Course Code:	**20BSMA204**
Course Name:	**DISCRETE STRUCTURES**
Year / Sem :	**I/II**

PART A

S.No	**Questions**	**Marks splitup**	**K level**	**CO**
1	Let A = {1, 2, 3, 4} and B = {5, 7, 9} R, S are relations from A to B defined as R = {(1, 5), (1, 7), (2, 7), (2, 9) (3, 7), (4, 5)} and S = {(1, 7), (2, 9), (3, 7), (4, 7)}. Compute R^{-1}, $R \cap S$.	2	K2	C01
2	Let A = {0, 1, 2, 3, 4}, B = {0, 1, 2, 3} and R is a relation from A to B, where a R b iff (i) a + b = 4, Find Domain and Range of R.	2	K2	CO1
3	Let A= {0, 1, 2, 3, 4}, B = {0, 1, 2, 3} List the ordered pairs in the relation R from A to B, where (a, b) ∈ R iff (i) a > b (ii) lcm (a, b)= 2 .	2	K2	C01
4	If $f: R \to R$, find the domain of $g(x) = \frac{5x+4}{x^2+3x+2}$	2	K2	CO1
5	If $f: R \to R$, find the domain of $g(x) = \frac{1}{x^2-x}$	2	K2	CO1
6	Test the following functions one-one or onto (i) $f : Z \to Z$, defined by $$f(x) = 2x + 4, \forall x \in Z$$	2	K2	CO1
7	What is partial order relation?	2	K2	CO1
8	The relation R on the set A = {1,2,3,4,5} is defined by the rule (a, b) ε R, If 3 divides a – b. Find the domain and range of R.	2	K2	CO1
9	Determine whether the relation R on the set of integers is reflexive, symmetric, antisymmetric and transitive, where a R b if and only if $a \neq b$.	2	K2	CO1
10	Find the range of $f(x) = \sqrt{4 - x^2}$, if f is a real valued function.	2	K2	CO1
11	Find the range of $f(x) = \frac{x+1}{x-1}$	2	K2	CO1
12	If $f: R \to R$ defined by $f(x) = \frac{1}{x}$. Whether f is a function?	2	K2	CO1
13	Determine the domain for the function $f(x) = \sqrt{x+5}$.	2	K2	CO1
14	Determine whether the function $f(x) = x + 1$ from the set of real numbers to itself is one-one or not?	2	K2	CO1
15	If $f: R \to R$ defined by $f(x) = x^2$. Whether the function is invertible?	2	K2	CO1
16	Let $f, g: R \to R$ defined by $f(x) = 2x + 5$ and $g(x) = x - 5 \forall$ x ∈ R. Find the composites $f \circ g$ and $g \circ f$	2	K2	CO1

UNIT - I

Unit - I / Part - B / 8 Marks				
S.No	**Questions**	**Marks splitup**	**K level**	**CO**
1.	Examine whether M is an equivalence relation or not where M is the relation on the set of integers Z defined as follows: For $a, b \in Z, aMb$ if and only if a is a multiple of b.	8	K2	CO1
2	Examine R a partial order relation where R is the relation on the set of people such that xRy if x and y are people and x is older than y.	8	K2	CO1
3.	The relation R on the set $A = \{1,2,3,4,5\}$ is defined by the rule $(a, b) \in R$, if 3 divides $a - b$. (i) compute the elements of R and R^{-1}. (ii) compute the domain and range of R. (iii) compute the domain and range of R^{-1}. (iv) test whether reflexive, symmetric, antisymmetric and transitive properties are satisfied by R.	8	K2	CO1
4.	Let the set $A = Z$, the set of integers and the relation R on Z is equality. That is aRb if $a = b$, prove that it is an equivalence relation on Z.	8	K2	CO1
5.	Let A be the set of lines in a plane and the relation R is 'parallel to'. Prove that R is an equivalence relation.	4	K2	CO1
6.	Let $A = \{1,2,3,4,5\}$. The relation R on A is defined as aRb iff $3\|a - b\|$ Test whether R is an equivalence relation	8	K2	CO1
7.	Let R be a relation on the set of positive integers Z^+ such that (i) $(a, b) \in R$ iff ab is a perfect square (ii) $(a, b) \in R$ iff $a^2 + b$ is even. Prove that both the relation is equivalence relation.	8	K2	CO1
8.	For a fixed positive integer $n > 1$, the congruence mod n relation R on Z is defined by $(a, b) \in R \ iff \ a \equiv b \ (mod\ n)$. Prove that R is an equivalence relation on Z.	8	K2	CO1
9.	Let R be a relation on the set of integers Z and $\{a, b\} \in R$ iff $b = a^m$ for some positive integer m. Show that R is a partial order on Z.	8	K2	CO1
10.	If $f(x) = \sqrt{3x - 2}$ find f^{-1}, if it exists.	8	K2	CO1

11.	Examine whether the function $f: R \to R$ defined by $f(x) = ax + b$ is invertible. If so find the inverse and $f^{-1}(\{1\})$.	8	K2	CO1
12.	Give an example of a function from N to N that is (i) injective but not surjective (ii) surjective but not injective (iii) both injective and surjective with justification.	8	K2	CO1
13.	Let $f: Z \to Z$ be a function defined by $f(x) = 2x^2 + 7x$. Test f is one-one and onto.	8	K2	CO1
14.	Let $f: Z \to N$ be defined by $f(x) = \begin{cases} 2x - 1 & if\ x > 0 \\ -2x & if\ x \le 0 \end{cases}$ Test f^{-1} exists	8	K2	CO1
15.	Let $f(x) = 2x + 3$ and $g(x) = x^2 + 4, h(x) = x + 2$ find $(f \circ g) \circ h$ and $f \circ (g \circ h)$.	8	K2	CO1

