UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET

COURSE CODE	: BMT 2013
COURSE	: ELECTRONICS SYSTEM
SEMESTER/SESSION	: 1-2022/2023
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 9 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) i. Draw the basic construction *of pnp* BJT transistor. (1 mark)

ii. Label the minority and majority carriers flow. (1 mark)

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

i. Determine the value of r_e (5 marks)

ii. Draw the ac equivalent circuit for the network. (2 marks)

iii. Solve the voltage gain, A_V. (3 marks)

iv. Examine the low cutoff frequency, F_L (6 marks)

Given β =120

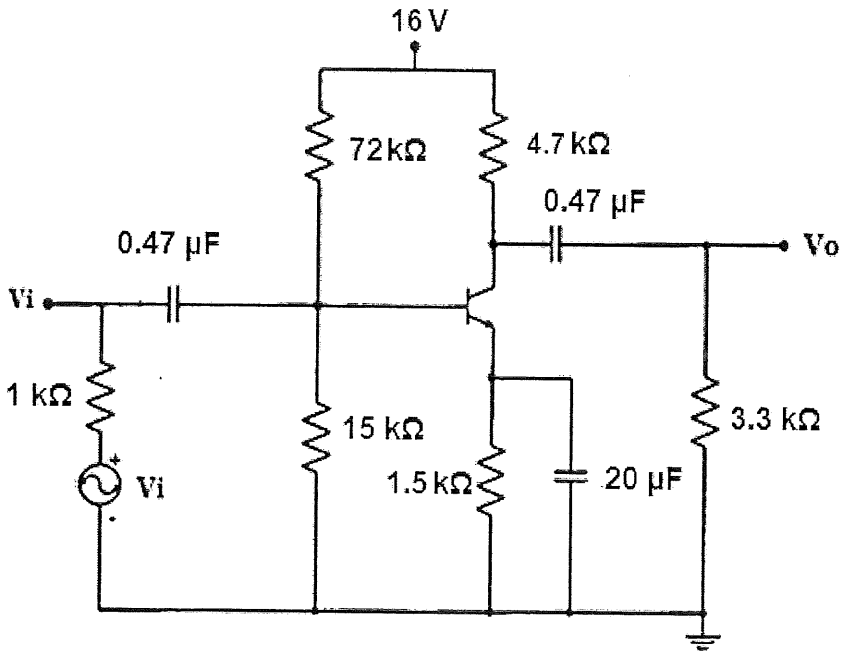

Figure 1

c) Figure 2 shows a FET amplifier circuit. Given that the saturation current ***(I_{DSS} = 10 mA)*** and cut-off voltage ***(Vp = -6V)***.

i. Name the bias configuration in Figure 2. (1 mark)

ii. Using the mathematical approach only, express the operating point, I_{DQ} and V_{GSQ}, for the network. (4 marks)

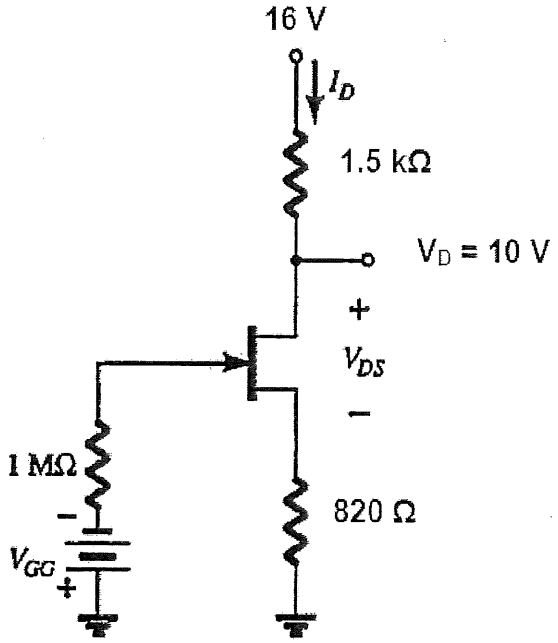

Figure 2

QUESTION 3

a) List **three (3)** characteristics of ideal operational amplifier. (3 marks)

b) With the aid of suitable diagrams, describe closed loop voltage gain of an operational amplifier. (2 marks)

c) Calculate the output voltage for the circuit of Figure 5 (4 marks)

