

**UNIVERSITY COLLEGE TATI (UC TATI)****FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE	: BMT 2013
COURSE	: ELECTRONICS SYSTEM
SEMESTER/SESSION	: 2-2024/2025
DURATION	: 3 HOURS

**Instructions:**

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

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

**THIS BOOKLET CONTAINS 8 PRINTED PAGES INCLUDING COVER PAGE**

**QUESTION 1**

Figure 1 shows the circuit of an amplifier with common emitter configuration.

- Determine the value of  $r_e$ . (5 marks)
- Draw the ac equivalent circuit for the network. (3 marks)
- Solve the voltage gain,  $A_v$ . (4 marks)
- Examine the low cutoff frequency,  $F_L$ . (10 marks)

Given  $\beta = 120$

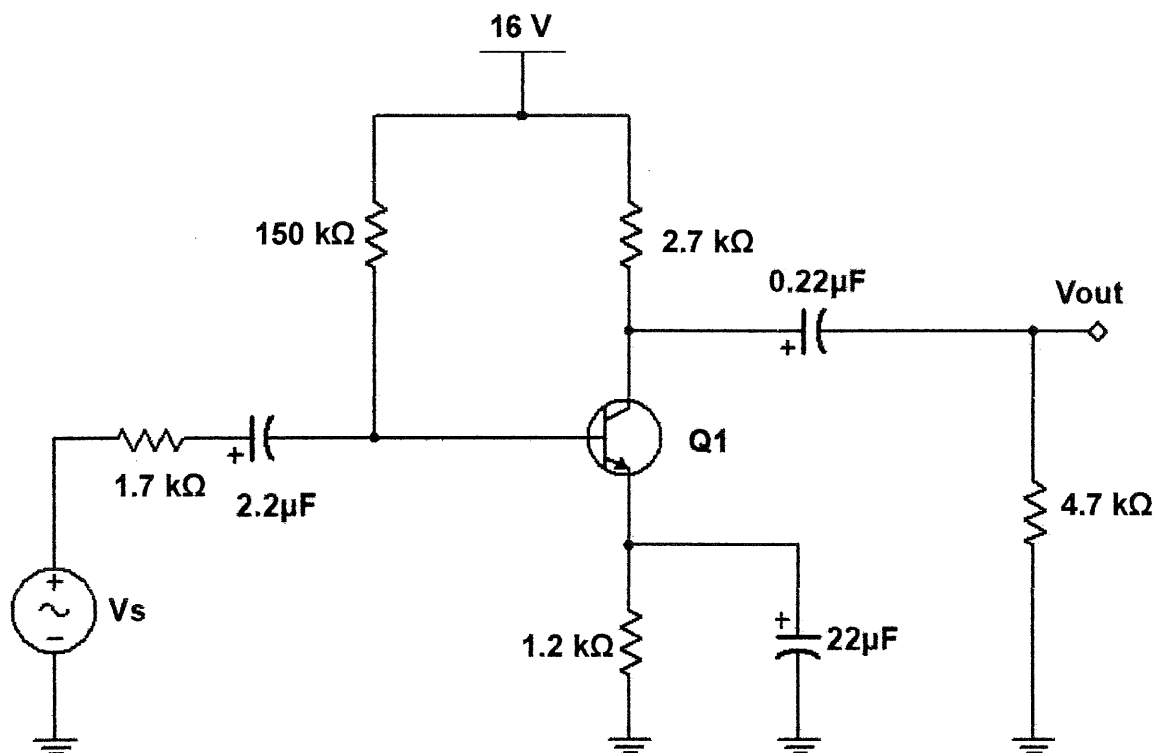


Figure 1

**QUESTION 2**

- a) State the differences between **BJT** and **FET** Amplifier. (2 marks)
- b) Sketch the transfer characteristics graph for the **JFET** transistor by using the drain-source leakage current,  $I_{DSS} = 12\text{mA}$  and pinch off voltage,  $V_P = -4\text{V}$ . (5 marks)
- c) From the network system in Figure 2, answer the following items:
- Calculate  $g_{m0}$  and  $g_m$ , given  $V_{GSQ} = -3\text{V}$ . (4 marks)
  - Draw the AC equivalent circuit for the network. (3 marks)
  - Express the input impedance,  $Z_i$  and output impedance,  $Z_o$ . (4 marks)
  - Solve the voltage gain,  $A_v = V_{out}/V_{in}$ . (4 marks)

