UNIT – II COMBINATORICS

Unit - II / Part - A / MCQ				
Sl. No.	**Questions**	**Marks Split-up**	**K – Level**	**CO**
1.	If n is a positive integer, then a) $1+2+3+------+n=\frac{n(n+1)}{3}$ **b)** $1+2+3+-------+n=\frac{n(n+1)}{2}$ c) $1+2+3+-------+n=\frac{n(n+2)}{2}$ d) $1+2+3+-------+n=\frac{n(n+1)(2n+1)}{6}$	1	K2	CO2
2.	$2^n < n!$ is true for a) $n\geq 1$ b) $n\geq 2$ c) $n\geq 3$ **d)** $n\geq 4$	1	K2	CO2
3.	If x divides n^5-n for all $n\geq 1$ then x is a)4 b)7 **c)5** d)8	1	K2	CO2
4.	If x divides 3^n+7^n-2 for all $n\geq 1$ then x is **a)8** b)7 c)5 d)9	1	K2	CO2
5.	If y is a factor of a^n-b^n for all positive integers n then y is a) $a+b$ **b)** $a-b$ c) a^2+b^2 d) a^2-b^2	1	K1	CO2
6.	If A, B, C are not mutually Exclusive Events then, a) $\lvert A\cup B\cup C\rvert = \lvert A\rvert+\lvert B\rvert+\lvert C\rvert+\lvert A\cap B\rvert+\lvert A\cap C\rvert+\lvert B\cap C\rvert-\lvert A\cap B\cap C\rvert$ b) $\lvert A\cup B\cup C\rvert = \lvert A\rvert-\lvert B\rvert-\lvert C\rvert-\lvert A\cap B\rvert-\lvert A\cap C\rvert-\lvert B\cap C\rvert-\lvert A\cap B\cap C\rvert$	1	K1	CO2

	c)$\lvert A\cup B\cup C\rvert = \lvert A\rvert + \lvert B\rvert + \lvert C\rvert - \lvert A\cap B\rvert - \lvert A\cap C\rvert - \lvert B\cap C\rvert + \lvert A\cap B\cap C\rvert$ d)$\lvert A\cup B\cup C\rvert = \lvert A\rvert + \lvert B\rvert + \lvert C\rvert - \lvert A\cap B\rvert - \lvert A\cap C\rvert - \lvert B\cap C\rvert - \lvert A\cap B\cap C\rvert$			
7.	The number of integers between 1 and 250 both inclusive that are divisible by 2 and 3 is a)47 **b)41** c)38 d)45	1	K2	CO2
8.	If m pigeons are assigned to n pigeonholes, then there must be a pigeonhole containing at least **a)**$\left[\left(\frac{m-1}{n}\right)\right]+1$ **pigeons** b) $\left[\left(\frac{m-1}{n}\right)\right]-1$ pigeons c) $\left[\left(\frac{m+1}{n}\right)\right]+1$ pigeons d) $\left[\left(\frac{m-n}{n}\right)\right]+1$ pigeons	1	K1	CO2
9.	If $\lvert A\rvert = 6$, $\lvert B\rvert = 9$ and $\lvert A\cup B\rvert = 10$ then the value of $\lvert A\cap B\rvert$ is a)8 b)9 c)4 **d)5**	1	K2	CO2
10.	If 9 colours are used to paint 100 houses then at least how many houses will be of the same colour a)15 b)13 **c)12** d)14	1	K2	CO2
11.	How many ways can 10 students win a race? (a) 2! (b) 5! **(c)** 10! (d) 4!	1	K2	CO2
12.	How many ways can I arrange 5 books? (a) 25 (b) 10 **(c) 120** (d) 100	1	K2	CO2

13.	How many positive divisors does 2000 have? (a) 5 **(b) 20** (c) 30 (d) 10	1	K2	CO2
14.	How many distinguishable ways can the letters of COMPUTER be arranged? **(a)** 8! (b) 3! (c) 5! (d) 7!	1	K2	CO2
15.	How many distinguishable ways can the letters of DISCRETE be arranged? (a) 8! (b) 6! **(c)** $\frac{8!}{2}$ (d) $\frac{6!}{2}$	1	K2	CO2
16.	How many five-digit numbers can be made from the digits 1 to 7 if repetition is allowed? **(a) 16807** (b) 54629 (c) 26467 (d) 32354	1	K2	CO2
17.	There are 2 twin sisters among a group of 15 persons. In how many ways can the group be arranged around a circle so that there is exactly one person between the two sisters? **(a)** $15 \times 12! \times 2!$ (b) $15! \times 2!$ (c) $14C_2$ (d) $16 \times 15!$	1	K2	CO2
18.	There are 15 people in a committee. How many ways are there to group these 15 people into 3, 5, and 4? (a)846 (b) 2468 (c) 658 **(d) 1317**	1	K2	CO2
19.	In a multiple-choice question paper of 15 questions, the answers can be A, B, C or D. The number of different ways of answering the question paper are **(a)** 65536×4^7 (b) 194536×4^5 (c) 23650×4^9 (d) 11287435	1	K2	CO2
20.	Find the number of rectangles and squares in an 8 by 8 chess	1	K2	CO2

