UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET		
COURSE CODE	:	DEI 2013
COURSE	:	ANALOG ELECTRONICS
SEMESTER / SESSION	:	02 - 2024/2025
DURATION	:	3 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **ALL**.
2. All answers should be written in the answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hand and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 9 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) Define The Field Effect Transistor (FET).

(2 marks)

b) Name the **two (2)** types of the Field Effect Transistors.

(2 marks)

c) List the **three (3)** operating regions of the Junction FET.

(3 marks)

d) List the **two (2)** types of Junction FET biasing methods.

(2 marks)

e) Refer to the Junction FET circuit in **Figure 1**. Given the drain current $I_D = 5\ mA$.

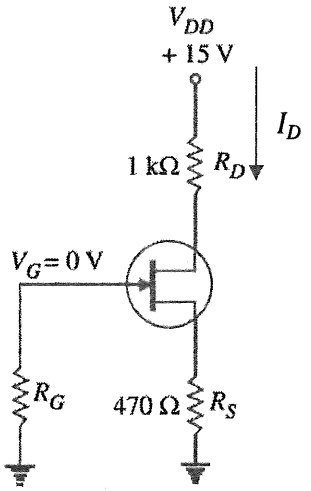


Figure 1

i. Calculate the source voltage, V_s.

(2 marks)

ii. Calculate the drain voltage, V_D.

(3 marks)

iii. Calculate the drain-source voltage, V_{DS}.

(2 marks)

iv. Calculate the gate-source voltage, V_{GS}.

(2 marks)

f) List the **two (2)** types of the Metal Oxide Field Effect Transistors (MOSFET).

(2 marks)

QUESTION 2

a) List the **three (3)** types of Junction FET small amplifier configuration circuits.

(3 marks)

b) Describe **four (4)** advantages of Junction FET compared to Bipolar Junction Transistor (BJT) as amplifiers.

(4 marks)

c) Explain the function of small amplifier devices in electronics.

(2 marks)

d) Based on the common source voltage divider JFET amplifier circuit in **Figure 2.** Given the drain voltage, $V_D = 7.0\ V$:

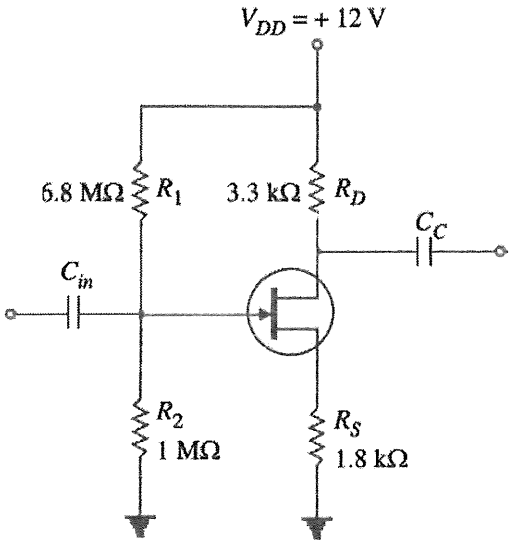


Figure 2

i) Calculate the input resistance, R_{in}.

(3 marks)

ii) Calculate the gate voltage, V_G.

(2 marks)

iii) Calculate the drain current, I_D.

(3 marks)

iv) Calculate the drain-source voltage, V_{DS}.

(3 marks)

QUESTION 3

a) Based on the inverting amplifier circuit shown in **Figure 3**:

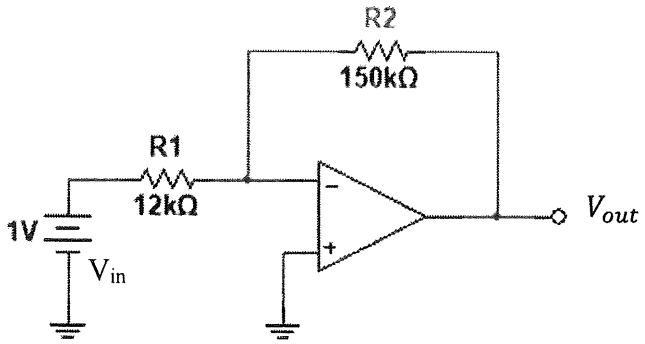


Figure 3

i) Compute the voltage gain, A_V.

(3 marks)

ii) Compute the output voltage, V_{out}.

(3 marks)

b) Based on the non-inverting amplifier circuit shown in **Figure 4**:

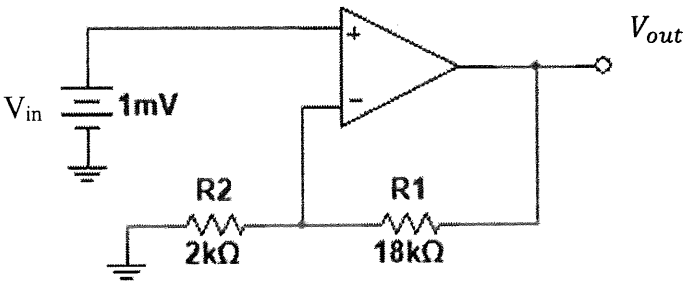


Figure 4

i) Compute the voltage gain, A_V.

