(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2021 ONLY) **(NO.OF PAGES: 2)**

21 PMS 313

REG. NO.

N.G.M COLLEGE (AUTONOMOUS): POLLACHI
END-OF-SEMESTER EXAMINATIONS : NOVEMBER - 2022
M.Sc. - MATHEMATICS **MAXIMUM MARKS: 70**
III SEMESTER **TIME: 3 HOURS**

PART III
21PMS313 - COMBINATORICS
SECTION – A **(10 X 1 =10 MARKS)**

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

1. P (n, r) = _____.
   a) $\frac{np}{r!}$ b) $\frac{n!}{(n-r)!}$ c) $\frac{n!}{(n+r)!}$ d) $\frac{np!}{(n-r)!}$

2. The graph which has a pairing off of all the vertices is_____.
   a) Complete b) Assignment c) edges d) bipartite

3. A simple tree is defined to be a tree with each vertex of degree _____.
   a) $=3$ b) $=4$ c) ≤ 4 d) ≤ 3

4. No two octads can intersect in exactly _____ elements.
   a) 1 b) 2 c) 3 d) 4

5. In Hadamard matrix, AA' = _____.
   a) A'A b) IA' c) AI d) nI

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

6. Evaluate P (7, 4).
7. State Assignment theorem.
8. Define simple network.
9. Write the inclusion – Exclusion principle for three sets.
10. Define Hadamard matrix.

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(CONTD…..2)

SECTION –B (5 X 4 = 20 MARKS)

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

11. a) Solve the recurrence relation $a_n = na_{n-1}$, subject to the condition $a_1 = 1$.

(OR)

b) How many solutions are there in non-negative integers of

(i) $x+y+z=8$

(ii) $x+y+z+w=18$?

12. a) 10 people meet and form 5 pairs. In how many ways can these 5 pairs be formed?

(OR)

b) State and prove the Harem Theorem.

13. a) If a_n denotes the nth Fibonacci number then show that $a_{n+2} = a_n + a_{n-1} + \cdots + a_1 + 2$

(OR)

b) Find a_4 and check the answer by writing down all the possible derangements of 1234.

14. a) Find the rook polynomial for an ordinary 4 X 4 board.

(OR)

b)Explain Leech's Lattice.

15. a) Show that there is no finite projective plane of order 6.

(OR)

b) Prove that the weight of each code word of G24 is a multiple of 4.

SECTION –C (4X10 = 40 MARKS)

ANSWER ANY FOUR OUT OF SIX QUESTIONS

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

16. Prove that $\binom{n}{r} = \binom{n-1}{r-1} + \binom{n-1}{r}$. (K4)

17. Prove that exp(x).exp(y)=exp(x+y) using binomial theorem (K4)

18. State and prove exchange property (K4)

19. Obtain the recurrence relation (K5)

$U_n = U_{n-1} + U_1 U_{n-2} + U_2 U_{n-3} + \ldots + U_{n-2} U_1$

20. If *E*, *F are* octads and $E \cap F = \phi$ then show that $(E+F)^1$ is also an octad. (K4)

21. If *A* is square $(0,1)$ matrix and if *A* satisfies $AA' = (k-\lambda)I + \lambda J$ with $k > \lambda$ then provethat $AA' = (k-\lambda)I + \lambda J$ (K4)

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