	board respectively. (a) 296,204 **(b) 1092,204** (c) 204,1092 (d) 204,1296			

Unit - II / Part - B / 2 Marks

Sl. No.	Questions	Marks Split-up	K – Level	CO
1.	State Generalized Pigeon Hole Principle.	2	K1	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	K1	CO2
9.	State the Well ordering Principle.	2	K1	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
12.	How many ways are there to select five players from a 10 member tennis team to make a trip match at another school?	2	K2	CO2
13.	Find the minimum number of students needed to make sure that 5 of them take the same engineering course CSE,IT,AIDS and Cyber Security.	2	K2	CO2
14.	In how many ways can 8 people sit around round table?	2	K2	CO2
15.	How many permutations are there in the word MISSISSIPPI?	2	K2	CO2
16.	A coin is tossed 10 times where each toss comes up with a head or tail. How many possible outcomes contain at least 3	2	K2	CO2

	tails?			
17.	How many integer solutions there $x + y + z = 15$ where $x, y, z \geq 0$.	2	K2	CO2
18.	How many integers solution are there $x + y + z = 20$ subjects to the constraints $x \geq -1, y \geq 0, z \geq 4$.	2	K2	CO2
19.	In how ways 5 men and 5 ladies dine at a round table if no two ladies sit together?	2	K2	CO2
20.	There are 12 identical balls consisting of 5 red balls, 4 black balls and 3 green balls. Find the number of ways the balls can be arranged in a row.	2	K2	CO2

Unit - II / Part - C / 10 Marks				
Sl. No.	**Questions**	**Marks Split-up**	**K – Level**	**CO**
1.	Prove by Mathematical Induction Method , $1 + 2 + 2^2 + 2^3 + \cdots + 2^{n-1} + 2^n = 2^{n+1} - 1$.	10	K3	CO2
2.	Use mathematical induction to prove that $\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \cdots + \frac{1}{(2n-1)(2n+1)} = \frac{n}{2n+1} \quad \forall\, n \geq 1$	10	K3	CO2
3.	Using mathematical induction, show that for all positive integers n, is $3^{2n+1} + 2^{n+2}$ divisible by 7.	10	K3	CO2
4.	Prove that $8^n - 3^n$ is a multiple of 5 by using method of induction.	10	K3	CO2
5.	Use Mathematical induction to prove that “Every positive integer $n \geq 2$ is either a prime or can be written as a product of primes”.	10	K3	CO2
6.	Prove by induction, for $n \geq 1$, $$\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$$	10	K3	CO2

7.	Use mathematical induction, to prove that inequality, $$2^n < n! \ \forall n \geq 4.$$	10	K3	CO2
8.	Prove that $n^3 - n$ is divisible by 3 for $n \geq 1$.	10	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.	10	K3	CO2
10.	Determine the number of positive integers n, $1 \leq n \leq 1000$ that are not divisible by any of the integer 2, 3, 5 but are divisible by 7.	10	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.	10	K3	CO2
12.	How many positive integers not exceeding 1000 are divisible by none of 3,7 and 11?	10	K3	CO2
13.	In a survey of 100 students, with respect to their choice of the ice cream flavours Vanila, Chocolate and Strawberry shows that 50 students like Vanila ,43 like Chocolate, 28 like Strawberry,13 like Vanila and Chocolate,11 like Chocolate and Strawberry,12 like Vanila and Strawberry , and 5 like all of them. Find the number of students who like (i) Vanila only (ii) Chocolate only (iii) Strawberry only.	10	K3	CO2
14.	(i) Prove that in any group of six people, there must be at least 3 mutual friends or at least 3 mutual enemies. (ii) State the generalized pigeonhole principle using this finds the minimum number of students in a class to be sure that at least 3 of them are born in the same month.	5+5	K3	CO2
15.	A computer password consists of a capital letter of English alphabet followed by 2 or 3 digits. Find the following (i)The total number of passwords that can be formed. (ii)The number of passwords in which no digit repeats.	10	K3	CO2
16.	There are six men and five women in a room. Find the number of ways four persons can be drawn from the room if (i) they can be male or female, (ii) two must be men and two women, (iii) they must all are of the same sex.	10	K3	CO2
17.	5 boys and 5 girls are to be seated in a row. In how many ways can they be seated if (i) the boys are together and the girls are together. (ii) No two girls are together. (iii) The boys and girls alternate.	10	K3	CO2
18.	How many permutations of the letters A, B, C, D, E, F, G contain i) the string BCD ii) the string CFGA iii)the strings BA and GF iv)the strings ABC and DE v) the strings ABC and CDE vi) the strings CBA and BED?	10	K3	CO2
19.	How many permutations can be made out of the letters of the word	10	K3	CO2

	"Basic"?. How many of these (i) Begin with B? (ii) End with C? (iii) B and C occupy the end places?			
20.	From a committee consisting of 6 men and 7 women, in how many ways can be select a committee of (i) 3 men and 4 women. (ii) 4 members which has at least one women. (iii) 4 persons that has at most one man. (iv) 4 persons of both sexes. (v) 4 persons in which Mr. and Mrs. Kannan is not included.	10	K3	CO2