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UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET

COURSE CODE	: BMT 2013
COURSE	: ELECTRONIC SYSTEM
SEMESTER/SESSION	: 2-2023/2024
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) 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 (8 marks)

Given β =150

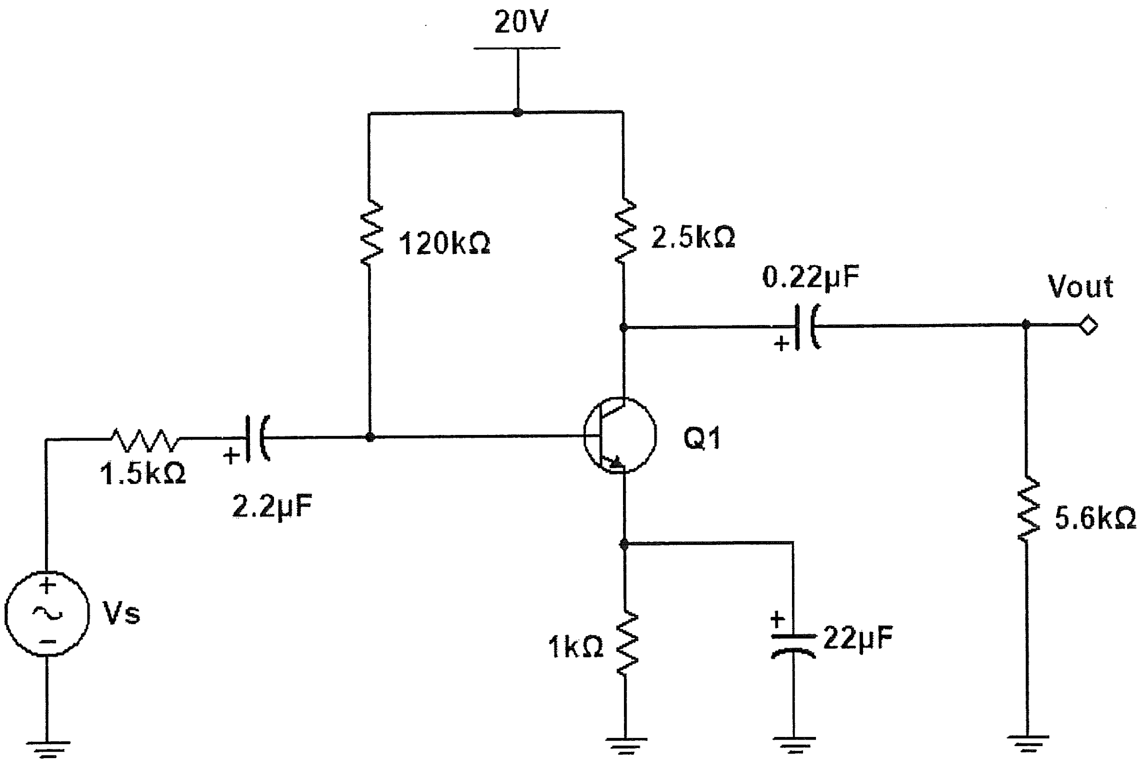

Figure 1

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

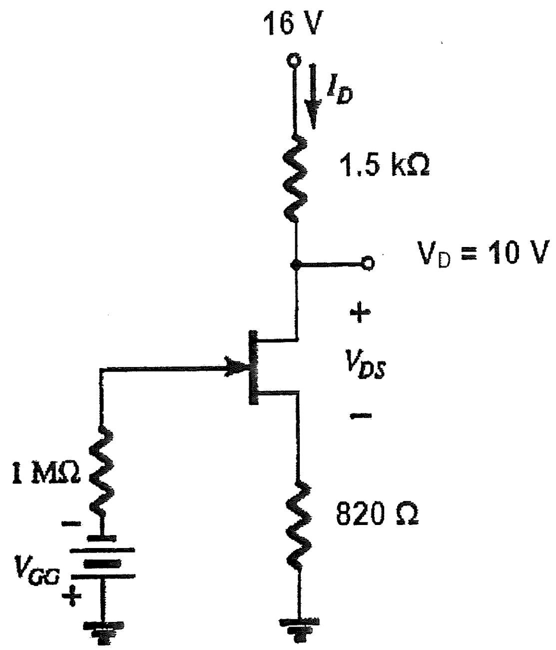

Figure 2

c) From the network system in Figure 3, answer the following items:

i. Calculate g_{mo} and g_m, given $V_{GSQ} = -3V$. (4 marks)

ii. Draw the AC equivalent circuit for the network. (3 marks)

iii. Express the input impedance, Z_i and output impedance, Z_o. (3 marks)

iv. Solve the voltage gain, $A_V = V_{out}/V_{in}$. (3 marks)

