Strathmore UNIVERSITY

SCHOOL OF COMPUTING AND ENGINEERING SCIENCES

BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

BEE 3205: ANALOGUE ELECTRONICS II

END OF SEMESTER EXAMIATIONS

Date: 17th March 2025. **Time:** 11:00-13:30 Hours

Instructions:

1. This Examination consists of **FIVE QUESTIONS**
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

QUESTIO ONE

a) State **two** causes of distortions in class B amplifiers and their **possibly remedies** **(2 marks)**

b) State **TWO** characteristics of an ideal operational amplifier **(2 marks)**

c) Figure 1 shows an operational amplifier circuit. State THREE characteristics of the circuit and explain the use of the circuit.

(4 marks)

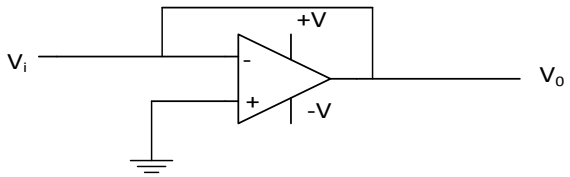
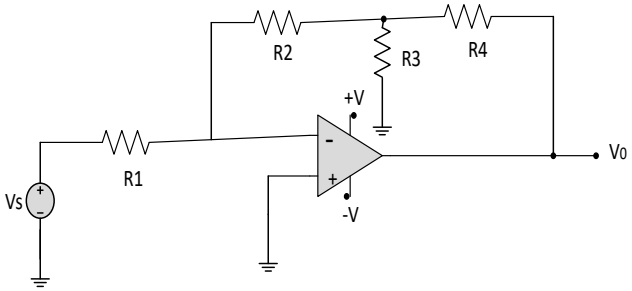


Figure 1

d) Explain the significance of slew rate in the performance of operational amplifiers **(2 marks)**

e) Figure 2 shows an operational amplifier circuit. Obtain the closed loop gain of the circuit, $A = V_0/V_s$



(4 marks)

f) Draw the basic circuit diagram of that performs the following operations

i. Integrator

ii. Differentiator

iii. Anti-logarithmic function **(6 marks)**

g) Explain the significance of gain-bandwidth product in operational amplifiers **(2 marks)**

h) State the Barkhausein criteria of oscillation in oscillators **(2 marks)**

i) Figure 2 shows an op-amp based RC oscillator. Determine each of the following:

i. Feedback factor β;

ii. Magnitude of the loop gain $T(s) = A_{CL}\beta$;

iii. Frequency of oscillation f_o.

(6 marks)

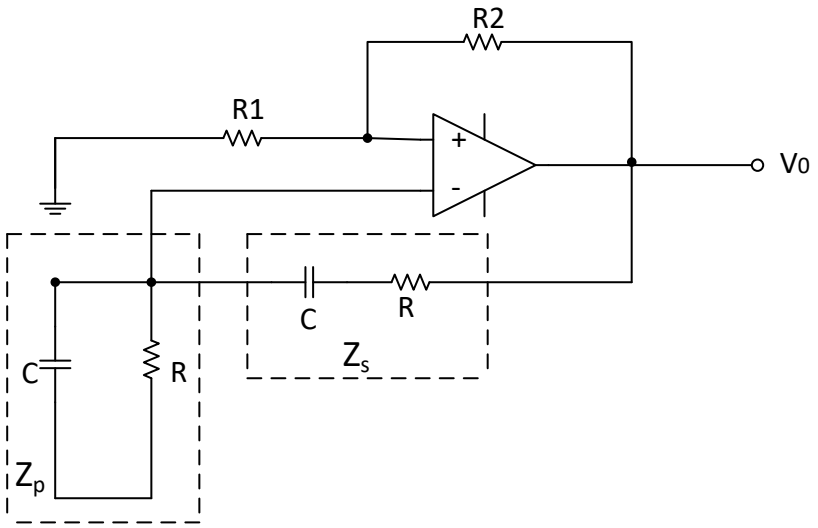


Figure 2

QUESTION TWO

a) Figure 2 shows a class A power amplifier.

i. Determine the following d.c values

I. Emitter currentI_E

II. The dc collector voltage , V_C

III. The collector emitter voltage, V_{CEQ}

IV. The transistor power dissipation P_{DC}

(8 marks)

ii. The efficiency of the amplifier given that the peak output voltage is 18V

(5 marks)

