Reg. No.												

Question Paper Code	12533

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

First Semester

Computer Science and Business Systems

20BSMA102 - DISCRETE MATHEMATICS

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level,CO
1.	Symbolize the following expressions "*x* is the father of the mother of y*"*.	*2,K1,CO1*
2.	Show that the hypothesis "*x* works hard", "If x works hard then he is a dull boy" and "If *x* is a dull boy, then he will not get a job" imply the conclusion "*x* will not get a job".	*2,K2,CO1*
3.	Prove that if n is an integer and n is odd, then n^2 is odd.	*2,K2,CO2*
4.	Find the recurrence relation satisfying $y_n = (A + Bn)4^n$.	*2,K1,CO2*
5.	Prove that in a Boolean algebra, the complement of every element is unique.	*2,K2,CO3*
6.	Simplify the Boolean expression $a \,.\, c + c + [(b + b') + c]$.	*2,K2,CO3*
7.	State and prove the hand shaking theorem.	*2,K2,CO4*
8.	Define Hamiltonian graph and example.	*2,K1,CO4*
9.	Define a partial ordering with an example.	*2,K1,CO5*
10.	Let f be a homomorphism from (G , $*$) to (G , Δ) .Then prove that $f(a^{-1}) = [f(a)]^{-1}$.	*2,K2,CO5*

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11.	a)	(i) Prove the implication $(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow s) \Rightarrow (s \vee r)$.	*8,K3,CO1*
		(ii) Verify the validity of the following argument: Every living thing is a plant or an animal. Rama's dog is alive and it is not a plant. All animals have hearts. Therefore, Rama's dog has a heart.	*8,K3,CO1*
		OR	
	b)	(i) Prove that $\big(\neg P \wedge (\neg Q \wedge R)\big) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$ without using truth tables.	*8,K3,CO1*
		(ii) Obtain the disjunctive normal form and hence find the conjunctive normal form of $(p \wedge \neg(q \wedge r)) \vee (p \rightarrow q)$.	*8,K3,CO1*

12. a) (i) Prove by using Mathematical induction *8,K3,CO2*

$$\frac{1}{1.2}+\frac{1}{2.3}+\frac{1}{3.4}+....+\frac{1}{n(n+1)}=\frac{n}{n+1}$$

(ii) Use the method of generating function to solve the recurrence relation $a_{n+1}-8a_n+16a_{n-1}=4^n,\ n\geq 1\ , a_0=1\ and\ a_1=8.$ *8,K3,CO2*

OR

b) (i) Prove, by using Mathematical induction that $n^3+(n+1)^3+(n+2)^3$ is divisible by 9 for $n\geq 1$. *8,K3,CO2*

(ii) Solve the recurrence relation $a_n-2a_{n-1}=2n^2,\ n\geq 1$ given that $a_1=4$. *8,K3,CO2*

13. a) (i) In any Boolean algebra, Show that *4,K3,CO3*

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

(ii) Simplify the Boolean expression *4,K3,CO3*

$a'.b'.c+a.b'.c+a'.b'.c'$ using Boolean identities.

(iii) Find the CNF of $f(x,y,z)=xz+x'y+yz$ by *8,K3,CO3*

a) Truth table

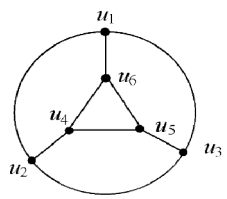
b) Algebraic method.

OR

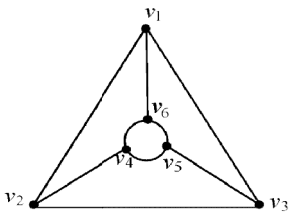
b) (i) State and prove De Morgan's laws in Boolean algebra. *8,K3,CO3*

(ii) Minimize the function $f(a,b,c,d)=\Sigma(0,1,2,3,4,6,7,8,9,11,15)$ using Karnaugh map method. *8,K3,CO3*

14. a) (i) Explain Isomorphism. Test whether the graphs G1 and G2 are isomorphic. *8,K3,CO4*



G1



G2

(ii) Prove that a tree with n vertices has $n-1$ edges. *8,K3,CO4*

OR

b) Prove that a connected graph G is Eulerian if and only if its vertices are of even degree. *16,K3,CO4*

15. a) (i) If R is a relation defined on Z such that $a\,R\,b$ iff a^2-b^2 is divisible by 3, show that R is an equivalence relation. *8,K3,CO5*

(ii) Show that the intersection of any two subgroup of a group G is also a subgroup of G. *8,K3,CO5*

OR

b) State and prove Lagrange's theorem. *16,K3,CO5*