(3 marks)

ii) Compute the output voltage, V_{out}.

(3 marks)

c) Based on the op-amp configuration circuit shown in **Figure 5**:

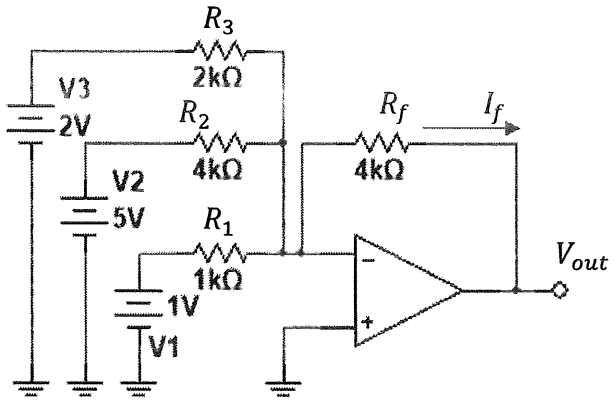


Figure 5

i) Name the configuration of the op-amp. (2 marks)

ii) Calculate the voltage output, V_{out}. (3 marks)

iii) Calculate the feedback current, I_f. (4 marks)

d) Based on the op-amp configuration circuit shown in **Figure 6**:

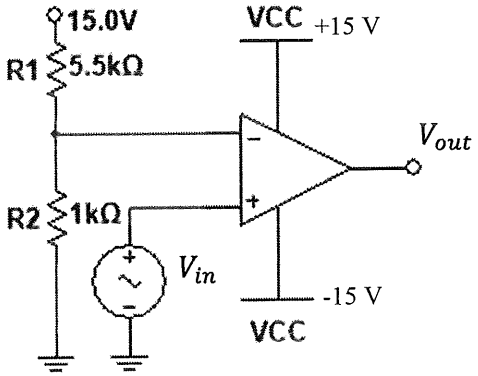


Figure 6

i) Name the configuration of the op-amp. (2 marks)

ii) Name the type of reference voltage used. (2 marks)

iii) Compute the reference voltage, V_{ref}. (3 marks)

iv) Compute the output voltage, V_{out}, if the input voltage, V_{in} is greater than the reference voltage, V_{ref}.

(2 marks)

QUESTION 4

a) Describe the function of electronic filters.

(2 marks)

b) Name the type of filters shown in **Figure 7**, **Figure 8** and **Figure 9** based on their frequency response.

(6 marks)

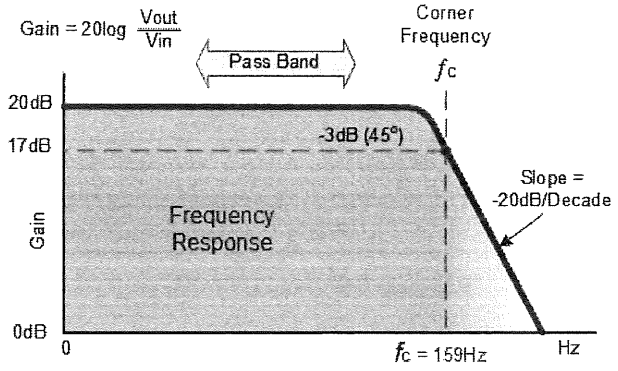


Figure 7

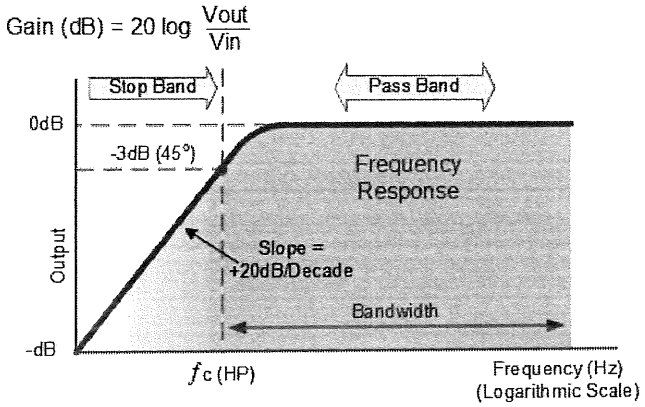


Figure 8

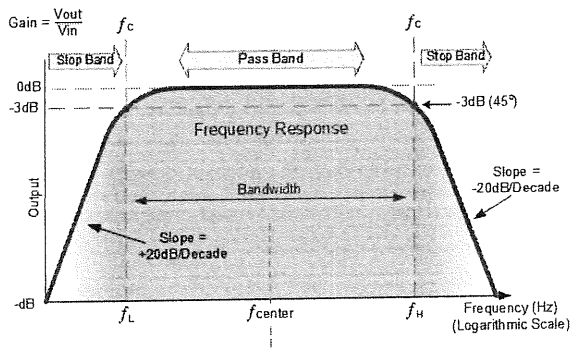


Figure 9

c) Answer the following questions based on the circuit in **Figure 10**.

