Ser. No. EDU 135/18

GARISSA UNIVERSITY

UNIVERSITY EXAMINATION 2017/2018 ACADEMIC YEAR TWO SECOND SEMESTER EXAMINATION

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCE

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: PHY 213

COURSE TITLE: ELECTRONICS 1

EXAMINATION DURATION: 3 HOURS

DATE: 17/04/18 **TIME: 09.00-12.00 PM**

INSTRUCTION TO CANDIDATES

- **The examination has SIX (6) questions**
- **Question ONE (1) is COMPULSORY**
- **Choose any other THREE (3) questions from the remaining FIVE (5) questions**
- **Use sketch diagrams to illustrate your answer whenever necessary**
- **Do not carry mobile phones or any other written materials in examination room**
- **Do not write on this paper**

This paper consists of SEVEN (7) printed pages ***please turn over***

QUESTION ONE (COMPULSORY)

a) Explain the difference between a metal and an insulator. **[2 marks]**

b) i. Define the terms **[2 marks]**

-Doping

-Hole

ii. Explain how temperature affects the electrical conductivity of intrinsic

Semiconductors **[2 marks]**

c). Given that current gain $\beta = \frac{I_C}{I_B}$ and $\alpha = \frac{I_C}{I_E}$ show that $I_E = (\beta + 1)I_B$ and

$\alpha = \frac{\beta}{(\beta+1)}$ **[4 marks]**

ii. An intrinsic semiconductor current (I) flow is due to electrons and holes

$I = I_e + I_h = enV_eA + e\rho V_hA$ Where e = electron charge

n= no of electrons per unit

volume of conductor

v_e= electron drift velocity

v_h=hole drift velocity

ρ=hole density

Show that resistivity, $\rho = \frac{1}{en(\mu_e + \mu_h)}$ **[3 marks]**

iii. Mobilities of electrons and holes in a sample of intrinsic germanium at room temperature are $0.36m^2$/v-s and $0.17m^2$/v-s respectively. If the electron and hole densities are each equal to 2.5×10^{-19} m^3, Calculate germanium conductivity. **[3 marks]**

d). Briefly explain the behavior of PN junction in forward and reverse bias mode. **[3 marks]**

e). The base of PNP bipolar transistor is grounded. A battery is connected between the emitter and the base. Another battery is connected between the base and the collector. This is known as the base configuration.

i. Draw the circuit indicating polarities of the batteries that would put the transistor in the forward active mode. Explain why you have chosen these polarities **[4 marks]**

ii. Why is the emitter more heavily doped? **[2 marks]**

QUESTION TWO

a). State and explain two uses of photo resistors **[2 marks]**

b). i. In a zener diode circuit below state giving reasons if the zener diode is properly biased hence the diode current assuming it to be an ideal one **[5 marks]**