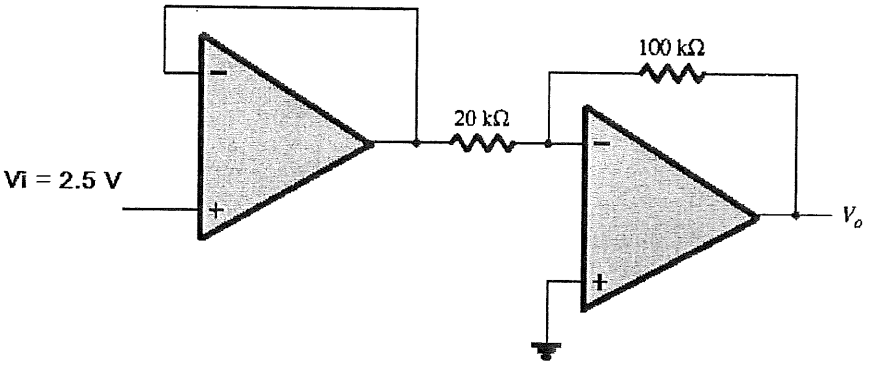

Figure 5

d) Examine the output voltage, V_o for the network in Figure 6. (9 marks)

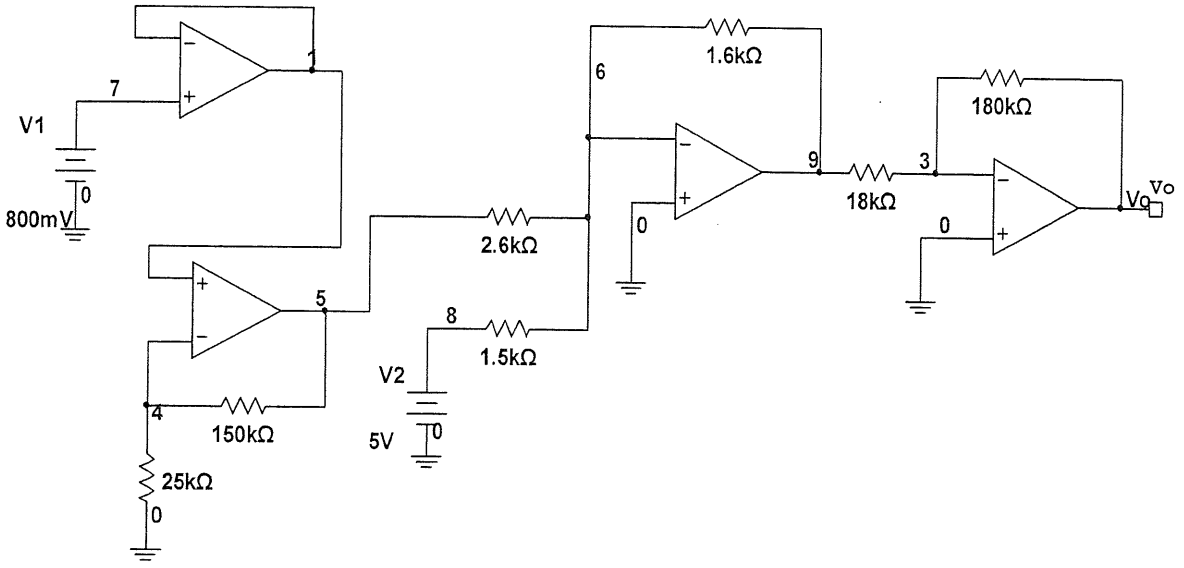

Figure 6

QUESTION 4

a) i. Define the meaning of oscillator circuit. (1 mark)

ii. Classified the type of oscillators. (2 marks)

iii. List two (2) examples of oscillators 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 2kHz. Assume that the capacitor value is 0.1 uF and the resistor between the inverting terminal of op-amp and ground has a value of 5kΩ. (7 marks)

c) Refer to circuit shown in Figure 7:

i. Name the oscillator. (2 marks)

ii. Design the circuit to oscillate at f_o = 5 kHz if R_1 = R2 = 20 kΩ. (4 marks)