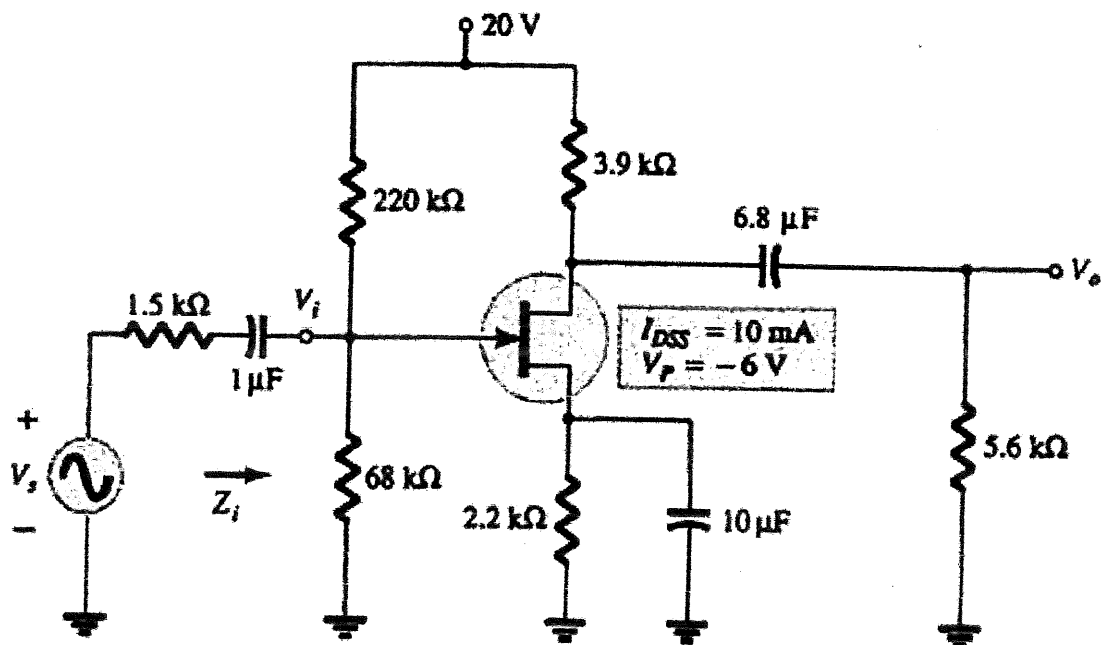


Figure 2

**QUESTION 3**

a) Answer the following questions:

- i. Sketch a circuit of a basic inverting op-amp. (2 marks)
- ii. Derive the closed-loop gain of the non-inverting op-amp. (2 marks)

- b) i. Name the circuit shown in Figure 3. (1 mark)
- ii. Identify the expression for the output voltage,  $V_{out}$ , with respect to the inputs and given  $V_1 = -3\text{ V}$ ,  $V_2 = +3\text{ V}$ ,  $V_3 = -1\text{ V}$ ,  $R_1 = 250\text{ k}\Omega$ ,  $R_2 = 280\text{ k}\Omega$ ,  $R_3 = 520\text{ k}\Omega$ , and  $R_F = 1\text{ M}\Omega$ . (7 marks)

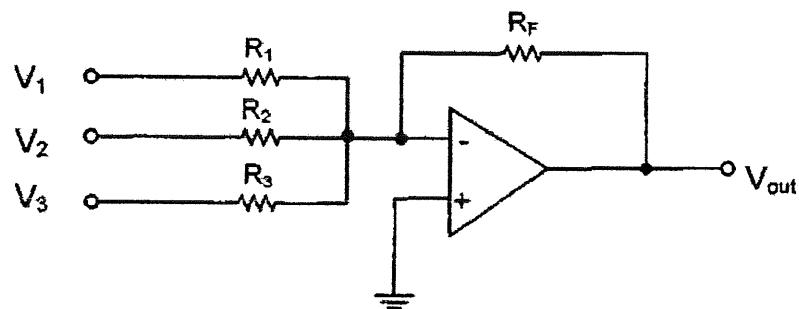


Figure 3

- c) Examine the output voltage,  $V_o$  for the network in Figure 4.

(10 marks)

