099

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

Study Programme	: Bachelor of Technology Honors in Engineering/ Bachelor of Science Honors in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: EEX4351- Electronics II**
Academic Year	: 2022/2023
Date	: 16th February 2024
Time	: 1400-1700hrs
Duration	: **3 hours**

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **FOUR (4)** questions on **FIVE (5)** pages.
3. Answer **All** the questions.
4. The answer for each question should commence from a new page.
5. Clearly state all your assumptions.
6. This is a Closed Book Test **(CBT).**
7. Answers should be in clear handwriting.
8. Do not use red colour pens.

Question I

1. State two applications of combinational logic circuits. **(02 Marks)**
2. The diagram shown below is a system to control three valves. Pw, Px, and Py will control the flow of water, liquid X, and liquid Y into the tank.

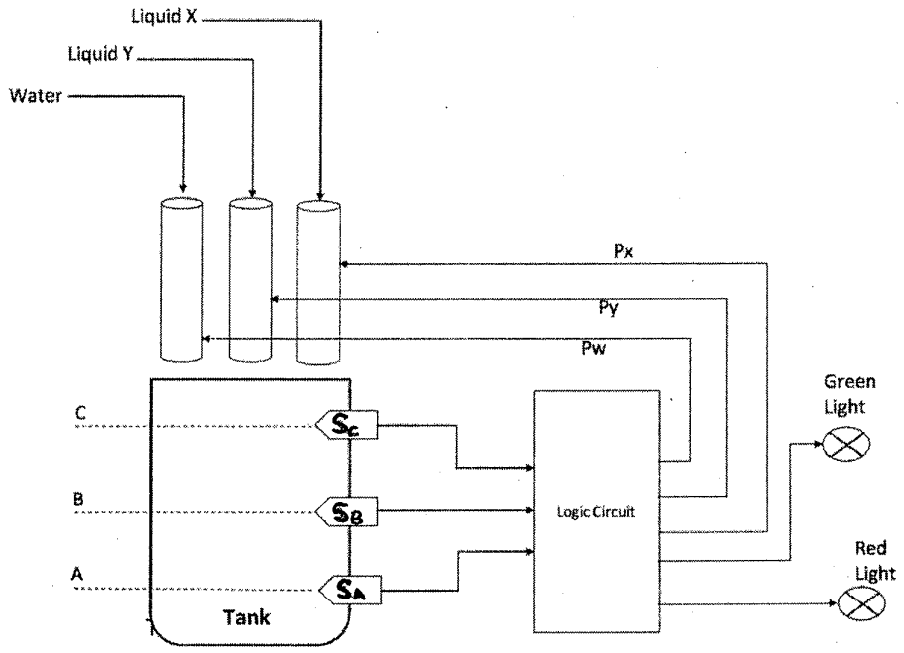


Figure 1.1

- During the initial state, the tank is empty.
- When the system starts, valve **Pw** is opened to allow the flow of water.
- As the water level reaches level **A**, the next valve **Px** is opened to allow the flow of liquid X into the tank
- When the mixture of water and liquid X reaches level **B** valve **Py** is opened to allow the flow of liquid Y.
- When it reaches level **C**, all valves are closed, and green light is switched on signalling a successful operation.
- The tank uses three level sensors, S_A, S_B and S_C at level A, B, and C respectively
- If any of the sensors fail to function, all valves are closed, and red light is switched on to indicate the sensors are malfunctioning.