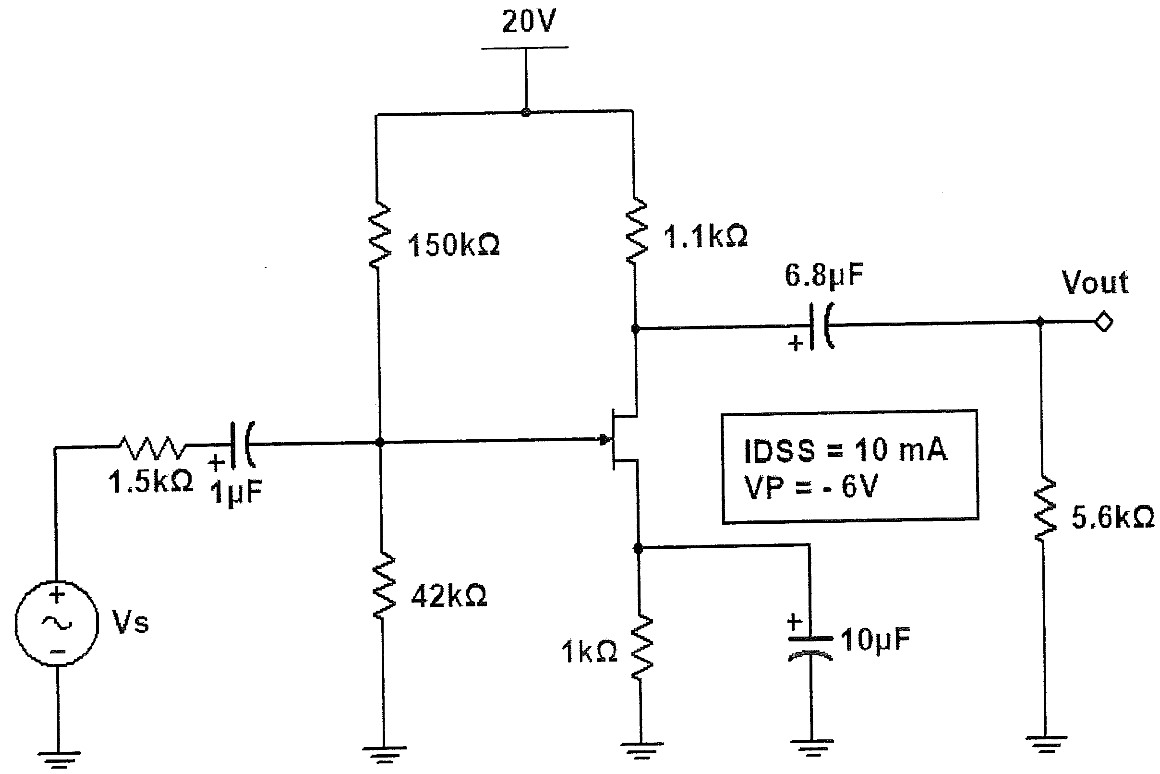

Figure 3

QUESTION 2

a) Refer to the cascaded system of Figure 4. Given β1 = β2 = 110.

i. Express the current base at first stage, I_{B1}. (4 marks)

ii. Determine the voltage from collector to emitter, V_{CE1} at first stage. (2 marks)

iii. Estimate r_{e1} and r_{e2}. (3 marks)

iv. Sketch the AC equivalent circuit for the network of Figure 4. (3 marks)

v. Analyze Figure 4 for the voltage gain of each stage. (5 marks)

vi. Define the total gain of the system, A_{VT} (1 mark)

