UNIVERSITY OF ESWATINI

FACULTY OF SCIENCE & ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

MAIN EXAMINATION MAY 2019

TITLE OF PAPER: **BASIC ELECTRONICS**

COURSE CODE: **EEE222**

TIME ALLOWED: **THREE** HOURS

INSTRUCTIONS:

1. Answer all five (5) questions
2. Each question carries 20 marks.
3. Marks for different sections are shown in the right-hand margin.

This paper has 4 pages including this page.

DO NOT OPEN THE PAPER UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR.

QUESTION 1

A) Find the values of I and V in the circuits shown in Figure 1 A,

(i) when the diodes are ideal. (7 marks)

(ii) when the diode voltage $V_D = 0.7$ V. (6 marks)

B) The 6.8-V zener diode in the circuit of Figure1 B is specified to have $V_Z = 6.8$ V at $I_Z = 5$ mA, $r_z = 20\ \Omega$, and $I_{ZK} = 0.2$ mA. The supply voltage $V+$ is nominally 10 V but can vary by ± 0.5 V.

(i) Find the change line regulation. (3 marks)

(iii) Find the change in V_o resulting from connecting a 4k Ω load resistance. (4 marks)

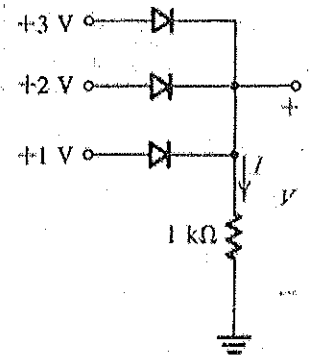


Figure 1 A

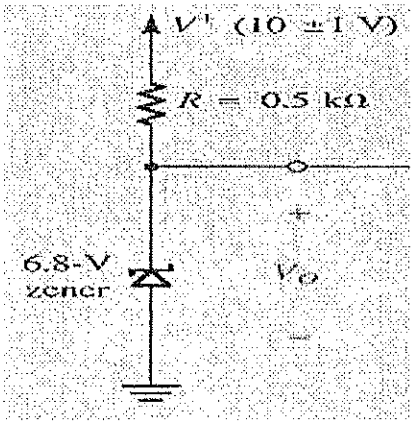


Figure 1 B

QUESTION 2

A) In the circuit shown in Figure 2, measurement indicates V_B to be 1 V and V_E to be 1.7 V.

(i) What are α and β for this transistor? (10 marks)

(ii) What voltage V_C do you expect at the collector? (2 marks)

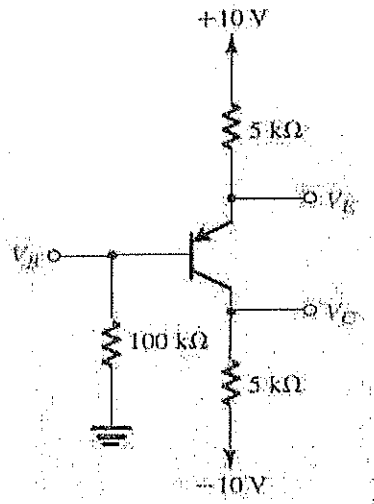


Figure 2

B) Using a npn transistor, draw the equivalent circuit that would give the same results as the circuit shown in Figure 2, and then calculate the collector voltage for your equivalent circuit. (8 marks)

QUESTION 3

For the circuit shown in Figure 3 and assuming β = 150, do the following:

(i) Draw the hybrid - π small signal equivalent circuit. (10 marks)

(iii) Determine the voltage gain $\frac{V_O}{V_I}$. (10 marks)

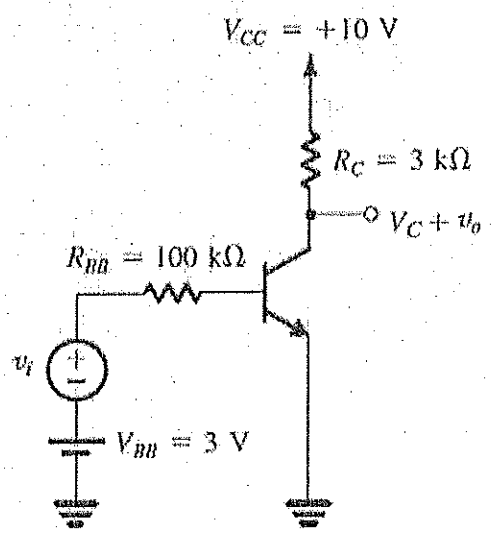
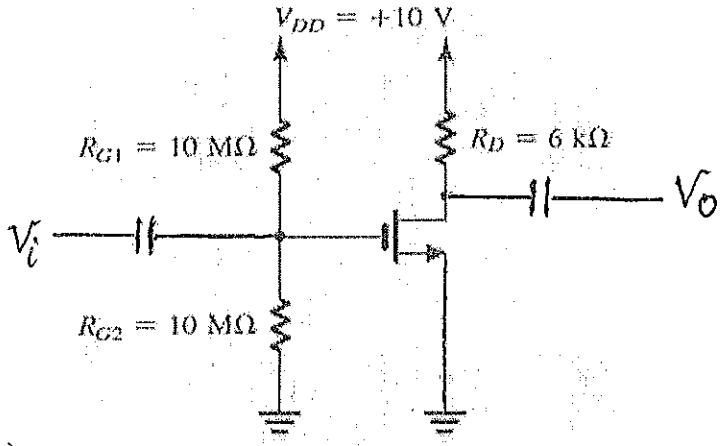


Figure 3

QUESTION 4

A) List five characteristics of the ideal op amp. (5 marks)

B) Draw the small-signal-equivalent circuit diagram for the MOSFET circuit shown below in Figure 4, and with g_m = 0.2 find the voltage gain $\frac{v_o}{v_i}$.



(10 marks)

C) (i) What is slew rate? (2 marks)

QUESTION 5

A) For the logic circuit shown in Figure 5, obtain the function G (10 marks)

B) Obtain a truth table for the Boolean function $F = A\bar{C} + \bar{B}$ (10 marks)

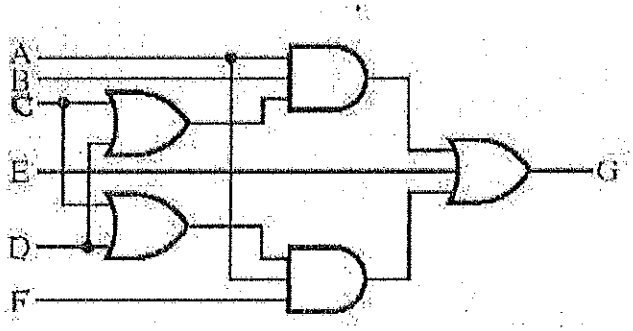


Figure 5