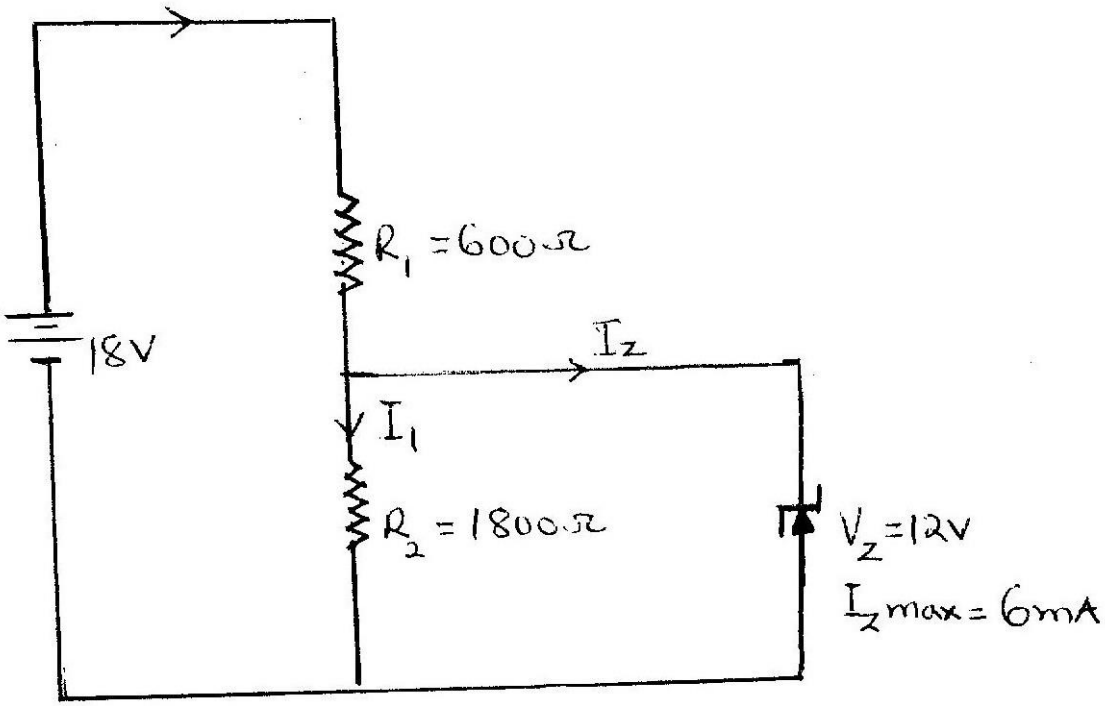


Fig. 1

ii. Draw the symbol for a photodiode and state its uses. **[3 marks]**

c). i. Define fabrication. **[1 mark]**

ii. Discuss the processes of fabrication of a BJT transistor. **[4 marks]**

QUESTION THREE

(a) Explain the difference between field effect transistor and bipolar junction transistor **[3 marks]**

(b) The circuit below represents abias connection. Use the circuit to answer questions that follow.

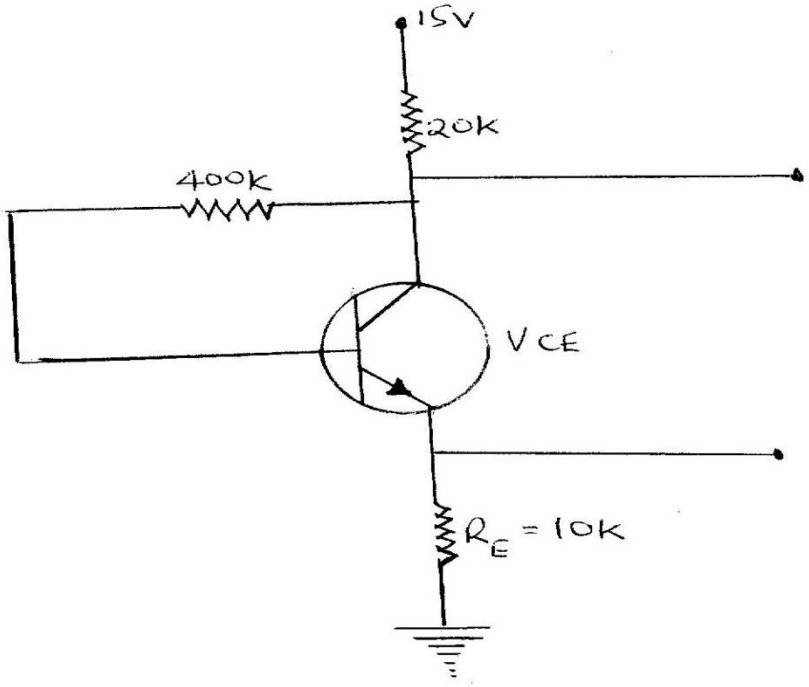


Fig.2

Find

i). $I_{C(sat)}$ **[2 marks]**

ii). V_{CE} **[3 marks]**

iii). K_β neglect V_{BE} and take β=100 **[2 marks]**

c). i. Define Quiescent point **[1 mark]**

ii. For the circuit below draw the d.c load line and locate its Quiescent or dc working point. **[4 marks]**

