



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 2018/2019 ACADEMIC YEAR
MAIN CAMPUS

COURSE CODE: SPH 307

COURSE TITLE: INTRODUCTION TO ELECTRONICS

EXAM VENUE: STREAM: (BED Sc.)

DATE: DEC 2018

EXAM SESSION:

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)

- a) From the band theory of solids, explain why semiconductors are preferred to solids in the construction of electronic devices. **(2 marks)**
- b) By use of schematic diagram, fully explain how a P-type semiconductor is obtained **(4 marks)**
- c) Explain what happens to the charges recombinations when a p-type semiconductor is joined to an n-type semiconductor material.
- d) Derive the relation between β and α **(3 marks)**
- e) For a transistor, $\beta = 45$ and voltage drop across $1k\Omega$ resistor whichs connected in the collector circuit is 1 volt. Find the base current for common emitter connection. **(3 marks)**
- f) Using well illustrative diagrams explain the three transistor circuit configurations **(6 marks)**
- g) An NPN Transistor has a DC current gain, $\beta=200$. Calculate the base current I_b required to switch a resistive load of 4mA. **(3 Marks)**
- h) An NPN Transistor has a DC base bias voltage, V_b of 10v and an input base resistor, R_b of $100k\Omega$. What will be the value of the base current into the transistor.
- i) i. Define an operational amplifier (op-amp), **(1 mark)**
ii. Draw the symbol of the op-amp and its associated terminals and ports **(3 marks)**
- j) An NPN transistor circuit has got the following voltage and current values; $V_{cc}=-4.5V$, $V_{ce}=3.2V$ and $R_L=25ohms$, Calculate I_c **(3 marks)**

QUESTION 2 (20 MARKS)

- a) Outline any three properties of Semiconductors **(3 marks)**
- b) Using well labelled diagrams, explain the band structures of the P-type and N-type semiconductors hence draw the band structure of a P-N junction diode. **(6 marks)**
- c) A p-n junction diode can be connected in a circuit both in a forward bias and reverse bias modes.
 - i. Fully explain the voltage-current (V-I) characteristics of a P-N junction diode both in the forward and reverse bias modes. **(3 marks)**
 - ii. Draw a well labelled voltage-current characteristics graph of the diode for both forward and reverse bias modes **(3 marks)**
 - iii. With focus on charge carrier movements, explain the shape of the graph both in the forward and the reverse regions. **(3 marks)**

QUESTION 3 (20 MARKS)

- a. Depending on the biasing of the bipolar junction transistor junctions, a transisoer can operate either in saturation, cut off or active modes. Using illustrative circuit diagrams, explain the tree modes of the transistor **(9 marks)**
- b. With focus on the charge carriers, explain the operation of a transistor in the active mode. **(5 marks)**
- c. Draw and explain the operation of a transistror as a switch **(6 marks)**

QUESTION 4 (20 MARKS)

- Using a well labelled diagram explain how the operation of a Single Stage Common Emitter Amplifier (6 marks)
- 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)
Explain the following transistor parameters in the diagram above Loadline. Q point (4 marks)

QUESTION 5 (20 MARKS)

- Define the following terms
 - First order circuit
 - Natural response of a circuit
 - Time constant of a circuit (3 marks)
- In the RC circuit shown in Figure. 5.1, let $V_c(0)=15V$, find V_c , V_x and i_x for $t=0$ (7 marks)

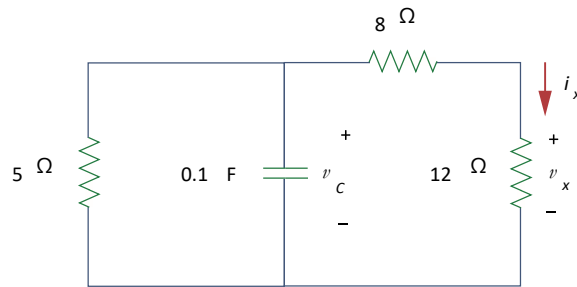
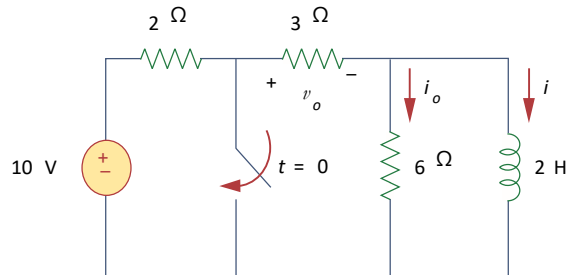


Figure 5.1

- In the RL circuit shown in figure below, find i_o , v_o and i for all time assuming that the switch was left open for a long time. (7 marks)



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