ELECTRONICS 1
CMES 09
MARCH/APRIL 2010 SERIES

THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

DEPARTMENT OF MEDICAL ENGINEERING

CERTIFICATE IN MEDICAL ENGINEERING

END SEMESTER EXAMINATION

TIME: 2 HOURS

INSTRUCTIONS TO THE CANDIDATE.

You should have the following for this examination.
Answer booklet
Scientific calculator
Drawing instruments and a graph paper.
This paper consists FIVE questions.
Answer question ONE and any other TWO questions.
Question ONE carries 30 marks, all other questions carry 20 marks each.

Q1(a). Describe the following materials, giving one example of the material in each case.

(i). Conductors
(ii). Insulators
(iii). Semi conductors (9 marks)

(b). With the aid of simple sketches, explain how pure germanium can be treated in such a way that conduction is predominantly due to
(i). Electrons
(ii). Holes (10 marks)

(c). Identify the types of diodes shown in figure 1.

(i). (ii) (iii) (iv) (6 marks)

(d). Draw the schematic circuit symbol for:
(i). n-p-n bipolar junction transistor.
(ii). p-n-p bipolar junction transistor. (3 marks)

(e). A bipolar transistor has a common-emitter current gain of 125. If the transistor operates with a collector current of 50mA, determine the value of base current. (2 marks)

Q2.(a). With reference to a P-n-P transistor, explain briefly what is meant by the term 'transistor action' and why a bipolar junction transistor is so named. (16 marks)

(b). A Bipolar junction transistor operates with a collector current of 12A and a base current of 50mA. What will be the value of
(i). Emitter current.
(ii). Common-emitter current gain. (4 marks)

Q3. (a). Why is a FET less affected by temperature changes than a bipolar type? (4 marks)

(b)(i). State TWO uses of MOSFETs. (4 marks)

(ii). Why can a MOSFET be damaged by 'handling'? (4 marks)

(c). Using a suitable diagram briefly describe the construction of a JUGFET. (6 marks)

(d). Define the term transconductance as used in FETS. (2 marks)

Q4. (a). Briefly explain how a Light emitting diode works. (5 marks)

(b). State TWO advantages of light emitting diodes when compared with convectional filament indicating lamps. (4 marks)

(c)(i). Draw the reverse characteristics of a Zener diode, giving typical values on your axes. In what way does its behavior differ from a normal p.n diode in reverse bias. (4 marks)

(ii). The zener diode shown in figure 4 has a break-down voltage of 6V. What is the current through it?

(iii). Discuss what happens to the current through the diode, and the p.d across it when the positive supply is altered to:-

(i). 12V

(ii). 4V

Figure 4.

Q5. (a). Draw a circuit diagram that can be used for obtaining the common-emitter characteristics of an n-p-n bipolar junction transistor.

(b). Briefly explain how input characteristic and output characteristics are obtained using the circuit in Q5(a).

(c). Sketch labeled diagrams for input characteristics and output characteristics of a common emitter configuration. (16 marks)

(d). Draw the construction diagram of a n-p-n bipolar junction transistor. (4 marks)

Q1(a). A piece of pure silicon is doped with
(i). Pentavalent impurity
(ii). Trivalent impurity
Explain the effect these impurities have on the form of conduction in silicon. (10 marks)

(b). State briefly what you understand by the terms
(i). Reverse bias
(ii). forward bias
(iii). Contact potential
(iv). Diffusion
(iv). Minority carrier conduction. (10 marks)

(c). (i). Briefly describe with diagrams, the action of an n.p.n transistor. (7 marks)

(ii). A transistor operates with a collector current of 100mA and an emitter current of 102mA. Determine the value of Base current. (3 marks)

Q2. (a). Explain briefly why a bipolar junction transistor is so named. (4 marks)

(b). State and draw the three basic circuit configurations used for transistor amplifiers. (6 marks)

(c). With the aid of a circuit diagram, explain how the input and output characteristic of a common emitter n-p-n transistor may be produced. (10 marks)

Q3. I. State briefly what you understand by the terms:
(a). Pentavalent impurity
(b). Trivalent impurity
(c). Intrinsic semi conductor
(d). Valency electrons

II. Explain what is meant by minority and majority carries in an n-type material and state whether the number of each of these carries are affected by temperature.

III(a). Corresponding readings of current, 1,and voltage, V, for a semi conductor device are given in the table:

V_f(V)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
I_f (mA)	0	0	0	0	0	0	0	0	50

Plot the I/V characteristics for the device and identify the type of device.

(b). For the characteristics plotted in III (a), determine for the device.
(i). The forward current when the forward voltage is 0.65V

(ii). The forward voltage when the forward current is 35mA.

Q4. (a). Briefly describe each of the following, drawing their circuit diagram symbol and stating typical applications.
(i). Zener diode
(ii). Schottky diode (10 marks)

(b). State TWO advantages of Light Emitting Diodes when compared with convectional filament indicating lamps. (4 marks)

(c). Explain the terms given below when used in semi-conductor terminology (P-n junction)
(i). Forward biased
(ii). Reverse biased (6 marks)

Q5. (a). Compare electrical characteristics of a FET with those of a Junction transistor. (10 marks)

(b). List the TWO types of FETs and draw their respective symbols. (4 marks)

(c). Electrical materials fall into THREE categories – insulators, semiconductors and conductors. Describe each category and give ONE example in each case. (6 marks)