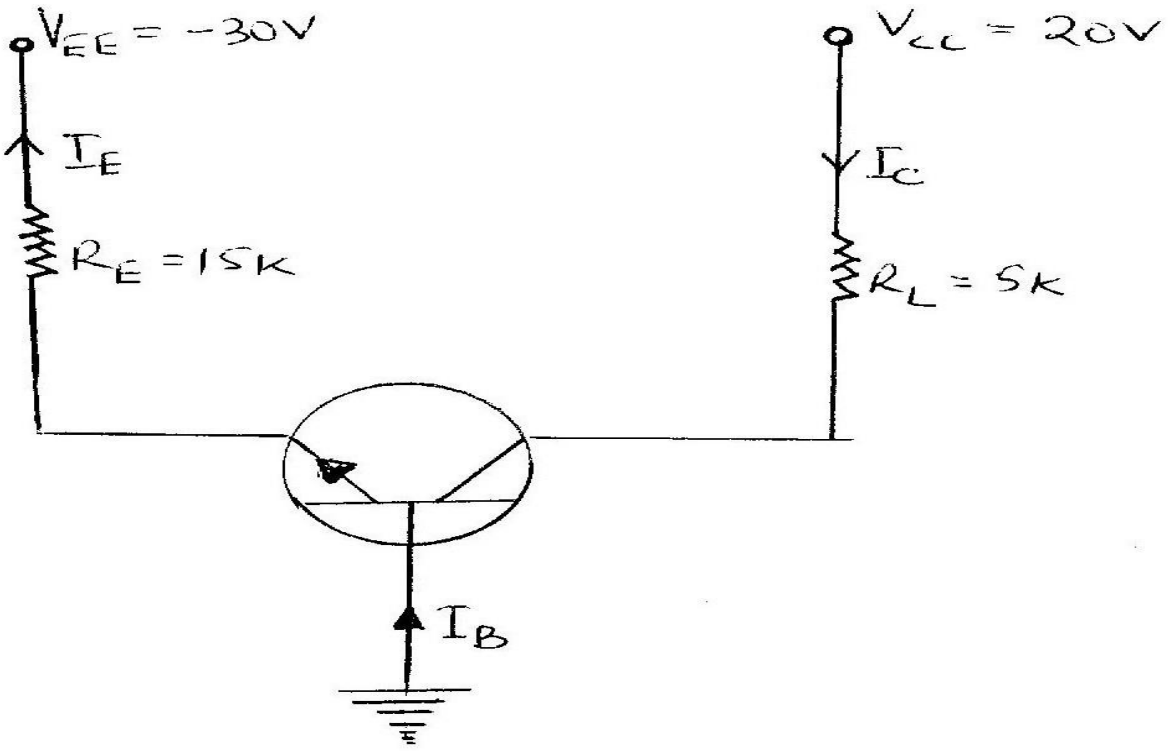


Fig. 3

QUESTION FOUR

a). state and describe any two optoelectronic devices that are made from semiconductors p-n junction. **[5 marks]**

b). i. State the use of Thevenin's theorem in a circuit. **[1 mark]**

ii. Apply Thevenin's theorem to find equivalent resistance (R_{th}), current through the 3Ω resistor and Thevenin's voltage (Vth) **[6 marks]**

