

**W1-2-60-1-6**

**JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2015/2016**

**SCH 2355: INSTRUMENTATION FOR ANALYTICAL CHEMISTRY**

**DATE:DECEMBER 2015 TIME: 2 HOURS**

**INSRUCTIONS:** Answer question one and any other two questions.

QUESTION ONE 30 MARKS

a.

i. What is a junction diode?

ii. Give the differences in characteristics of diodes made from Silicon and germanium

iii. Give four important characteristics of semi conductor diodes. (8 marks)

b.

i. Briefly describe a bipolar transistor

ii. Give three factors that determine the selection of a transistor.

iii. Give two reasons why the base of a bipolar transistor should be as this as possible.

 (7 marks)

c.

i. List two reasons why linear integrated circuits need additional components.

ii. Give four advantages of using integrated circuits. (5 marks)

d.

i. What is the function of a voltage regulator?

ii. Explain how a simple zener diode voltage stabilizer works. (5 marks)

e.

i. Give four reasons for justification for automation in Analytical laboratories.

ii. Distinguish between discrete from continuous automated analytical systems.

 (5 marks)

QUESTION TWO

a.

i. Give three uses of diodes in circuits

ii. Define the a.c resistance of a diode

iii. Distinguish signal diodes from power diodes. (7 marks)

b.

i. Plot a sketch of current flow versus bias voltage applied to u-p semiconductor diode.

 (4 marks)

ii. Explain each of the following terms

 -Diffusion current

 -Depletion layer

 -Zener limit (5 marks)

c. A varacter diode has a capacitance of 54pF and 20 pF when the reverse bias voltage is 1V and 10 V respectively. Calculate the capacitance of the varactor diode when the bias voltage is 3V. (4 marks)

QUESTION THREE

a.

i. Give the three components of the base current of a bipolar transistor.

ii List two kinds of field effect transistors. (4 marks)

b.

i. Briefly explain the operation of a N channel field effect transistor. (4 marks)

ii. Compare the characteristics of a bipolar and field transistor in a circuit.

 (4 marks)

c. The most common configuration of a bipolar transistor is the common emitter.

 (2 marks)

 i. Give a sketch diagram of a bipolar transistor connected in a common emitter amplifier circuit.

 ii. Show that the bipolar transistor in the common emitter configuration gives a high current gain.

 iii. A transistor has a current gain hfe of 500 and a base current of 25μA. Calculate its current gain hfb and collector current. (3 marks)

QUESTION FOUR

a.

i. List three main components of a power supply.

ii. Briefly explain how full wave rectification of a.c to d.c voltage may be achieved using two and four diodes. (10 marks)

b. Briefly explain how a voltage doubler works. (3 marks)

c. i. What is the purpose of instrument maintenance

 ii. Give four factors that determine the lifetime of a pH electrode.

 iii. Give the stages of equipment qualification. (7 marks)