTED** pages

## QUESTION ONE

- (a) Using the two transistor analogy and characteristic curves, describe the construction and operation of a thyristor. **(10 marks)**
- (b) With the aid of a diagram and output waveforms, explain the operation of a UJT relaxation oscillator. **(10 marks)**

## QUESTION TWO

- (a) With the aid of voltage/current characteristic curve, describe the operation of a thyristor. **(8 marks)**
- (b) Draw a circuit diagram of a varactor diode frequency modulator and describe its operation. **(8 marks)**
- (c) Describe the function of the following tests in logic fault-finding:-
- (i) Dynamic
  - (ii) Static **(4 marks)**

## QUESTION THREE

- (a) State **THREE** advantages of using gate pulse technique for triggering thyristors **(3 marks)**
- (b) Show, with the aid of a circuit diagram and waveforms, how a triac may be used to control the brightness of theatre lights connected to the mains. **(10 marks)**
- (c) With the aid of a graph, explain the variation of percentage failure rate with the age of equipment. **(7 marks)**

## QUESTION FOUR

- (a) Derive an equation relating thyristor current, leakage currents and two transistor's gains in an analogy circuit. **(8 marks)**
- (b) (i) Define the term failure as used in reliability studies.
- (ii) Explain **FOUR** ways by which failures in medical electronic equipment may be categorized. **(9 marks)**
- (c) Draw a labeled equivalent circuit diagram of a varactor diode. **(3 marks)**

## QUESTION FIVE

(a) The circuit of **figure 2** shows a common emitter amplifier.

(i) Calculate the normal voltages at the given test points.

(ii) Table 1 shows the voltage readings at the test points (TP) for various component faults. In each case, state which component is faulty and the type of fault. **(10 marks)**

	TP1	TP2	TP3	Additional symptoms
FAULT A	1.6	9	1.0	No output signal
FAULT B	1.6	1.4	1.4	No output signal
FAULT C	1.6	4.0	0.8	Output signal with very low gain

**Table 1**

(b) (i) With the aid of a sketch, explain the principle of operation of a varactor diode.  
(ii) Draw V-I curve for a varactor diode and explain its shape. **(10 marks)**