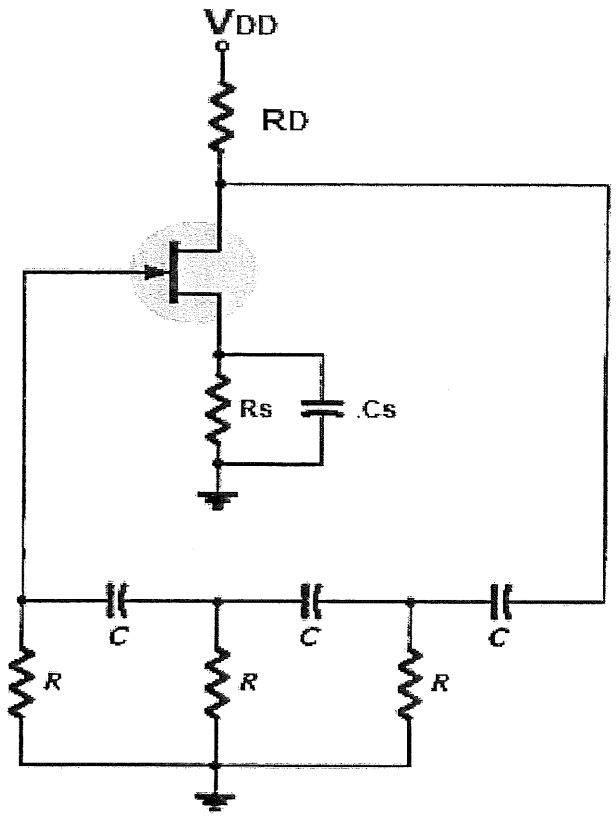

Figure 7

d) Figure 8 and Figure 9 show the Sallen-Key two-poles active filter.

i. Name the type of filter in Figure 8 and Figure 9. (2 marks)

ii. Using Figure 8 and Figure 9, construct a band-pass filter circuit. (4 marks)

iii. Draw the response curve of the band-pass filter. (4 marks)

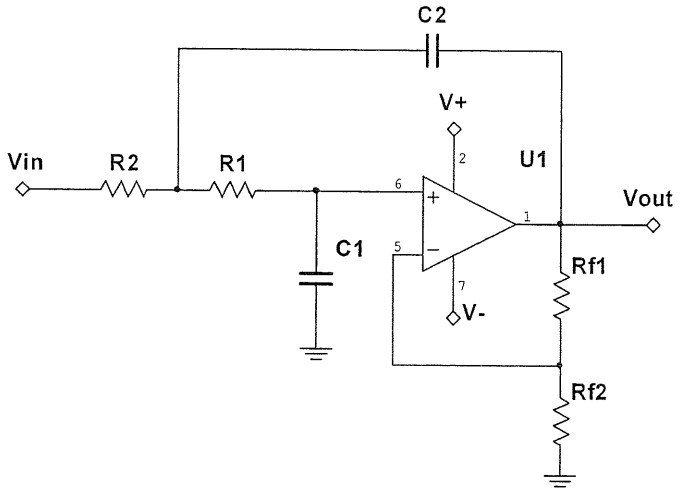

Figure 8

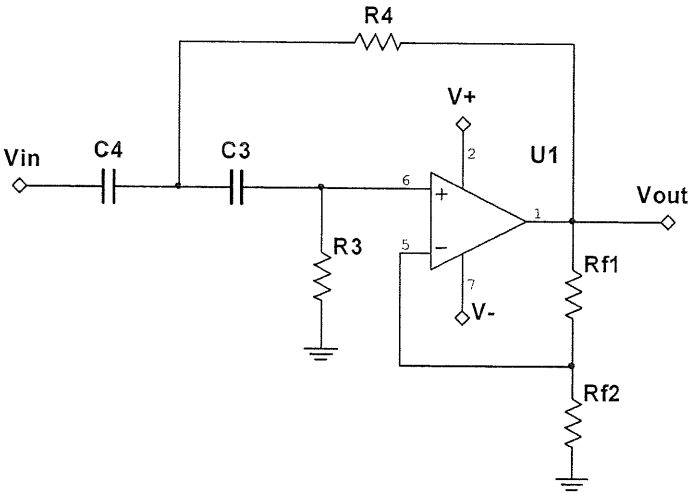

Figure 9

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

Formula Electronics System

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

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

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

iv. $f_{Ls} = \frac{1}{2\pi(R_s+R_i)\,C_s}$ where Ri = R_1 //R_2//βre

v. $f_{LC} = \frac{1}{2\pi(R_o + R_L)C_c}$ where $R_o = R_C \| r_o$

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