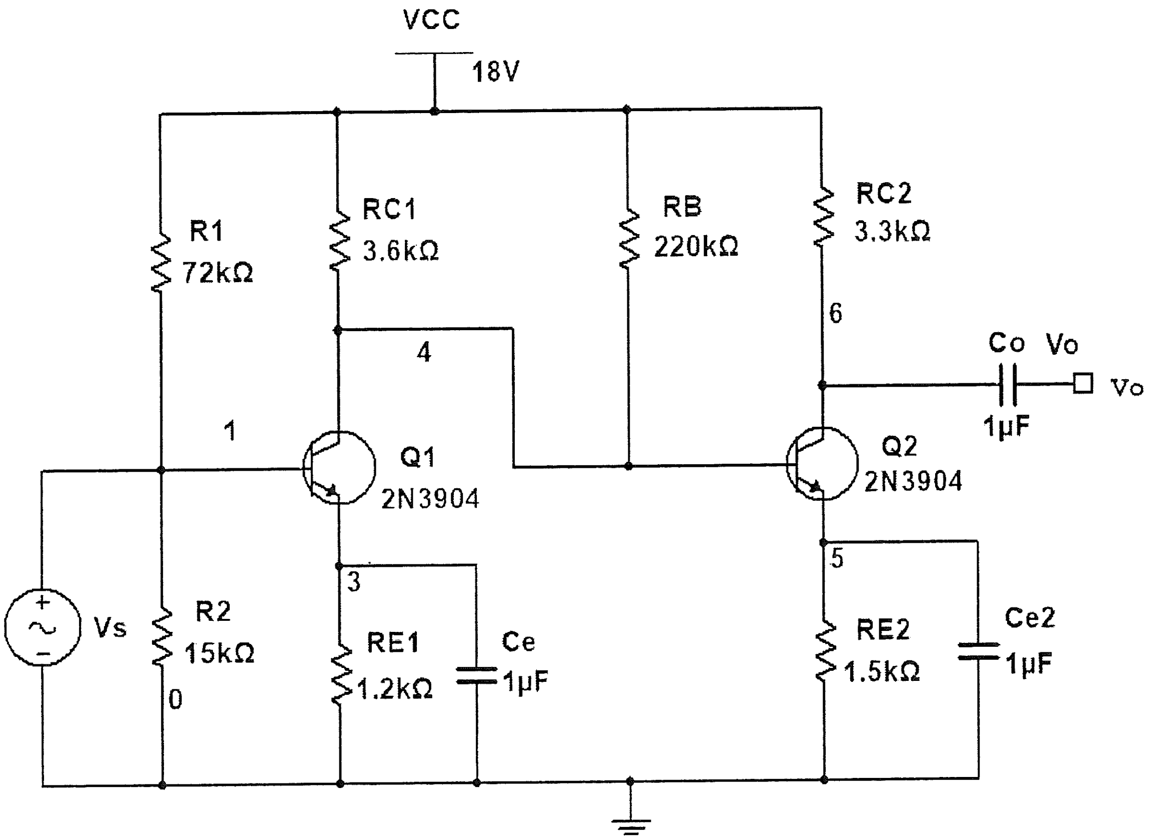

Figure 4

QUESTION 3

a) Build a two-stages operational amplifier with gains of -12 and +36. Use a 300kΩ feedback resistor for all two circuits. (8 marks)

b) Examine the output voltage, V_o for the network in Figure 5. (10 marks)

