QP CODE: 26019091

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Reg No : .....

Name : .....

M.Sc DEGREE (CSS) EXAMINATION, MARCH 2026

Fourth Semester

M Sc MATHEMATICS

ELECTIVE - ME800403 - COMBINATORICS

2019 Admission Onwards

CF1A9387

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. State the Addition Principle.Find the number of ways to choose a pair $\{a, b\}$ of disticnt numbers from the set $\{1, 2, 3, \ldots, 50\}$such that $|a - b| = 5$.
2. In how many ways can a committee of 5 be formed from a group of 11 people consisting of 4 teachers and 7 students if a particular teacher and a particular student cannot be both in the committee?
3. In how many ways can distribute r distinct objects into n distinct boxes , if each box can hold any number of objects and the ordering of object in each box is count?
4. If atleast kn+1 objects are disrtibuted among n boxes prove that there is a box contains atleast k+1 objects.
5. Using Pigeonhole principle prove that there must exist two different integers in an n+1 element subset A of {1,2,...,2n } such that n|(a-b)
6. FInd the number of integers in the set $\{11, 12, \ldots .400\}$ which are divisible by 3.
7. State General Principle of Inclusion and Exclusion.
8. Define derangement of N_n? Also find D_4
9. What you mean by convolution of two sequences (a_r) and (b_r)
10. Let a_r be the number of r-permutations of p identical objects. Then find the exponential generating function for (a_r)

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Define Q_r^n in the usual notation and obtain a formula for evaluating the same

12. Find the number of ways to pave a 1 X 7 rectangle using 1X1,1X2,1X3 blocks,assuming that blocks of same sizes are indistingushable

13. Prove that in a gathering of 6 people some three of them are either mutually acquaintances or completly strangers to one another

14. For any integers $p, q \geq 2$ Show that R(p,q)≤R(p-1,q)+R(p,q-1)

15. Using GPIE, find the number of non-negative integer solutions of the equation $x_1 + x_2 + x_3 = 15$ where $x_1 \leq 5, x_2 \leq 6, x_3 \leq 7$

16. Show that $\sum_{k=0}^{n} (-1)^k \binom{n}{k} (n-k)^n = n!$

17. Each of the 3 boys tosses a die once. Find the number of ways for them to get a total of 14.

18. A) Define a reccurence Relation,and solution of a reccurence relation.
    B) Solve the reccurence relation of Tower of Hanoi using method of backword substitution

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. A) A permutation $x_1 x_2 \ldots x_{2n}$ of the set {1,2,...,2n} is said to have property P if $|x_i - x_{i-1}| = n$ for some i. Show by an example that there are more permutations with property P than without. Also prove the result for an arbitrary value of n.
    B) Let $X = \{1, 2, \ldots, 99\}, Y = \{A \subset X \mid n \notin A\}, Z = \{A \subset X \mid n \in A\}$.Show by B.P that $|Y| = |Z|$

20. A)State Generalisation of Ramsay numbers
    B)Seventeen people corresponds by mail with one another-each one with all the rest.In their letters only three different topics are discussed.Each pair of correspondents deals with only one of the three topics.Prove that there are atleast three people who write to one another about the same topic

21. A) State simplest form of Principle of inclusion and exclusion for two finite sets ?.Extend and prove it for n finite sets
    B)A group of 102 students took examinations in Chinese, English and Mathematics. Among them 92 passed Chinese, 75 English and 63 Mathematics; atmost 65 passed Chinese and English, atmost 54 Chinese and Mathematics and atmost 48 English and Mathematics. Find the largest possible number of the the students that could have passed all the three subjects

22. A) Derive Binet Formula.
    B)Solve $a_n - 3a_{n-1} = 3.2^n - 4n$ *given that* $a_1 = 2$

(2×5=10 weightage)