Reg. No.												

14/08/2023

Question Paper Code	12140

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

First Semester

Computer Science and Business Systems

20BSMA102 - DISCRETE MATHEMATICS

(Regulations2020)

Duration: 3 Hours

Max. Marks: 100

PART-A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	Construct the truth table for $(P \to Q) \wedge (Q \to P)$	2,K2,CO1
2.	Write the negation of the statement $(\exists x)(\forall y)P(x,y)$.	2,K1,CO1
3.	State the Pigeonhole principle.	2,K1,CO2
4.	Find the recurrence relation of the sequence $s(n)=a^n, n\geq 1$.	2,K2,CO2
5.	State any two laws of Boolean algebra.	2,K1,CO3
6.	How many cells does a K- map in three variables have?	2,K1,CO3
7.	How many edges are there in a graph with 10 vertices each of Degree 3?	2,K1,CO4
8.	Define Hamiltonian path.	2,K1,CO4
9.	Prove that identity element in a group is unique.	2,K2,CO5
10.	Define Kernel of homomorphism.	2,K1,CO5

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) (i) Show that $((P \vee Q) \wedge \neg(\neg P \wedge (\neg Q \vee \neg R))) \vee (\neg P \wedge \neg Q) \vee (\neg P \wedge \neg R)$ is a tautology. 8,K2,CO1

(ii) $(P \vee Q) \wedge (\neg P \wedge (\neg P \wedge Q)) \Leftrightarrow (\neg P \wedge Q)$ using equivalence formula. 8,K3,CO1

OR

b) Show that the following premises are inconsistent. 16,K3,CO1

1. If Jack misses many classes through illness, then he fails high school.
2. If Jack fails high school, he is uneducated
3. If Jack reads a lot of books, then he is not uneducated.
4. Jack misses many classes through illness and reads a lot of books.

12. a) (i) Using induction principles prove that n^3+2n is divisible by 3. 8,K3,CO2

(ii) Using mathematical induction prove that $\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$. 8,K3,CO2

OR

b) Solve $S(k) - 7S(k-1) + 10S(k-2) = 8k+6$, for $k\geq 2$, $S(0)=1$, $S(1)=2$. 16,K3,CO2

13. a) (i) In Boolean algebra, show that the following are equivalent. For any a and b, (A) $a+b=b$ (B) $a \cdot b = a$ (C) $a'+b=1$ (D) $a \cdot b' = 0$ (E) $a \leq b$. *12,K3,CO3*

(ii) In a Boolean Algebra. Show that *4,K2,CO3*

$$(a+b')(b+c')(c+a')=(a'+b)(b'+c)(c'+a)$$

OR

b) Find the minimal expansion as a sum of products of each of the following Boolean functions using K- map *16,K3,CO3*

$(i)\, f(x,y) = x\,y + x\,\bar{y}$

$(ii)\, f(x,y) = \bar{x}\,y + \bar{x}\,y$

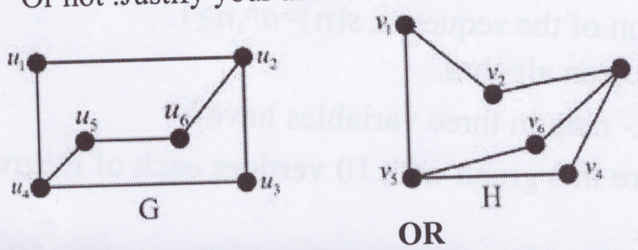
$(iii)\, f(x,y) = \bar{x}\,y\,z + \bar{x}\,\bar{y}\,\bar{z}$

$(iv)\, f(x,y,z) = \bar{x}\,y\,z + \bar{x}\,\bar{y}\,z$

$(v)\, f(x,y,z) = \bar{x}\,y\,\bar{z} + \bar{x}\,\bar{y}\,\bar{z} + x\,\bar{y}\,\bar{z} + x\,y\,z + x\,\bar{y}\,z$

14. a) (i) State and Prove Handshaking Theorem *4,K2,CO4*

(ii) Examine whether the following pair of graphs are isomorphic Or not .Justify your answer. *12,K2,CO4*



OR

b) Given an example of a graph which is *16,K3,CO4*

(i) Eulerian but not Hamiltonian
(ii) Hamiltonian but not Eulerian
(iii) Both Eulerian and Hamiltonian
(iv) Non Eulerian and not Hamiltonian

15. a) (i) State and prove Lagrange's theorem. *8,K2,CO5*

(ii) Show that the set of positive rational numbers Q^+ is an abelian group for the operation $*$ defined by $a*b=\frac{ab}{3}$. *8,K2,CO5*

OR

b) Let $(G,*)$, and $(G_1,*)$ be two groups and let $f: G \to G_1$ be a group homomorphism from G to G_1. Prove that *16,K2,CO5*

(a) $f(e)=e_1$ where e and e_1 are the identities of $(G,*)$ and $(G_1,*)$ respectively.

(b) $f(a)=[f(a)]^{-1}$ for any $a \in G$.