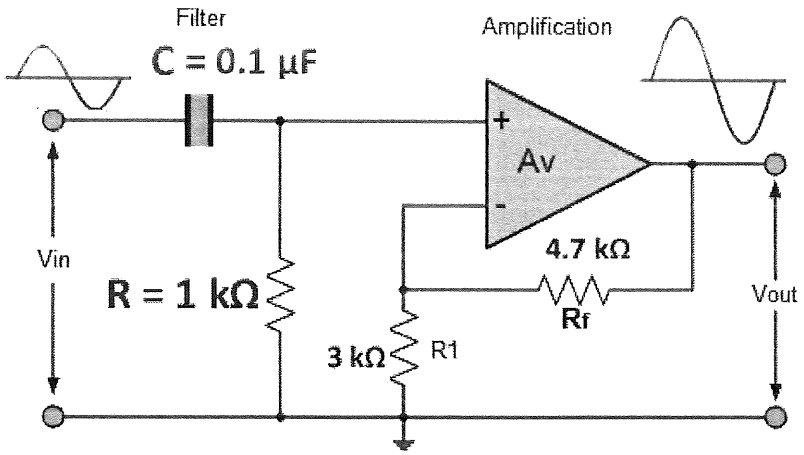


Figure 10

i) State the type of the active filter.

(2 marks)

ii) Calculate the critical frequency, f_c.

(3 marks)

iii) Calculate the voltage gain, A_v in db.

(3 marks)

iv) Sketch the appropriately labelled frequency response.

(4 marks)

d) Answer the following questions:

i) List **two (2)** types of Thyristor.

(2 marks)

ii) Identify **one (1)** application of Thyristor.

(1 mark)

e) Refer to the Thyristor circuit in **Figure 11**. Calculate the gate trigger current, I_G, when the SW1 is closed. Given the anode-cathode voltage, V_{AK} = 0.2 V, gate-cathode voltage, V_{GK} = 0.7 V and holding current, I_H = 5 mA.

(3 marks)

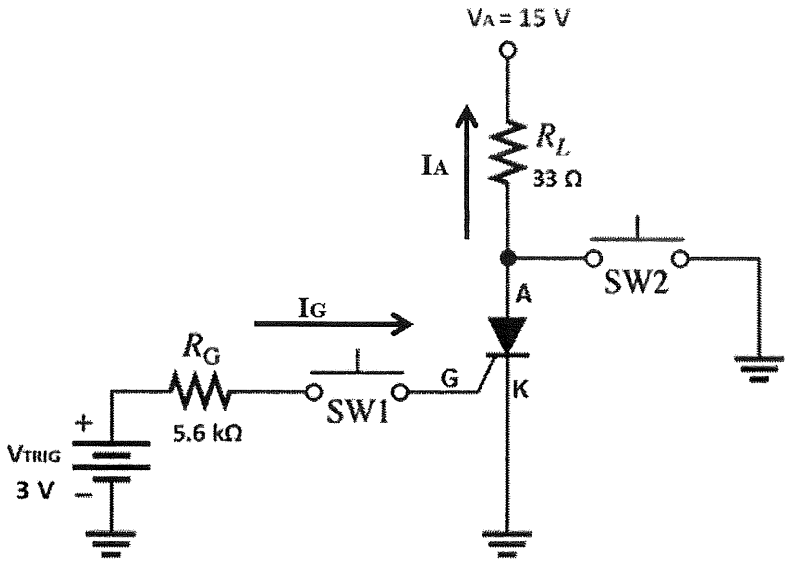


Figure 11

f) List **two (2)** types of Thyristor devices used in the circuit of **Figure 12**.

(2 marks)

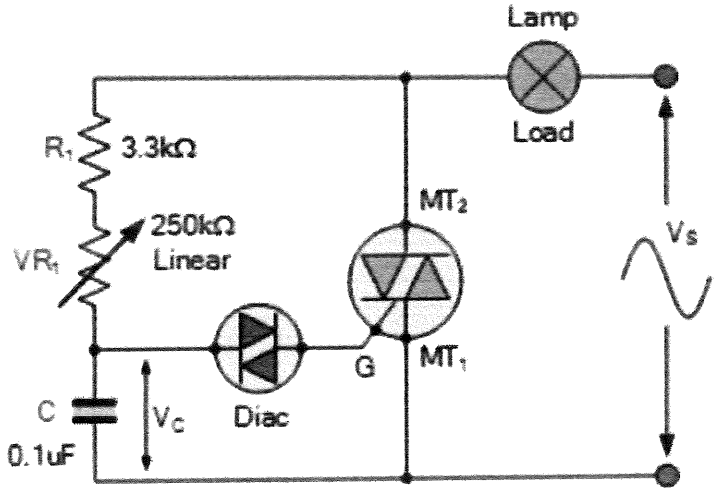


Figure 12

g) Define an Unijuntion Transistor (UJT).

(2 marks)

----------End of questions----------