****

**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES**

**UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE WITH IT**

 **3RD YEAR 1ST SEMESTER 2017/2018 ACADEMIC YEAR**

 **MAIN CAMPUS**

**COURSE CODE: SPH 307**

**COURSE TITLE: INTRODUCTION TO ELECTRONICS**

**EXAM VENUE: LR 6 STREAM: (BED Sc.)**

**DATE: 19/12/17 EXAM SESSION: 2.00 – 4.00PM**

**TIME: 2 HOURS**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Instructions:**

1. **Answer question 1 (compulsory) and ANY other 2 questions.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

**QUESTION 1 (30 MARKS)**

1. Distinguish between intrinsic and extrinsic semiconductors (2 marks)

1. Sketch and explain the current – voltage (IV) characteristics of a PN junction in forward bias (3 marks)
2. Explain what happens to the charges recombinations when a p-type semiconductor is joined to an n-type semiconductor material. (3 marks)
3. Derive the relation between β and α (3 marks)
4. For a transistor, β = 45 and voltage drop across 1kΩ resistor which is connected in the collector circuit is 1 volt. Find the base current for common emitter connection. (3 marks)
5. Using well illustrative diagrams explain the three transistor circuit configurations (6 marks)
6. An NPN Transistor has a DC current gain, β=200. Calculate the base current Ib required to switch a resistive load of 4mA. (3 Marks)
7. An NPN Transistor has a DC base bias voltage, Vb of 10v and an input base resistor, Rb of 100kΩ. What will be the value of the base current into the transistor.
8. i. Define an operational amplifier (op-amp), (1 mark)
9. Draw the symbol of the op-amp and its associated terminals and ports (3 marks)
10. An NPN transistor circuit has got the following voltage and current values; Vcc=-4.5V, Vce=3.2V and RL=25ohms, Calculate Ic (3 marks)

**QUESTION 2 (20 MARKS)**

1. Outline any three properties of Semiconductors **3mks**
2. Using a well labeled diagram, describe the formation of N type and P type semiconductors **8mks**
3. Using the band theory of solids, highlight the major differences between conductors, semiconductors and insulators **9mks**

**QUESTION 3 (20 MARKS)**

1. i) Using a well labelled circuit diagram, explain the output characteristics of a junction diode both in forward biasing and reverse biasing modes (6 marks)
2. draw the graph showing the output characteristics of a zener diode and in it indicate the following key parameters;

reverse breakdown voltage; Zener breakdown region, Zener forward bias region, minimum Zener current, maximum Zener current, Zener voltage, Knee voltage knee voltage (5 marks)

1. Fully describe the operations of the following types of diodes
2. Varactor
3. Schottky diode
4. Light emitting diode (9 marks)

**QUESTION 4 (20 MARKS)**

1. Draw a well labelled diagram of a Single Stage Common Emitter Amplifier Circuit (4 marks)
2. On a common cartesian plane, draw the Output Characteristics Curves for a Typical Bipolar Transistor and in the diagram, indicate the following parameters

Cut-off region, active region, saturation region, loadline, Q-Point (10 marks)

1. Draw and explain the operation of a transistror as a switch (6 marks)

**QUESTION 5 (20 MARKS)**

1. Define the following terms
2. First order circuit
3. Natural response of a circuit
4. Time constant of a circuit (3 marks)
5. In the RC circuit shown in Figure. 5.1, let Vc(0)=15V, find *Vc*, *Vx* and *ix* for t=0 (7 marks)

 Figure 5.1

5

Ω

8

Ω

12

Ω

*v*

*C*

*v*

*x*

*i*

*x*

+

−

+

−

0.1

 F

1. In the RL circuit shown in figure 5.2, find *i0, v0* and *i* for all time assuming that the switch was left open for a long time. (7 marks)

a long time.

*o*

 V

10

6

Ω

 H

2

*t*

0

=

*i*

*i*

*o*

+

−

*v*

*o*

3

Ω

2

Ω

+

−

 Figure 5.2

1. From the results obtained in c above, Plot time graphs for *io* and *i* on a common cartesian plane. (3 marks)