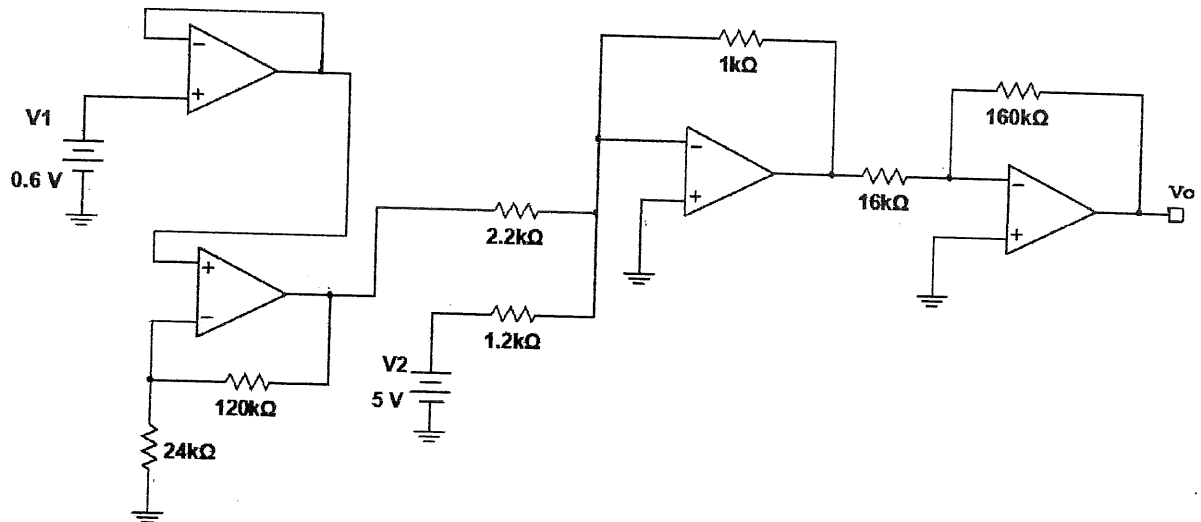


Figure 4

**QUESTION 4.**

a) Answer the following questions:

- i. Define the meaning of oscillator circuit. (2 marks)
- ii. Explain the basic operation of oscillator circuit (2 marks)
- iii. Sketch the waveform to support the answer from Question 4a (ii). (2 marks)

b) Sketch a Wien-Bridge oscillator circuit. Hence, demonstrate the resistor values in the circuit such that the oscillation frequency is 2.5 kHz. Assume that the capacitor value is 0.15  $\mu\text{F}$  and the resistor between the inverting terminal of op-amp and ground has a value of 7 k $\Omega$ . (8 marks)

c) Refer to circuit shown in Figure 6:

- i. Name the oscillator. (2 marks)
- ii. Design the circuit to oscillate at  $f_0 = 10 \text{ kHz}$  if  $R_1 = R_2 = 10 \text{ k}\Omega$ . (6 marks)

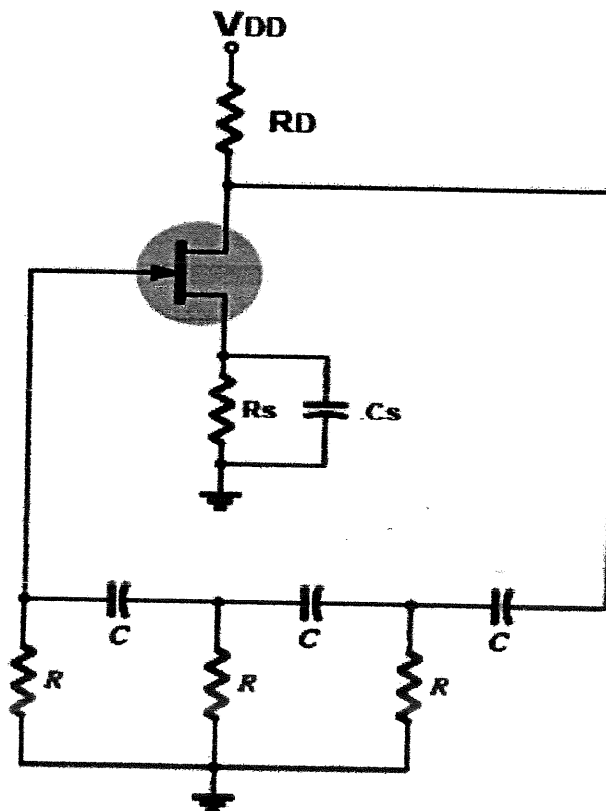


Figure 6

d) Answer the following questions:

- i. Describe the difference between analog signal and digital signal. (4 marks)
- ii. Draw the picture to support your answer in (i). (2 marks)
- iii. Explain two (2) steps process involve to convert from analog to digital conversion. (4 marks)
- iv. List two (2) types of A/D converter. (2 marks)

-----End of question-----

Formula Electronics System

$$\text{i. } g_{mo} = \frac{2I_{DSS}}{|V_p|}$$

$$\text{ii. } g_m = g_{mo} \left( 1 - \frac{V_{GSQ}}{V_p} \right)$$

$$\text{iii. } A_{VS} = \frac{V_o}{V_s} = \frac{V_o}{V_i} \cdot \frac{V_i}{V_s}$$

$$\text{iv. } f_{LS} = \frac{1}{2\pi(R_s + R_i)C_s} \quad \text{where } R_i = R_1 // R_2 // \beta r_e$$

$$\text{v. } f_{LC} = \frac{1}{2\pi(R_o + R_L)C_c} \quad \text{where } R_o = R_c // r_o$$

$$\text{vi. } f_{LE} = \frac{1}{2\pi R_e C_E} \quad \text{where } R_e = R_E // \left( \frac{R'_s}{\beta} + r_e \right) \quad \text{and } R'_s = R_s // R_1 // R_2$$