UNIT - II

Unit - II / Part - A / 2 Marks				
S. No	**Questions**	**Mark Split up**	**K – Level**	**CO**
1.	State Generalized Pigeon Hole Principle.	2	K2	CO2
2.	Show that if seven colours are used to paint 50 bicycles, at least 8 bicycles will be of the same colour.	2	K2	CO2
3.	Prove that in any group of six people, at least three must be mutual friends or at least three must be mutual strangers.	2	K2	CO2
4.	A committee of 11 members sit at a round table. In how many ways can they be seated if the 'President' and 'Secretary' choose to sit together?	2	K2	CO2
5.	From a club consisting of 6 men and 7 women, in how many ways can we select a committee of 4 persons that has at most one man?	2	K2	CO2
6.	A bit is either 0 or 1. A byte is a sequence of 8 bits. Find the number of bytes. Among these how many are starting with 11 and ending with 00.	2	K2	CO2
7.	How many positive integers not exceeding 1000 are divisible by 7 or 11?	2	K2	CO2
8.	State the Principle of Mathematical Induction.	2	K2	CO2
9.	Use mathematical induction to show that $n! \ge 2^{n+1}, n = 5,6 \ldots\ldots$	2	K2	CO2
10.	Find the minimum number of students needed to guarantee that 5 of them belong to the same subject, having major as English, Maths, Physics and Chemistry.	2	K2	CO2
11.	In how many ways can 20 articles be packed in the three parcels so that the first contain 8 articles, the second 7 articles and the third 5?	2	K2	CO2

Unit - II / Part - B/ 8 Marks				
S.No	**Questions**	**Marks Splitup**	**K – Level**	**CO**
1.	Prove by Induction, $1+2+2^2+2^3+....+2^{n-1}+2^n=2^{n+1}-1$.	8	K3	CO2
2.	For $m \in Z^+$ and m odd, prove that there exists a positive integer n, such that m divides 2^{n-1}.	8	K3	CO2
3.	Using mathematical induction, show that for all positive integers n, is $3^{2n+1}+2^{n+2}$ divisible by 7.	8	K3	CO2
4.	Prove that 8^n-3^n is a multiple of 5 by using method of induction	8	K3	CO2
5.	Use Mathematical induction to prove that the sum of the first 'n' odd positive integers is n^2.	8	K3	CO2
6.	Prove by induction, for $n \geq 1$, $$\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$$	8	K3	CO2
7.	Use mathematical induction, to prove that inequality, $n < 2^n$ for all positive integer n.	8	K3	CO2
8.	Prove that n^3-n is divisible by 3 for $n \geq 1$.	8	K3	CO2
9.	Find the number of integers between 1 and 250 (both inclusive) that are not divisible by any of the integer 2, 3, 5 and 7	8	K3	CO2
10.	Determine the number of positive integers n, 1≤ n ≤1000 that are not divisible by any of the integer 2, 3, 5 but are divisible by 7.	8	K3	CO2
11.	Find the number of integers between 1 to 100 (both inclusive) that are not divisible by any of the integer 2, 3, 5 and 7	8	K3	CO2
12.	How many positive integers not exceeding 1000 are divisible by none of 3,7 and 11?	8	K3	CO2
13.	In a survey of 100 students, it was found that 40 studied maths, 64 studied physics,35 studied chemistry 1 studied all the three subjects, 25 studied Maths and physics, 3 studied Maths and chemistry and 20 studied physics and chemistry. Find the number of students who studied chemistry only	8	K3	CO2
14.	State the generalized pigeonhole principle using this find the minimum number of students in a class to be sure that at least 3 of them are born in the same month	8	K3	CO2

15.	Prove that in any group of six people, there must be at least 3 mutual friends or at least 3 mutual enemies.	8	K3	CO2
16.	A computer password consists of a capital letter of English alphabet followed by 2 or 3 digits. Find the following (a)The total number of passwords that can be formed. (b)The number of passwords in which no digit repeats	8	K3	CO2
17.	There are six men and five women in a room. Find the number of ways four persons can be drawn from the room if (1) they can be male or female, (2) two must be men and two women, (3) they must all are of the same sex	8	K3	CO2
18.	How many positive integers less than 10,00,000 have the sum of their digits equal to 19?	8	K3	CO2
19.	a) In how many ways can 6 boys and 4 girls sit in a row? b) In how many ways can they sit in a row if the boys are to sit together and girls are sat together? c)In how many ways can they sit in a row if the girls are to sit together? d)In how many ways can they sit in a row if just the girls are to sit together?	8	K3	CO2
20.	How many permutations of the letters A, B, C, D, E, F, G contain a) the string BCD b) the string CFGA c)the strings BA and GF d)the strings ABC and DE e) the strings ABC and CDE f) the strings CBA and BED?	8	K3	CO2
21.	How many permutations can be made out of the letters of the word “Basic”? How many of these (i)Begin with B? (ii) End with C? (iii) B and C occupy the end places?	8	K3	CO2