Ser. No. EDU 001/17

GARISSA UNIVERSITY

UNIVERSITY EXAMINATION 2017/2018 ACADEMIC YEAR ONE SECOND SEMESTER EXAMINATION

SCHOOL OF EDUCATION, ARTS AND SOCIAL SCIENCES

FOR THE DEGREE OF BACHELOR OF EDUCATION (ARTS)

COURSE CODE: COM 217

COURSE TITLE:

EXAMINATION DURATION: 3 HOURS

DATE: /12/17 **TIME: .00-.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 TWO (2) printed pages ***please turn over***

QUESTION ONE (COMPULSORY)

(a). Differentiate between extrinsic and intrinsic semiconductor materials [2 marks]

(b). i. Describe the formation of a pnp semiconductor material . [2marks]

ii. Use the idea of free electrons to explain why semiconducting materials have higher resistivity than conducting materials. [2 marks]

(c). i. Define electron mobility. [1mark]

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, $\rho = \dfrac{1}{en(\mu_e + \mu_h)}$ [3marks]

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

(d). Sketch and explain the common-emitter static input characteristic. [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 common 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 [5marks]

ii. Why is the emitter more heavilydoped? [2marks]

iii. How do the carriers that are emitted into the base reach the collector. [2marks]

QUESTION 2 (15 MARKS)

(a). Define fabrication and state why an npn BJT is preferred. [2marks]

(b). Outline the process of fabrication of a BJT transistor. [6marks]

(c). i. State two applications of diodes. [2marks]

ii. Determine if the zener diode in the fig.1 below is properly biased, find I_Z and power dissipated by the diode. [5marks]

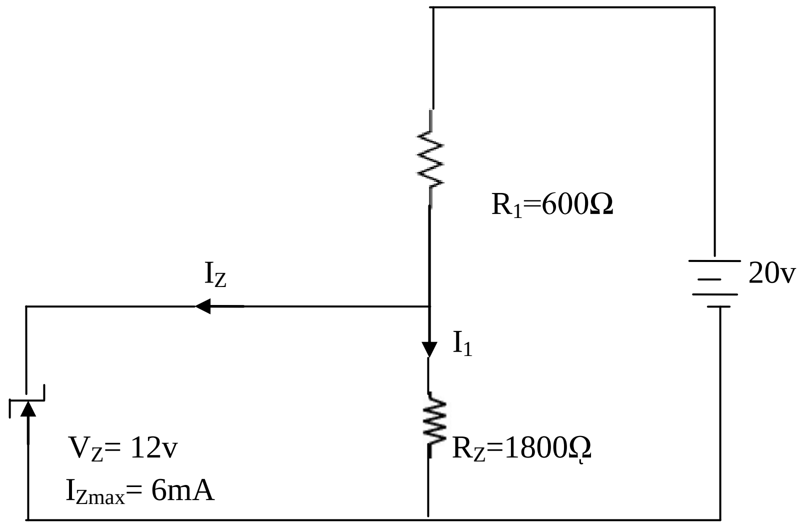


Fig.1

QUESTION 3 (15 MARKS)

(a). Explain how temperature affects bias variations . [2marks]