Table 1

Sensors	Detected	= 1	Not detected	= 0
Valves	Open	= 1	Closed	= 0
Lights	ON	= 1	OFF	= 0

i. Develop the truth table. **(04 Marks)**
ii. Find the logic expressions for each output using the K-map. **(04 Marks)**

3. Draw an overlapping common mealy FSM state diagram to detect both sequences 0001 and 0010. **(08 Marks)**

4. Design the sequential circuit for the given below state diagram shown in figure 1.2 using a T flip flop **(12 Marks)**

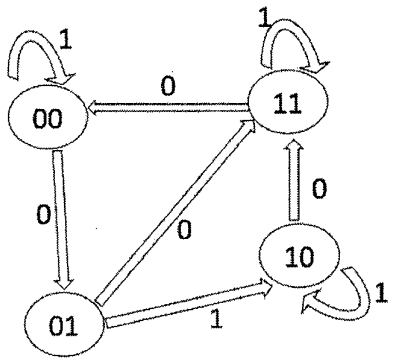


Figure 1.2

Question II

1. Describe the operational characteristics and efficiency differences between Class A, Class B, and Class C power amplifiers. **(05 Marks)**
2. In what way are the design features of power transistors different from small signal transistors? **(04 Marks)**
3. Compare the conduction angles and location of Q point of Class A, Class B, and Class C power amplifiers. **(05 Marks)**
4. A Basic class C amplifier circuit is shown in Figure 2.1. The supply voltages V_{CC} is 20V and V_{EE} is -5V, load resistance of 50Ω, and VCE (sat) = 0.3 V. Calculate the efficiency. **(06 Marks)**

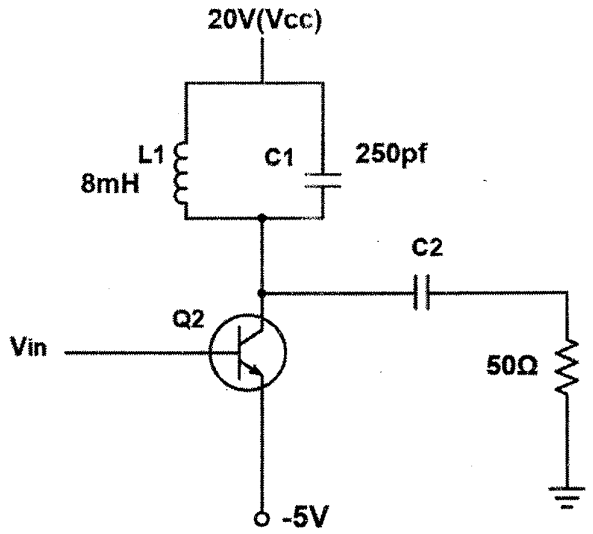


Figure 2.1

Question III

1. How does capacitive coupling affect the low and high frequency response of a BJT amplifier? **(02 Marks)**
2. State two advantages of using multistage amplifiers and explain what is Darlington's connection. **(03 Marks)**
3. Answer the following questions based on the circuit shown in Figure 3.1

$$\beta = 65, V_A = 50V \; V_T = 25mV$$

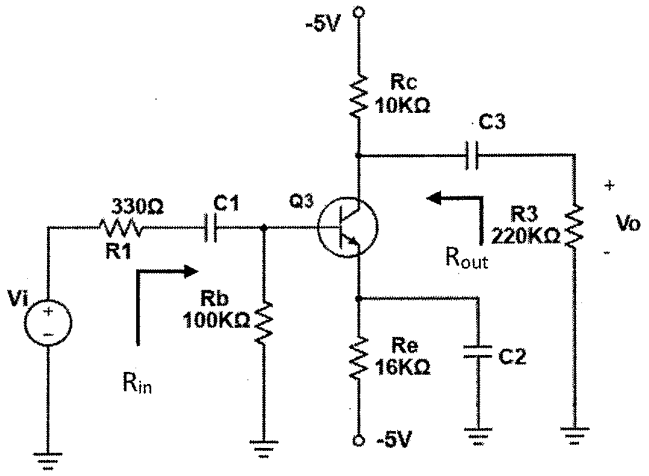


Figure3.1

i. State the transistor configuration. **(01 Marks)**
ii. Draw the small signal equivalent circuit using the hybrid pi model. **(04 Marks)**
iii. Calculate the voltage gain. **(05 Marks)**
iv. Find input impedance Rin & output impedance Rout. **(02 Marks)**

