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(FOR THE CANDIDATES ADMITTED **22PMS313**

DURING THE ACADEMIC YEAR 2021 ONLY)

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI
END-OF-SEMESTER EXAMINATIONS : NOVEMBER-2023

COURSE NAME: M.Sc.- MATHEMATICS **MAXIMUM MARKS: 50**
SEMESTER: III **TIME : 3 HOURS**

COMBINATORICS

SECTION - A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.
MULTIPLE CHOICE QUESTIONS. (K1)

1. $P(n,r) =$ ____

   (a) $\frac{n!}{(n-r)!}$ (b) $\frac{n!}{(n+r)!}$ (c) $\frac{n(n-1)}{2}$ (d) $n!$

2. Let S be a set of mn objects. Then S can be split up (partitioned) in to n sets of m elements in ____ ways

   (a) $\frac{mn}{(m!)(n!)}$ (b) $\frac{(mn)!}{(m!)(n!)}$ (c) $\frac{(m)^n!}{(m!)(n!)}$ (d) $\frac{(m)^n!}{(m!)^n(n!)}$

3. ____ is defined to be a tree in which vertex is of degree ≤ 3 _________.

   (a) Completed graph (b)Partitioned graph (c) simple tree (d) binary tree

4. An $n \times n$ matrix is a Hadamard matrix of order n if $a_{ij} = \pm 1$ for each i, j and ____.

   (a) $A A^1 = nI$ (b) $A A^T = nI$ (c) $A A^{-1} = nI$ (d) $A A^2 = nI$

5. If X and Y are row vectors of G then $X . Y$ is _____.

   (a) 0 (b) odd (c) even (d) ∞

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)

6. There are five seats in a row available, but 12 people to chose from . how many different seatings are possible ?
7. Write any one property of the Latin squares.
8. Write the recursion relation of the form .
9. Write the inclusion –Exclusion principle for tree variables.
10. Explain $w(x+y) = w(x) + w(y) - 2xy$

SECTION – B (5 X 3 = 15 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11. a) 30 girls , including Miss U.K enter a Miss world competition. The first 6 places are announced
(a) How many different announcements are possible?
(b) How many if Miss UK is assured of a Place in the first six?

(OR)

b) Prove that $\binom{n}{r} = \binom{n-1}{r-1} + \binom{n-1}{r}$

(CONTD……2)

12.a) State and prove marriage theorem .

(OR)

b) If $r < n$ any $r \times n$ Latin rectangle can be extended to an $(r+1) \times n$ Latin rectangle

13.a) Solve $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ given that $a_1 = 2,\ a_2 = 6\ , a_3 = 20$

(OR)

b) n-digit integer sequences are to be formed Using only the integers 0,1,2,3.

(a) How many n-digit sequences are there ?

(b) How many n-digit sequences have an odd number of 0s?

14.a) Analyze the number of permutations of n symbols in which no symbols is in a forbidden position is $\sum_{k=0}^{n} (-1)^k (n-k)!\, r_k$ where r_k is the number of ways of placing k- non taking rooks on to board of forbidden positions.

(OR)

b) Prove that there are no integers a,b,c such that $a^2 + b^2 = 6c^2$, apart from $a = b = c = 0$

15.a) Prove that the minimum weight of code words of g_{24} is 8

(OR)

b) Prove that the code words of weight in 8 in g_{24} yield an $S(5,8,25)$

SECTION - C (5 X 5= 25 MARKS)

ANSWER ANY FIVE OUT OF SIX QUESTIONS

(16th QUESTION IS COMPULSORY AND ANSWER ANY THREE QUESTIONS (FROM Qn. No : 17 to 21) (K4 (Or) K5)

16. State and prove Binomial theorem.

17. If a graph as 2n vertices , each of degree $\geq n$ ten the rap as perfect matching .

18. Prove that $f(n,k) = \binom{n+k-1}{k}$.

19. State and prove Fishers theorem.

20. In $S(5,8,24)$.

(a) The number of octads is 759

(b) each elements of B lies in 253 octads

(c) Each pair of elements lies in 77 octads

(d) Each triple of elements lies in 21 octads

(e) Each tetrad of elements (Each four elements subset of B) lies in 5 octals

(f) Each quintuple of elements lies in just 1 octad

21. An $S(2,3,n)$ S exists for each $n \equiv 1$ or 3 (mod 6)

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