RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

BSc in Applied Sciences
Second Year - Semester I Examination – May/July 2022

PHY 2103 – ELECTRONICS I

Time: One (01) hour

Answer only <u>two</u> Questions.

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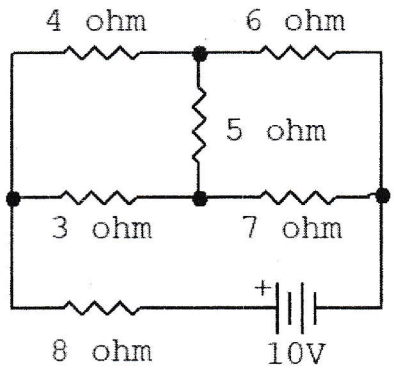
1. a) Using the Kirchhoff's rules, determine the current through the 5 Ω resistor in the network shown in the following figure.



(10 marks)

b) Given, for silicon at 300 K temperature, intrinsic carrier concentration (n_i) is 1.5 x 10^{10} cm^{-3}, electron mobility (μ_e) is 1250 $cm^2V^{-1}s^{-1}$, the hole mobility (μ_h) is 600 cm^2 $V^{-1}s^{-1}$ and the number of Silicon atoms per cm^3 is 5 x 10^{27}.

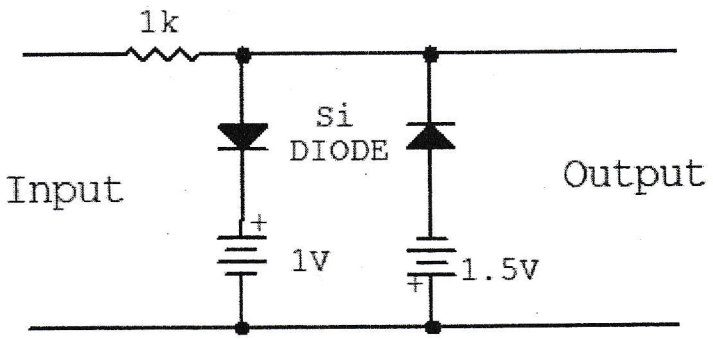
Calculate the conductivity of silicon under following conditions.

i. In intrinsic condition at a room temperature of 300 K.
ii. With a donor impurity of 1 in 10^9 Silicon atoms.
iii. With an acceptor impurity of 1 in 6 x 10^7 Silicon atoms.
iv. With both the above impurities present simultaneously.

(10 marks)

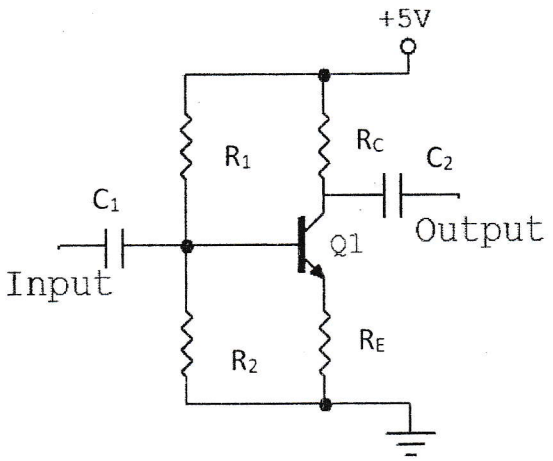
Contd.

c) Illustrate the output signal produced by the clipper circuit shown in the figure below, for a 5V (p-p) sinusoidal input signal.



(05 marks)

2. Use the given circuit to perform the following calculations.



i. Can this circuit be used as a class A amplifier with a 4V collector voltage (V_C = 4V)?

ii. To which class of amplifiers could this circuit belong as it was shown? Explanation should be based on the Q point value (V_C = 4V).

iii. Calculate the resistance R_C and the base current I_B when the collector current is 2mA and current gain (β) is 150.

iv. Determine a suitable value for R_E to bias the transistor in the active region.

v. Assuming Q_1 is a silicon transistor, calculate suitable values for the R_1 and R_2 with a low input impedance.

(25 marks)

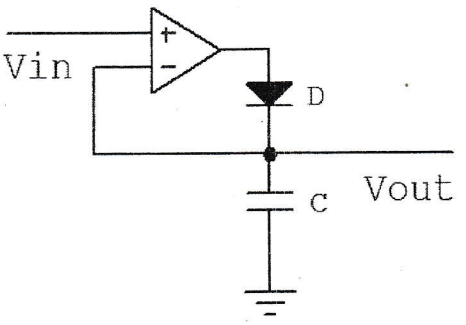
3. a) Explain why an op-amp needs a feedback loop when it is used in circuits other than in a comparator circuit.

(05 marks)

b) What are the two rules used in Op-amp circuits? Explain how those two differ from actual behaviour.

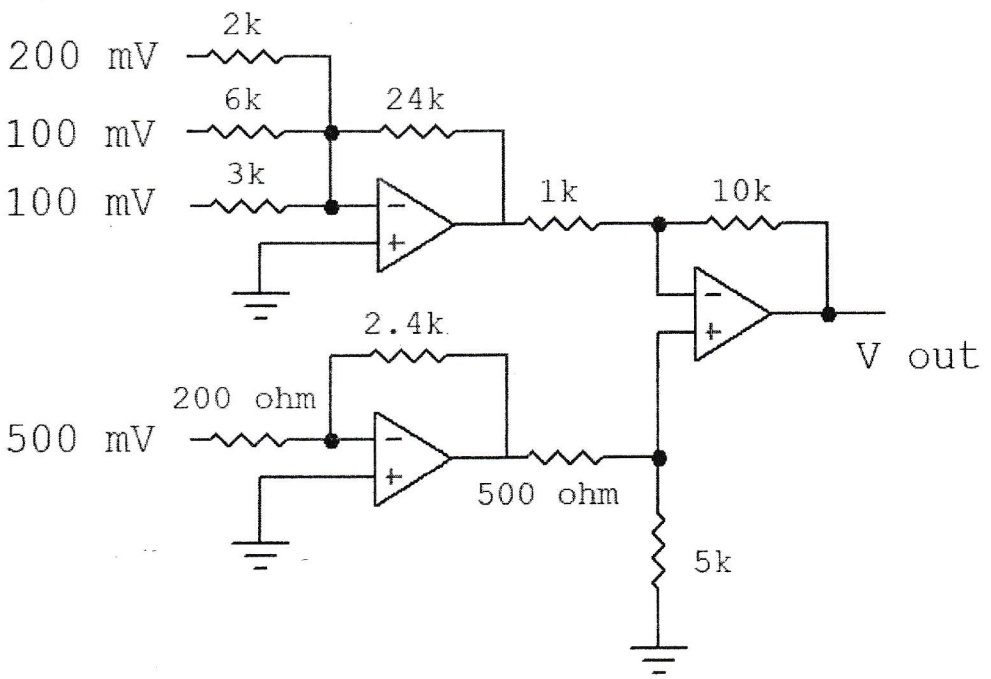
(05 marks)

c) Explain the functionality of the op-amp peak detector circuit shown below.



(05 marks)

d) Calculate the output voltage (V_{out}) for the following circuit.



(10 marks)

End.