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

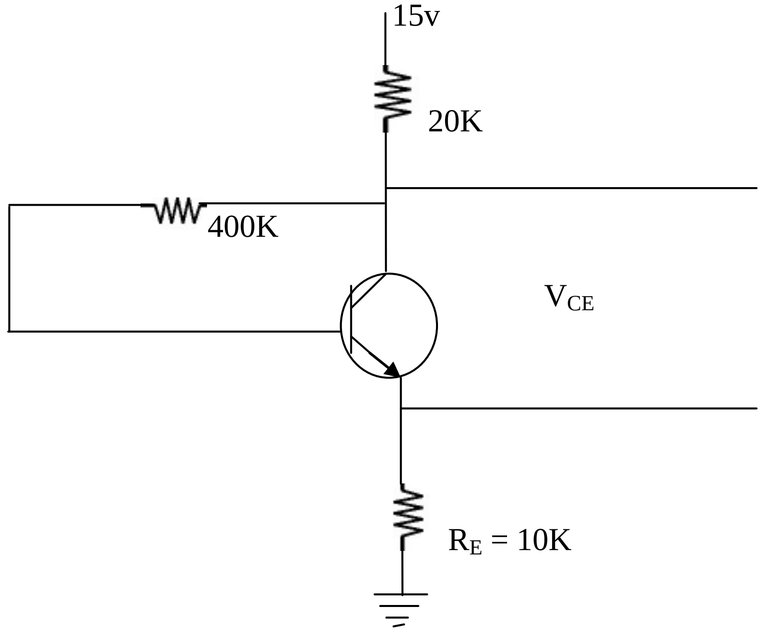


Fig.2

i. Name the bias connection [1mark]

ii. Find

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

b). V_{CE} [3 marks]

c). K_{β} neglect V_{BE} and take β=100 [2marks]

iii. Define Quiescent point [1mark]

iv. For the circuit below draw the d.c load line and locate its Quiescent or dc working point.

[4 marks]

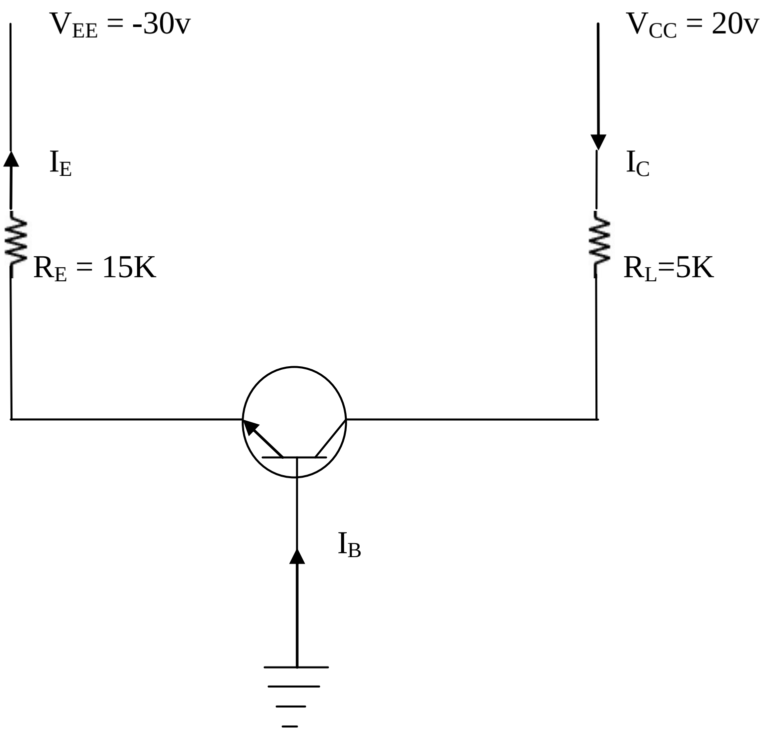
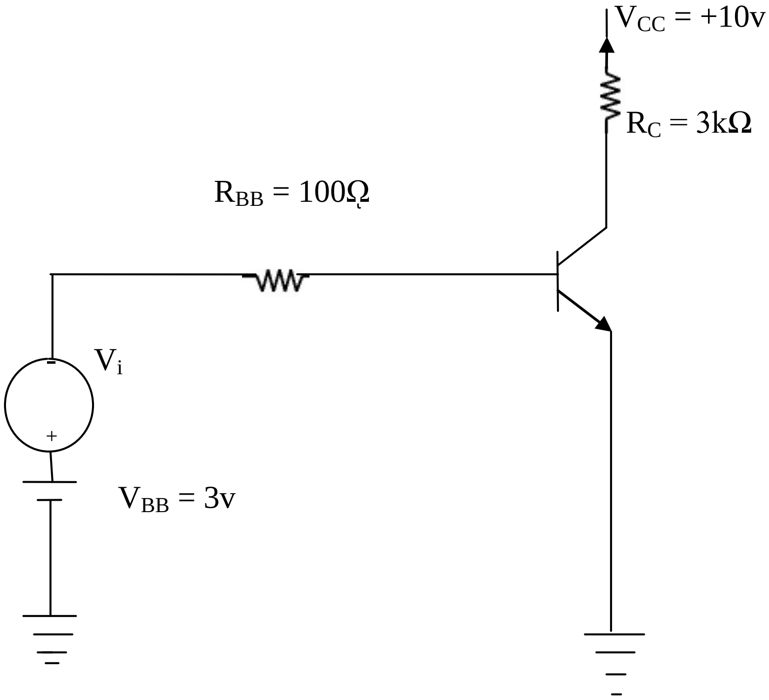


