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COMPUTER SCIENCE

(Major)

Paper : 1.2

(Basic Electronics)

Full Marks : 60

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Choose the correct option :   1×7=7

   (a) With the increase in temperature the resistivity or specific resistance of semiconductors

   (i) increases

   (ii) decreases

   (iii) remains unchanged

   (b) Which of the following is a unipolar device?

   (i) *p-n-p* transistor

   (ii) IC

   (iii) MOSFET

(Turn Over)

(c) At fixed temperature, Ohm's law is obeyed in case of

   (i) conductors

   (ii) electrolytes

   (iii) semiconductors

(d) Which of the following is not a universal gate?

   (i) AND

   (ii) NOR

   (iii) NAND

(e) The L-section filter with inductance L and capacitor C is connected at the output of a rectifier in which of the following ways?

   (i) C in series, L in parallel connection

   (ii) L in series, C in parallel connection

   (iii) Both L and C are in series connection

(f) The capacitance of a parallel-plate capacitor can be increased by

   (i) reducing its plate area

   (ii) filling the entire space between the plates with a dielectric material of dielectric constant $k > 1$

   (iii) increasing spacing between the plates

         (Continued)

(g) Boolean algebra was first developed by

   (i) Bertrand Russell

   (ii) George Boole

   (iii) Claude Shannon

2. Answer the following questions :   2×4=8

(a) How is an *n-p-n* transistor biased in CB configuration in order to operate it in active region?

(b) State the function of a filter circuit in rectifier.

(c) Differentiate between combinational and sequential circuits.

(d) Why are multiplexers called data selectors?

3. Answer any *three* of the following questions :   5×3=15

(a) How are *p*-type and *n*-type semi-conductors made? Distinguish between ordinary resistor and LDR.

(b) Simplify the following Boolean expression using K-map :

$$F (A, B, C, D) = \Sigma (0, 1, 2, 4, 5, 6, 8, 9, 12, 13, 14)$$

         (Turn Over)

(c) Draw the circuit diagram of transistor in CB and CE configurations using either *p-n-p* or *n-p-n* transistor with proper d.c. biasing. With same input signal, which of them will give higher voltage gain? Justify your answer.

(d) Draw the logic diagram of a binary half adder. Write the truth table and develop the expression for sum and carry.

4. Answer any *three* of the following questions :

$10 \times 3 = 30$

(a) What are the basic rules to convert SOP expression to POS form and POS expression into SOP form? Find the POS and SOP forms of the following expression :

$$X = \Sigma m(0, 1, 3, 6, 8, 13, 15)$$

Which one is more cost effective?

(b) What are digital demultiplexers? Explain their principle of operation and applications in communication system.

(c) State the rules for changing positive logic to its corresponding negative logic. Show diagrammatically with proper symbol, how you will realize the following :

(i) AND function using NAND gates only

(ii) OR function using NOR gates only

(iii) NOT function using NAND gates or NOR gates

(iv) AND function using NOR gates

(d) State the different types of shift registers. Considering two 4-bit shift registers, explain with a block diagram how the data transfer is made between them.

(e) Write short notes on any *two* of the following :

(i) LED

(ii) Operational amplifier

(iii) Decoder

(iv) S-R flip-flop

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