2021

COMPUTER SCIENCE — HONOURS

First Paper

Full Marks : 100

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Answer **question no. 1** and **any five** questions from the rest,
taking at least **one** from **each group**.

1. Answer **any ten** from the following questions :   2×10

    (a) State De Morgan's theorems.

    (b) What is Zener breakdown?

    (c) How JFET differs from MOSFET?

    (d) Convert $(1101.110)_2 = (?)_{10}$.

    (e) Add : $(11AB)_{16} + (C238)_{16}$.

    (f) What is the difference between opcode and operand?

    (g) What is depletion region of a p–n junction diode?

    (h) State Norton's theorem.

    (i) How can a transistor act as an inverter?

    (j) What is the input offset voltage of an operational amplifier?

    (k) What is Master slave flip-flop?

    (l) State the difference between RAM and ROM.

    (m) State the difference between weighted and non-weighted codes.

    (n) What is the difference between sequential circuit and combinational circuit?

    (o) What is machine cycle?

Group - A

(Computer Fundamentals)

2. (a) Simplify the following logical expression by K-map method.
    $Y = \Sigma\, m\, (0, 1, 2, 4, 5, 8, 9, 10, 12, 13)$

    (b) Design the simplied output by logic gates. Draw the truth table.

    (c) Write the above logical expression Y in POS form. Minimize it.

    (d) Represent EX-OR gate by NOR gate.   4+4+4+4

Please Turn Over

3. (a) Add :

   (i) $(1AB \cdot 3C)_{16} + (4BC2 \cdot A3)_{16}$

   (ii) $(11101 \cdot 101)_2 + (1001 \cdot 10)_2$

   (iii) $(756 \cdot 32)_8 + (543 \cdot 21)_8$

   (b) Subtract : (i) $(111010)_2 - (110001)_2$ by 2's complement method

   (ii) $(A34 \cdot C2)_{16} - (B5 \cdot 1)_{16}$

   (c) Multiply : $(1001101 \cdot 1001)_2 \times (110110 \cdot 101)_2$

   (d) Convert the number $(6789)_{10}$ into Binary Coded Decimal. 6+6+2+2

Group - B

4. (a) What is the origin of the reverse saturation current in a p–n junction diode?

   (b) Draw the circuit diagram of a forward-biased and reverse-biased p–n junction diode. Write the expression of the volt-ampere characteristic of the diode.

   (c) Draw the characteristic curve of the forward biased diode and explain its nature. 3+8+5

5. (a) What do you mean by the quiescent point of a transistor?

   (b) Draw the circuit diagram of a common-emitter transistor amplifier. Explain its operation.

   (c) What is a load line? Explain its significance.

   (d) Explain the working principle of the light emitting diode (LED). 3+9+2+2

Group - C

6. (a) What is 3-bit full adder? Design it by logic gates and draw the truth table.

   (b) Implement Y_{sum} of the 3-bit full adder (3-bit) by NAND gates only.

   (c) Implement Y_{carry} of the 3-bit full adder by 8 : 1 multiplexer. 6+5+5

7. (a) Design S–R flip-flop circuit. Draw the truth table.

   (b) Convert S–R flip-flop to D flip-flop and explain with truth table.

   (c) Design an asynchronous 3-bit counter using negative edge-triggered clock. Draw the truth table and explain its function. 4+5+7

Group - D

8. (a) What are the functions of Program Counter and Stack Pointer?

   (b) What do you understand by PUSH and POP operations?

   (c) How many times does the Control Unit refer to memory when it fetches and executes an indirect addressing mode instruction if the instruction is a computational type requiring and operand from memory? – Explain. 8+3+5

9. (a) Define the following :

   (i) Micro-operation

   (ii) Micro-instruction

   (iii) Microprogram

   (iv) Microcode.

   (b) What is the difference between a microprocessor and a microprogram? Is it possible to design a microprocessor without a microprogram? 10+6

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