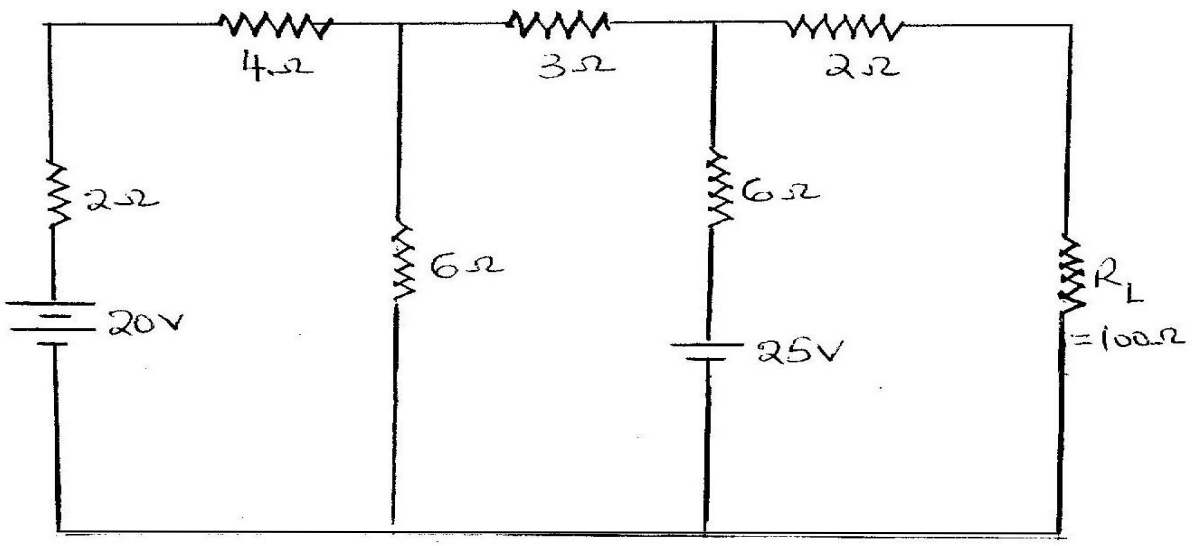


Fig. 4

iii. State the condition and disadvantages of Mesh analysis. **[3 marks]**

QUESTION FIVE

(a) Briefly describe the operations of a thyristor. **[3 marks]**

(b) Name two applications of silicon controlled rectifiers (SRC) and function of DIACS **[3 marks]**

(c) A given silicon UJT has an inter base resistance of 10K, R_B = 6K with I_E = 0. Find

i. UJT current if V_{BB} = 20V and V_E is less than V_P **[2 marks]**

ii. Peak point voltages, V_P **[2 marks]**

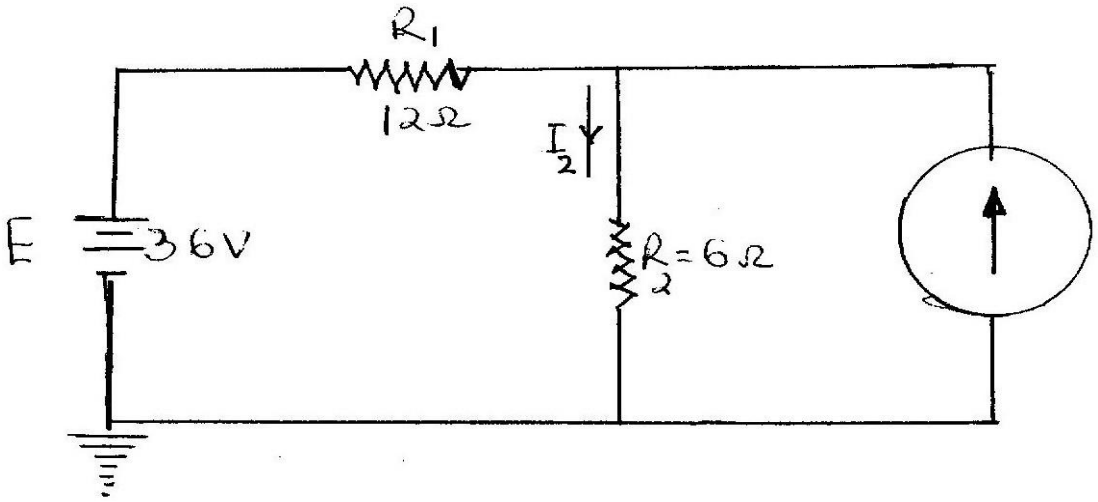
(d). i. Enumerate steps for drawing ac equivalent circuits **[3 marks]**

ii. State Norton's theorem as applied in circuit analysis. **[2 marks]**

QUESTION SIX

(a) i. Superposition theorem has widespread applications in electricity and electronics. State two uses of this theorem. **[2 marks]**

ii. Using Superposition theorem determine the current through resistor R_2 for the network in fig5 below. **[4 marks]**



i. Fig .5

ii. In the above circuit demonstrate that the Superposition theorem is not

iii. Applicable to power levels **[2 marks]**

(b) Describe fully the bridge full wave rectifier circuit. **[4 marks]**

(c) Small signal amplifiers also referred to as voltage amplifiers have three main properties. State and define these properties. **[3 marks]**