(6 pages) Reg. No. : .....

Code No. : 10083 E **Sub. Code : SEMA 5 B/ AEMA 52**

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2023.

Fifth Semester

Mathematics

Major Elective – DISCRETE MATHEMATICS

(For those who joined in July 2017 – 2020)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Those statements which contain one or more primary statements and some connectives are called _____.

   (a) molecular

   (b) composite

   (c) compound statements

   (d) all of the above

2. The statement P is called the _____ in $P \to Q$.

   (a) antecedent (b) consequent

   (c) tautologies (d) none

3. A sum of the variables and their negations is called as _____.

   (a) elementary sum (b) elementary product

   (c) normal sum (d) none

4. Which of the following is an example of elementary sums of two variables?

   (a) P (b) $\neg P \vee Q$

   (c) $\neg Q \vee P \vee \neg P$ (d) All of the above

5. Any such disturbance is called _____.

   (a) encoder (b) decoder

   (c) noise (d) code

6. Any one-to-one mapping of a set S onto S is called a _____ of S.

   (a) Group (b) Permutation

   (c) Combination (d) Subgroup

7. A _____ algebra is a complemented, distributive lattice.
(a) Boolean (b) Partial
(c) Ordinary (d) None

8. A lattice is called _____ if each of its nonempty subsets has a least upper bound and a greatest lower bound.
(a) Sublattice (b) Complement
(c) Complete (d) Bounds

9. What are the numbers using for representing any binary number?
(a) $0-9$ (b) $0-1$
(c) $0-7$ (d) None

10. Add : 100111 and 11011?
(a) 1000010 (b) 100100
(c) 111000 (d) 10101010

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Construct the truth table for $(P \vee Q) \vee \neg P$.

Or

(b) Write the following statement in symbolic form.

"If either Jery takes calculus or ken takes sociology, then Larry will take English".

12. (a) Symbolize the expression "All the world loves a lover".

Or

(b) Show that $(\exists x)M(x)$ follows logically from the premises $(x)(H(x) \rightarrow M(x))$ and $(\exists x)H(x)$.

13. (a) Show that A subset $S \neq \phi$ of G is a subgroup of $<G,*>$ iff for any pair of elements $a,b \in S$, $a * b^{-1} \in S$.

Or

(b) Let H be a matrix which consists of K rows and n columns. The prove that the set of words $x = < x_1, x_2, \cdots, x_n >$ which belong to the following set $C = \{x \mid (x \cdot H^t = 0) \bmod 2\}$ is a group code under the operation $\oplus$.

14. (a) Prove that every chain is a distributive lattice.

Or

(b) Prove that
$(a+b')(b+c')(c+a') = (a'+b)(b'+c)(c'+a)$.

15. (a) Convert $(101010101)_2$ to octal.

Or

(b) Multiply : 1010×1001.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Construct the truth table for $\neg(P \vee (Q \wedge R)) \Leftrightarrow (P \vee Q) \wedge (P \vee R)$.

Or

(b) Does the formula $(P \rightarrow (P \vee Q))$ is tautology or not?

17. (a) Obtain the principal disjunctive normal form of $P \rightarrow ((P \rightarrow Q) \wedge \neg(\neg Q \vee \neg P))$.

Or

(b) Show that $\overset{S}{\Rightarrow}(\neg Q \wedge (P \rightarrow Q)) \rightarrow \neg P$.

18. (a) Determine all the proper subgroups of the symmetric group $< S_3, \Diamond >$ described in the following table.

$\Diamond$	P_1	P_2	P_3	P_4	P_5	P_6
P_1	P_1	P_2	P_3	P_4	P_5	P_6
P_2	P_2	P_1	P_5	P_6	P_3	P_4
P_3	P_3	P_6	P_1	P_5	P_4	P_2
P_4	P_4	P_5	P_6	P_1	P_2	P_3
P_5	P_5	P_4	P_2	P_3	P_6	P_1
P_6	P_6	P_3	P_4	P_2	P_1	P_5

Or

(b) Prove that A code can correct all combinations of k or fewer errors iff the minimum distance between any two code words is at least $2k+1$.

19. (a) Define : Sub lattice and direct product.

Or

(b) When $< B, *, \oplus, 0, 1 >$ becomes a bounded lattices?

20. (a) Convert the following to hexa-decimal number.

(i) 1111101101_2

(ii) 11110.01011_2.

Or

(b) Add : 1001.011 and 0100.110

Subtract : 1110 – 0011.

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