



Instructions to candidates

Duration: Two (02) hours

Number of questions: Four (04) Questions

Number of questions to be answered: Four (04)

Mark allocation: Two hundred (200) marks

1.
 - a. Briefly explain the following
 - i. Combinational circuits
 - ii. Sequential circuits(5 marks)
 - b. Explain the differences between latches and flip flops. (10 marks)
 - c. 1. Draw the **D** type flip flop using,
 - i. A block diagram,
 - ii. NAND gates(5 marks)
2. Draw the corresponding truth table and the timing diagram for D type flip flop. (10 marks)
 - d. 1. Flip flop can be used to divide the frequency. Briefly explain how this can be done using diagrams.
2. Draw the block diagram of Asynchronous 3-bit up-down counter using T type flip flop. (20 marks)
2.
 - a. Convert the following
 - i. $10AF_{16}$ to Binary
 - ii. 724_8 to Decimal(4 marks)
 - b. Simplify the following Boolean functions.
 - i. $F = AB + BC + B'C$
 - ii. $F = A + A'B$
 - iii. $F = A'B'C + A'BC + AB'$
 - iv. $F = AB + (AC)' + AB'C(AB + C)$(20 marks)

c. The warning lamp in a car with 3 main controller systems, should light up in any of the following cases.

- All systems are down
- System A and B are down but C is OK
- System A and C are down but B is OK
- System A is down but B and C are OK

Create the truth table and simplified Boolean function to satisfying the above requirements.

(10 marks)

d. Briefly explain

- Encoder
- Decoder
- Multiplexer
- Shift register

(16 marks)

3. An operational amplifier (op-amp) is a DC-coupled high gain electronic voltage amplifier with a differential input and a single ended output.

a. Name five op-amp circuit configurations.

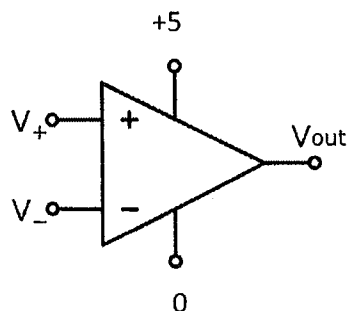
(10 marks)

b. You are asked to design an amplifier with the gain of **-15** (Negative fifteen).

- What kind of op-amp circuit configuration would you use? Draw the circuit of your design.
- Do the analysis and suggest components and their values for the circuit.
- State the assumptions that you have made in part (ii).

(40 marks)

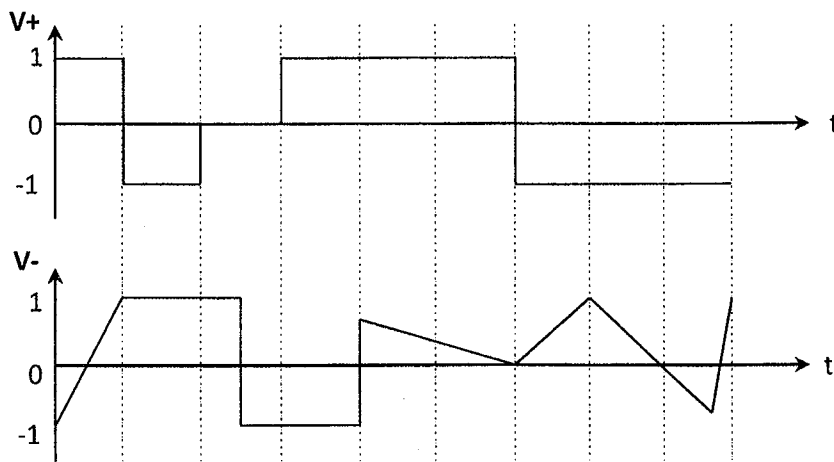
4. Figure shown below is a comparator.



a. Briefly explain what are the outputs according to the inputs.

(10 marks)

b. Draw the output wave form for given input waves below.



(15 marks)

c. Suggest a way to produce a pwm signal to control a motor using a comparator.
(hint: a saw-tooth wave is given to the inverting input).

(25 marks)