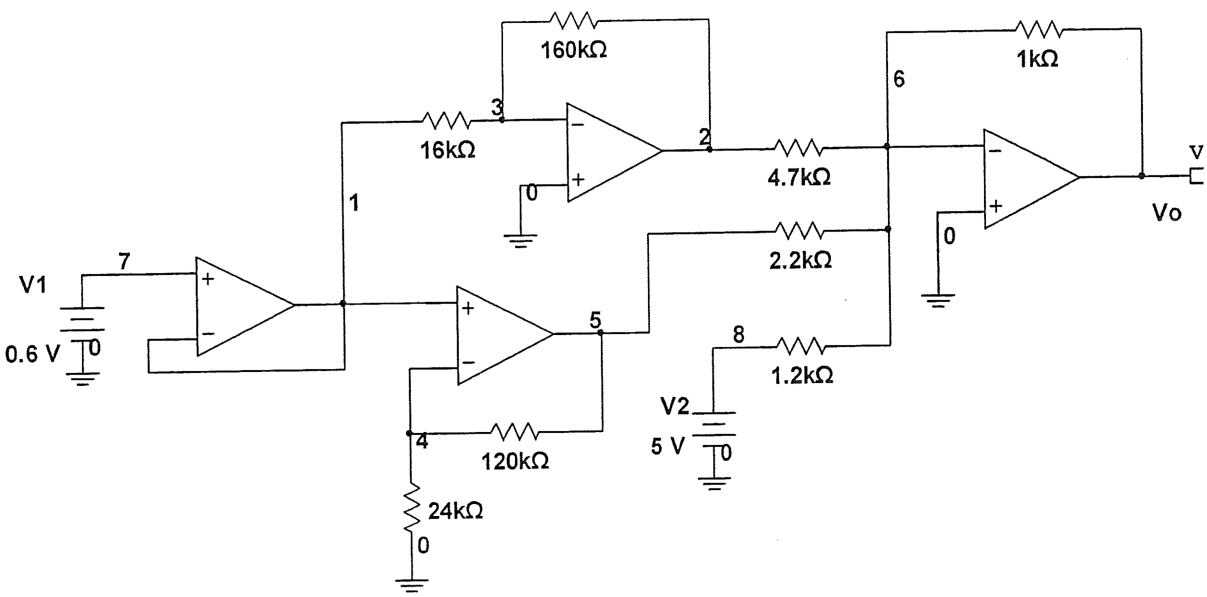

Figure 5

QUESTION 4

a) i. Explain the basic operation of Oscillator circuit (2 marks)

ii. Sketch the waveform to support the answer from Question 4a (i) (3 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 6:

i. Name the oscillator. (2 marks)

ii. Design the circuit to oscillate at f_o = 10 kHz if R_1 = R2 = 10 kΩ. (4 marks)

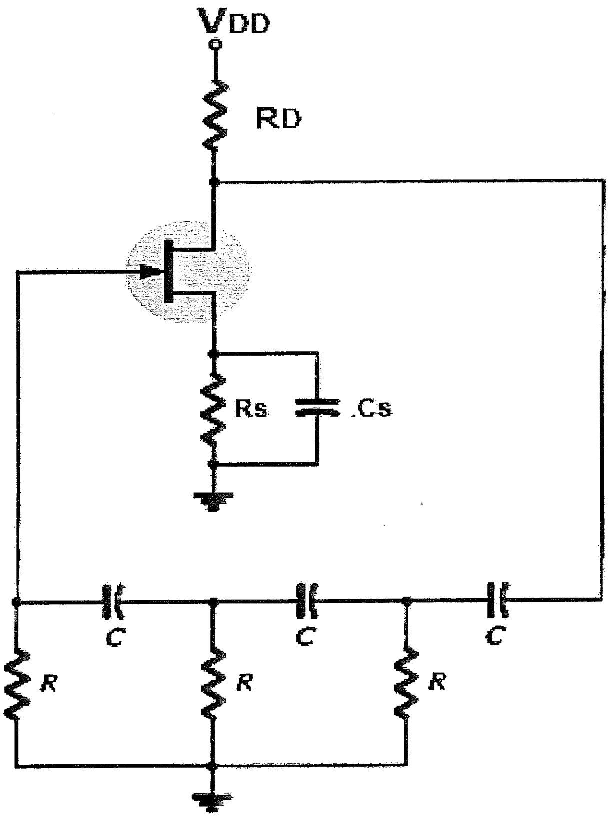

Figure 6

d) Draw the response curve of the following filter circuit :

i. The low-pass filter. (2 marks)

ii. The high-pass filter. (2 marks)

iii. The band-pass filter. (4 marks)

iv. The band-stop filter. (2 marks)

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

iv. $f_{Ls} = \frac{1}{2\pi (R_S + R_i)\, C_S}$ where $Ri = R_1 // R_2 // \beta re$

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

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