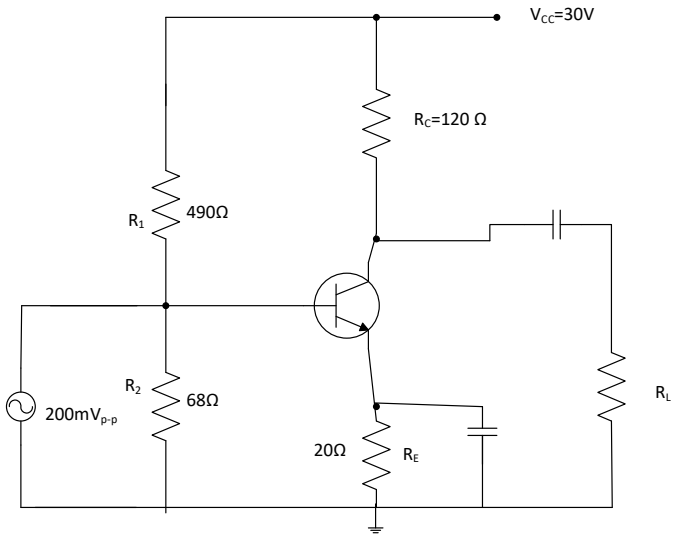


Figure 3

b) State one advantage ad one disadvantage of a class A amplifier

(2 marks)

QUESTION THREE

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a) Figure 3 shows a simplified block diagram of an operational amplifier. Identify the circuit configurations in block A and B and state why they are suitable for the functions performed by the blocks

(4 marks)

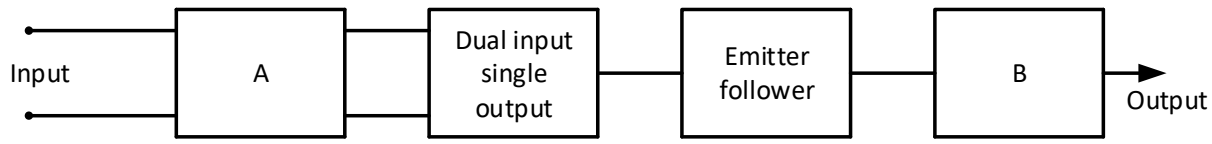


Figure 4

b) Identify the configuration of the differential amplifier shown in Figure 4 **(1 mark)**

c) Perform the dc analysis and obtain the:

i. Tail current, I_T

ii. Emitter current, I_E

iii. Quiescent collector emitter voltage, V_{CEQ} **(6 marks)**

d) Given that for both transistors, $\beta = 300$ obtain the:

i. ac output voltage;

ii. input impedance of the differential amplifier.

(4 marks)

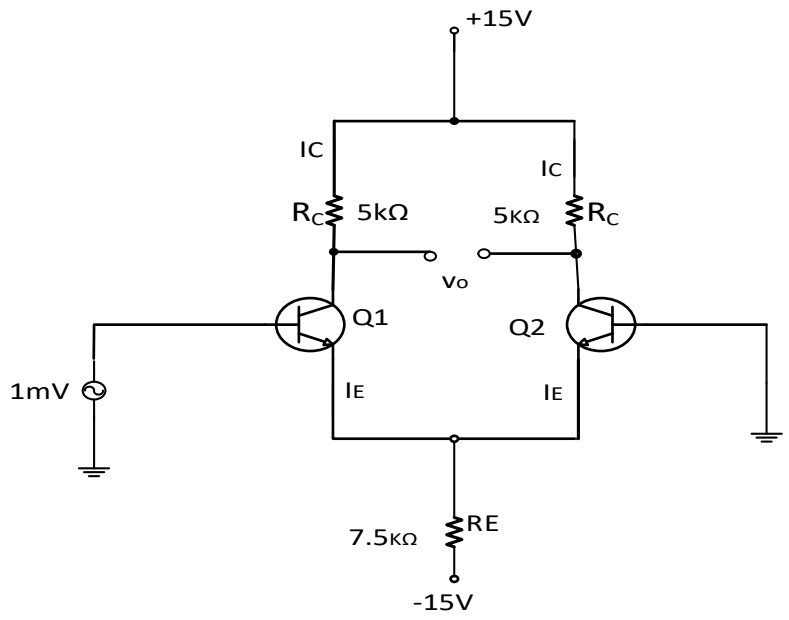


Figure 5

QUESTION FOUR

a) The amplifier in Fig. 5 has an open gain equal to -2500 and open loop output resistance of 100Ω. Determine the:

i. Magnitude of the open loop gain **(2 marks)**

ii. Closed loop gain **(2 marks)**

iii. Input resistance r_{if} see by V_{in}) **(2 marks)**

iv. The closed loop output resistance r_{of}) **(2 marks)**

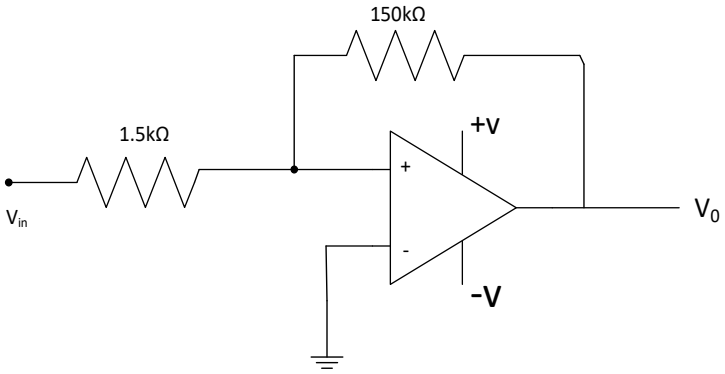


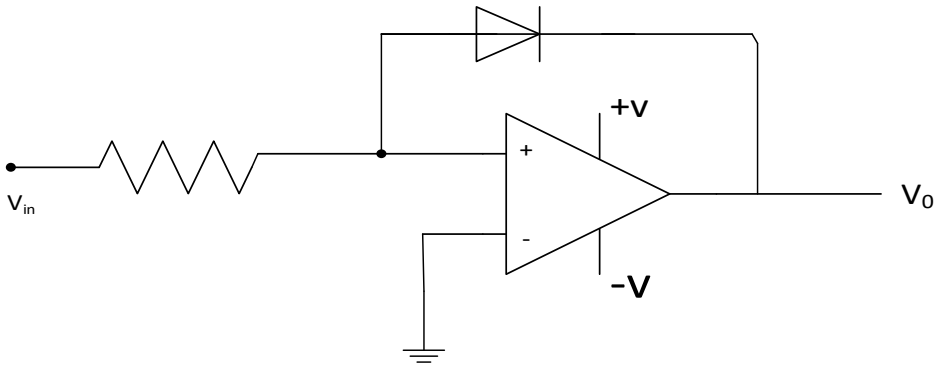
Figure 6

b) Explain two areas of application of logarithmic amplifiers

(2 marks)

c) Figure 6 is a logarithmic amplifier. Derive the output expression of the amplifier

(5 marks)



QUESTION FIVE

a) Figure 7 shows an application of a comparator to control street light. **(6 marks)**

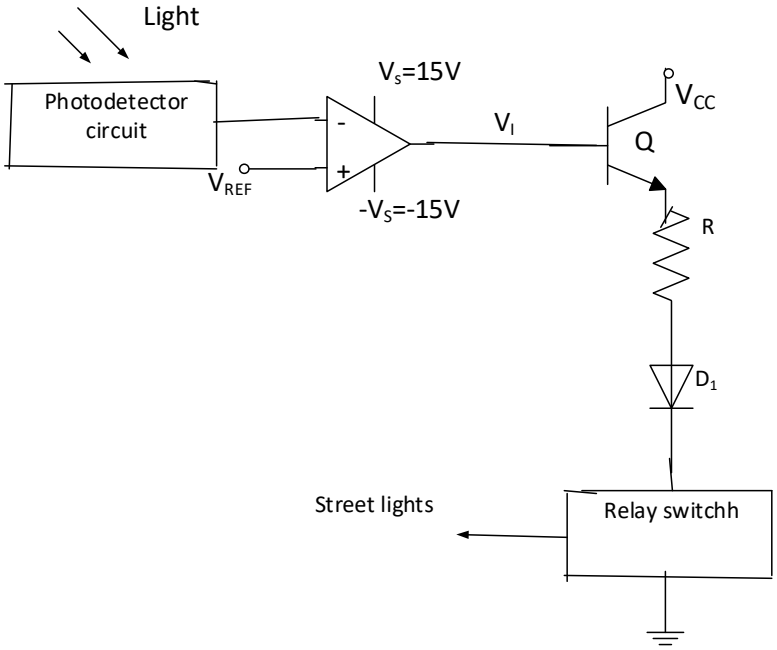


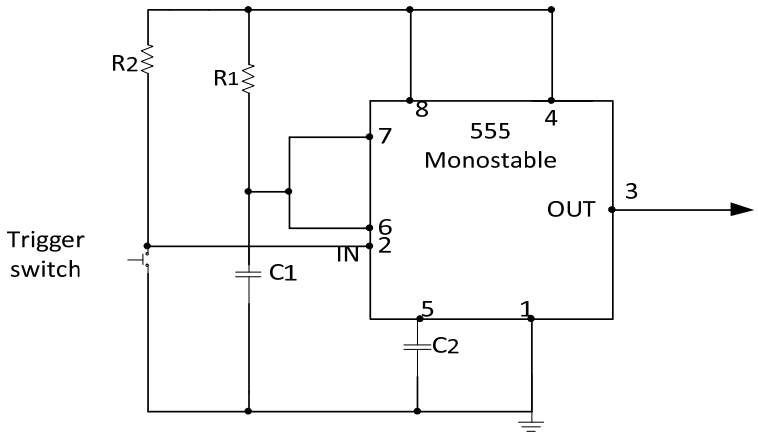
Figure 7

b) Figure 1 shows a circuit diagram of a monostable multivibrator using 555 timer IC. The supply voltage is $+\mathbf{12}$ volts. Resistor values are $\boldsymbol{R_1 = 71.0\ k\Omega}$ $\boldsymbol{R_2 = 15.0\ k\Omega}$.

i. Determine the value of the capacitor $\boldsymbol{C_1}$ that should be used to obtain a pulse width of $\mathbf{2.0}\ \boldsymbol{s}$ at the output of a monostable multivibrator.

i. Explain the reason for the use of resistor $\boldsymbol{R_2}$ in the circuit and capacitor $\boldsymbol{C_2}$

(6 marks)



c) Explain possible areas of application of the current to voltage converters

(3 marks)