Fig.3

QUESTION 4 (15 MARKS)

(a). State procedure for drawing ac equivalent circuits. [3marks]

(b). Determine the small signal AC voltage gain for the circuit below assuming β=100 and the output voltage taken at the collector terminal.



[10 marks]

Fig.4

(c). State two equivalent active mode small signal circuit models for BJT. [2 marks]

QUESTION 5 (15 MARKS)

(a) Small signal amplifiers also referred to as voltage amplifiers have three main properties. State and define these properties. [6marks]

(b). Consider the circuit below. Calculate the voltage gain $A_{V}=\frac{V_{out}}{V_{in}}$(Room temperature value

V_T=25mV). [4 marks]

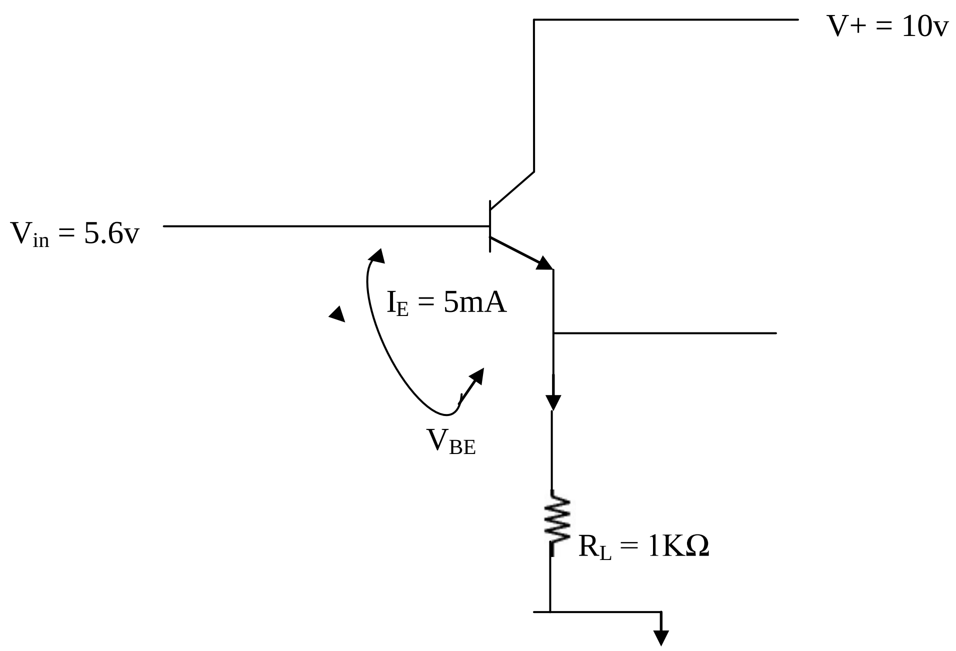


Fig. 5

(c). i. State two applications of a UJT. [2marks]

ii. A one phase half wave rectifier supplies power to a 1KΩ load the input supply voltage is 200 V_{rms}. Neglecting forward resistance of the diode, calculate V_{dc} and ripple voltage$_{(rms\ value)}$ [3marks]

QUESTION 6 (15 MARKS)

(a). State the symbol and function of a thyristor. [2 marks]

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

ii. Name two applications of silicon controlled rectifiers (SRC). [2 marks]

(c). What is the difference between UJT and FET. [2 marks]

(d). 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 [3 marks]

(e). State the function of DIACS. [1 mark]