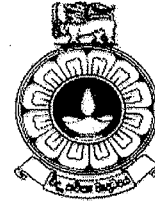


The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical and Computer Engineering



Study Programme	: Bachelor of Science Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	: EEX6450 Analog Electronic systems & Instrumentation
Academic Year	: 2024/25
Date	: 14 th February 2026
Time	: 1330-1630h
Duration	: 3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Five (5)** questions in **four (4)** pages.
3. Answer **all** questions.
4. All questions carry equal marks.
5. Answer for each question should commence from a new page.
6. This is a Closed Book Test (CBT).

Question 1

(20 Marks)

The transistor in the amplifier circuit in *Figure Q1* has the following hybrid- π parameters with the usual notation. $r_{be} = 1k\Omega$, $r_{bc} = 4M\Omega$, $r_{ce} = 80k\Omega$, $C_{bc} = 3pF$, $C_{be} = 100pF$ and $g_m = 50mA/V$.

Assume the effect of all the other unmentioned parameters to be negligible.

- (a) Draw the high frequency equivalent circuit for this amplifier circuit. (6 marks)
- (b) Using Miller's theorem, simplify the equivalent circuit model. (6 marks)
- (c) Hence, find the voltage gain of the same amplifier. (8 marks)

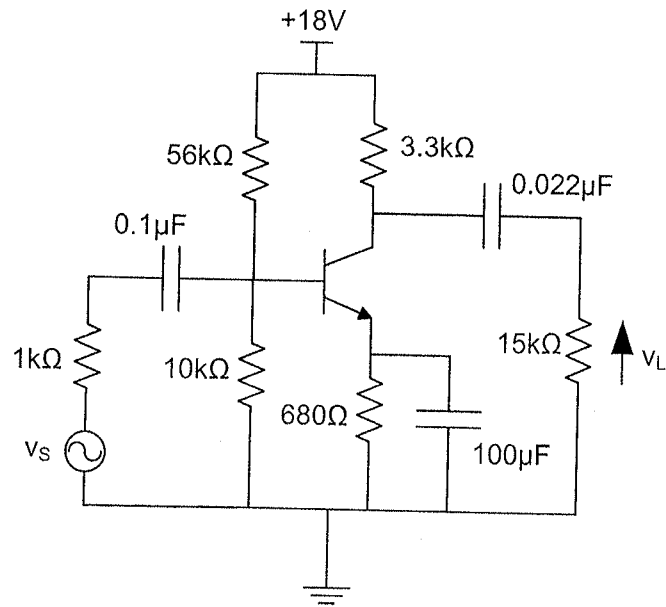


Figure Q1

Question 2

(20 Marks)

Consider the circuit given in *Figure Q2*.