4. The circuit shown in Figure 3.2 has

$$\beta = 100, V_T = 25mV, \quad C_{be} = 8pF \; and \; C_{bc} = 4pF, \; V_A = 100V$$

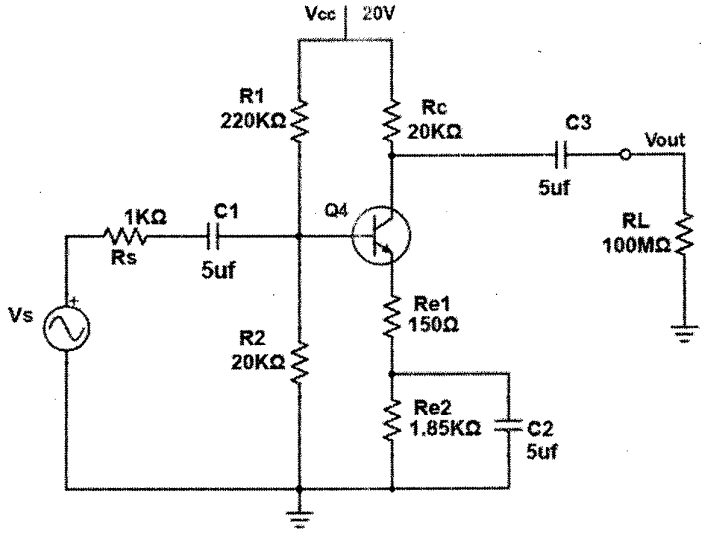


Figure 3.2

i. Draw the equivalent high-frequency circuit using the re-model (Consider the early voltage effect). **(06 Marks)**

ii. Consider the Input RC circuit and determine the upper critical frequency. **(04 Marks)**

iii. Consider the Output RC circuit and determine the upper critical frequency. **(03 Marks)**

Question IV

1. Draw the basic block diagram of the feedback amplifier and explain what is negative feedback. **(03 Marks)**
2. Comparator circuits, and sample and hold circuits are applications of advanced operational amplifiers.
   i. Briefly explain the operation of both applications. **(04 Marks)**
   ii. State how the comparator circuit becomes a Schmitt trigger. **(02 Marks)**
   iii. Find the upper, and lower trigger levels and hysteresis for the Schmitt trigger shown in Figure 4.1, when the output is between + 15V and -15V. **(03 Marks)**

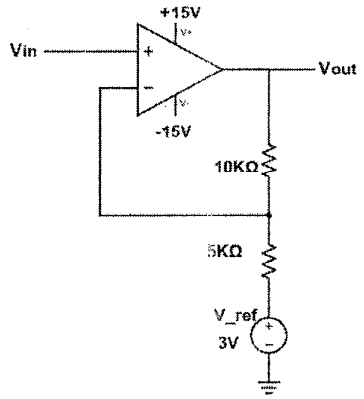


Figure 4.1

3. Compare active filter and passive filter in terms of used components, gain, power requirement, and complexity. **(04 Marks)**
4. State the condition for oscillation. For the Wien-bridge oscillator circuit shown in Figure 4.2, find the resistance **values** of R1, if the oscillator frequency varies between 5KHz to 12KHz. **(04 Marks)**

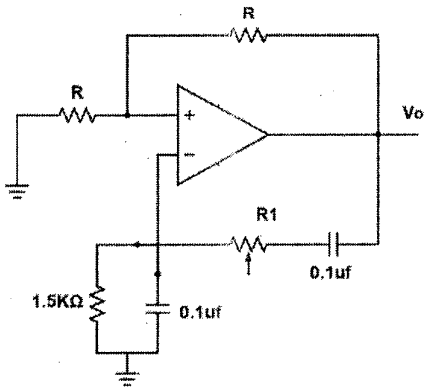


Figure 4.2