MURANG'A UNIVERSITY COLLEGE

(A Constituent College of Jomo Kenyatta University of Agriculture and Technology)

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DIPLOMA IN ELECTRICAL POWER SYSTEMS ENGINEERING

MAIN EXAMINATION

LEVEL: **DIPLOMA**

CLASS: **MRUC/EEP/14DS**

SEMESTER: **II**

ACADEMIC YEAR: **2014/2015**

UNIT: **ANALOGUE ELECTRONICS I**

UNIT CODE: **SEE 1105**

DATE: 22ND APRIL 2015 **TIME: 2 HOURS**

Instructions to candidates:

This paper contains **FOUR (4)** questions.

Answer **QUESTION ONE** and **ANY OTHER TWO** questions.

You should have the following for this examination;

- Answer booklet
- Scientific calculator

NB: NO MOBILE PHONES ALLOWED IN THE EXAMINATION ROOM.

Section A

QUESTION ONE (compulsory)

(a) Distinguish between drift current and diffusion current. **(2 marks)**

(b) Define the term ripple factor. Show that the ripple factor of a full wave rectifier is 0.48. **(5 marks)**

(c) Using biasing circuits, briefly explain the following:

i. Forward bias

ii. Reverse bias **(6 marks)**

(d) Briefly describe the construction of an Enhancement only-MOSFET. **(4 marks)**

(e) Explain how the drain current is controlled in n-channel JFETs. **(2 marks)**

(f) State two advantages of FETs over bipolar transistors. **(2 marks)**

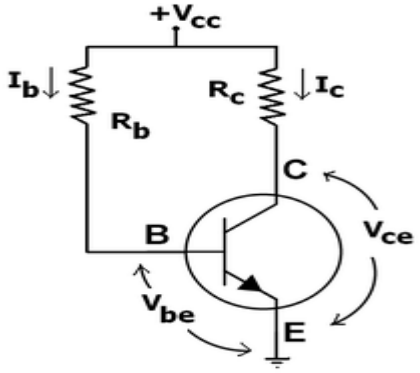
(g) Explain any three uses of cathode ray oscilloscope (CRO). **(3 marks)**

(h) The diagram below shows a bipolar transistor in the base bias (fixed bias) operating mode. Given that β=100, V_{cc}=10 V, R_b=910K, R_c = 4.7k and V_{be}=0.7V, calculate:

I. Base current, I_b.

II. Collector current, I_c.

III. Collector voltage, V_c. **(6 marks)**

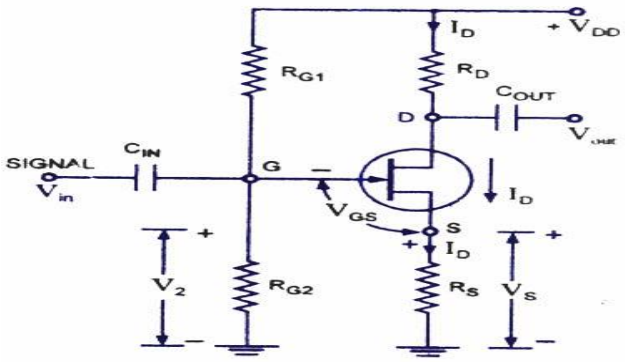


Section B

QUESTION TWO

(a) Use the energy band theory to distinguish between conductors, semi-conductors and insulators **(9 marks)**

(b) Determine the bias current I_D for the circuit shown below. Take V_{DD} = +16 V, R_{G1} = 2.1 MΩ, R_{G2} = 270 kΩ, R_D = 2.4 kΩ, R_S = 1.5 kΩ, I_{DSS} = 8 mA, V_P = - 4 V. **(8 marks)**



Potential-Divider Bias Circuit For N-Channel JFET

(c) Using first principles, show that $\beta=\alpha/1-\alpha$. **(3 marks)**

QUESTION THREE

(a) Define the following terms:

i. Q-point

ii. Hall effect

iii. Carrier lifetime **(3 marks)**

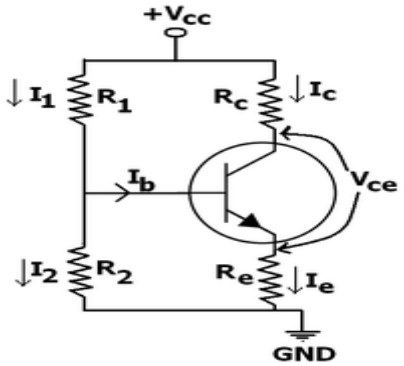
(b) Draw a bridge rectifier circuit and explain how it works. **(7 marks)**

(c) Draw the collector characteristics of a CE transistor configuration and show all operating regions. State the application of the transistor in each region. **(6 marks)**

(d) Determine the drain current (I_D) and transconductance (g_m) of an n-channel JFET having a pinch-off voltage, V_P = -4V and drain-source saturation current I_{DSS} = 12mA at a gate-source voltage, V_{GS} = 0V. **(4 marks)**

QUESTION FOUR

(a) Calculate the dc bias voltage V_{ce} and collector current I_c for the circuit shown below. Take V_{cc} = +22 V, R_1 = 39 kΩ, R_2 = 3.9 kΩ, R_c = 10 kΩ, R_e = 1.5 kΩ and β = 140. **(10 marks)**



(b) Define the following terms:

i. Breakdown voltage

ii. Peak inverse voltage **(2 marks)**

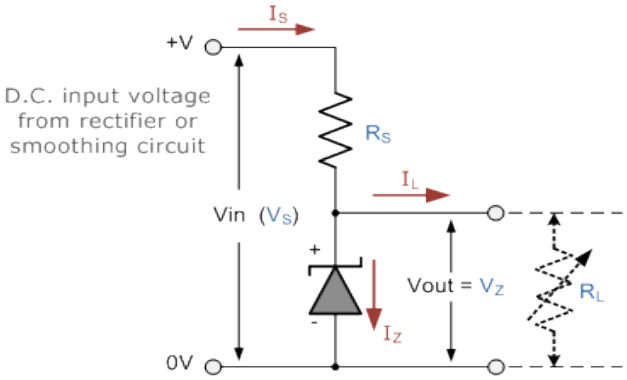
(c) A 5.0v stabilized power supply is required from a 12v D.C. input source. The maximum power rating of the Zener diode is 2W. Using the circuit diagram below of a Zener diode stabilizer, calculate:

i. The maximum current flowing in the Zener diode, I_Z.

ii. The value of the series Resistor, R_S.

iii. The load current, I_L if a load resistor of 1kΩ is connected across the Zener diode.

iv. The total supply current, I_S.



(8 marks)