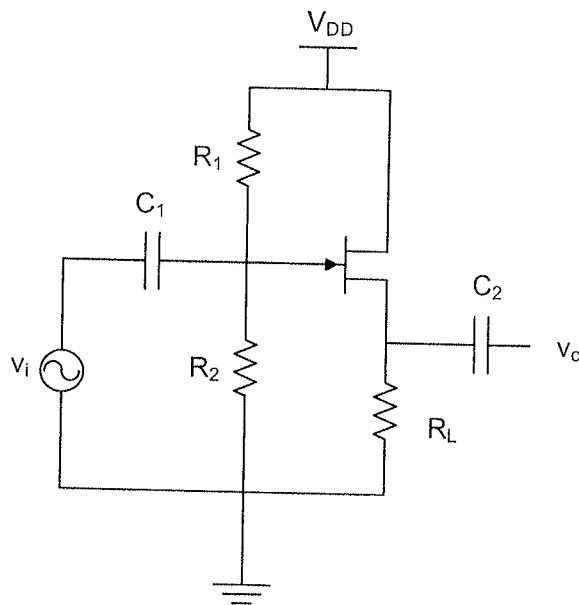


Figure Q2

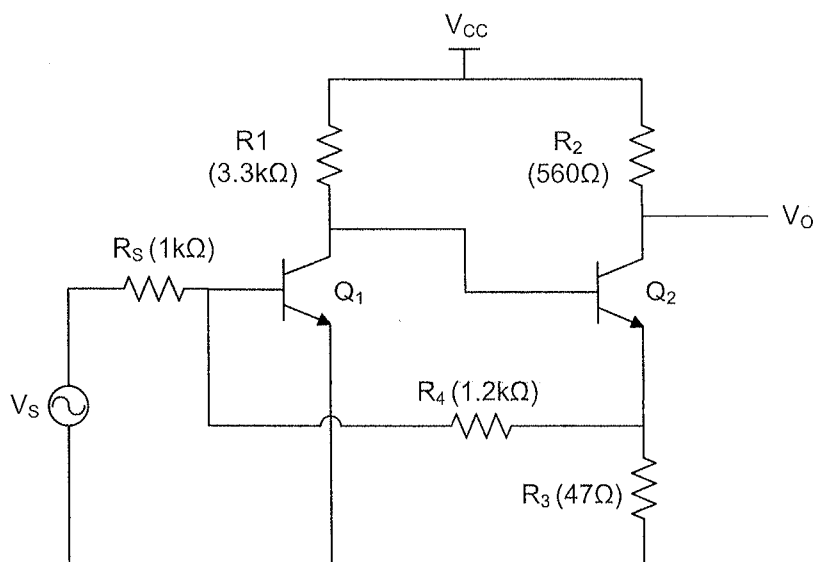
- (a) Draw the high frequency equivalent circuit for the single stage FET amplifier shown in *Figure Q2*. (7 marks)

- (b) Clearly stating all your assumptions and defining all the parameter values you use, find an expression for the voltage gain, A_v . (8 marks)
- (c) Hence show that the low frequency voltage gain for this amplifier is $\frac{\mu}{\mu+1}$, where, $\mu = \frac{g_m}{g_d}$. (g_m and g_d are transconductance and the drain conductance of the FET amplifier respectively) (5 marks)

Question 3**(20 Marks)**

Consider the two-stage amplifier in *Figure Q3*. The transistors are identical with

$h_{fe} = 50$ and $h_{ie} = 1.2k\Omega$. Neglect h_{re} and h_{oe} .

**Figure Q3**

- (a) Identify the type of feedback. (2 marks)
- (b) Redraw the circuit without the feedback path element R_4 . (5 marks)
- (c) Find the open loop current gain and the feedback factor. (9 marks)
- (d) Hence find the closed loop current gain. (4 marks)

Question 4**(20 Marks)**

- (a) Stating all your assumptions, derive an expression for the feedback factor for the circuit in *Figure Q4*. (4 marks)
- (b) Derive an expression for the forward gain. (8 marks)
- (c) Hence find the frequency of oscillation ($C = 100\mu F$, $L_1 = L_2 = 10mH$, $R_1 = R_2$). (8 marks)

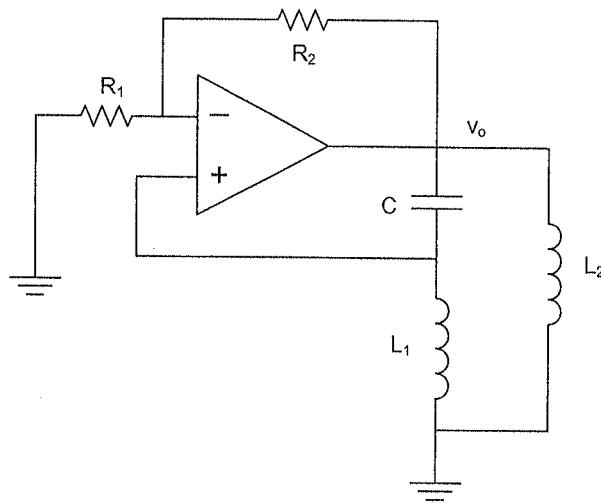


Figure Q4

Question 5

(20 Marks)

- a) Explain how the accuracy, resolution, and sensitivity of measuring instruments influence the experimental evaluation of a BJT-based small-signal amplifier. Discuss how instrument accuracy affects the confidence and reliability of gain and output voltage measurements obtained during amplifier testing. (8 marks)
- a) A small-signal BJT amplifier is tested using a digital multimeter (DMM) with an accuracy of $\pm 2\%$ of full-scale reading and a resolution of 2 mV. The expected output voltage of the amplifier is 250 mV, and the DMM is set to a 500mV full-scale range.
 - i.) Determine the possible range of measured output voltage due to the accuracy limitation of the multimeter. (4 marks)
 - ii.) If the sensitivity of the multimeter is 1 mV, can it reliably detect a voltage change of 3 mV at the amplifier output? Justify your answer. (4 marks)
 - iii.) Discuss how the accuracy and sensitivity of the measuring instrument influence the trustworthiness of amplifier performance evaluation in this experiment. Clearly state any assumptions made. (4 marks)

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