

Time : 3 Hrs.

Max. Marks : 100

**General Instructions:**

1. All questions are compulsory
2. The question paper consists of 26 questions.
3. Section A consists of 06 questions of 1 mark each.
4. Section B consists of 13 questions of 4 marks each.
5. Section C consists of 7 questions of 6 marks each.
6. Question No 21 is a graph based question.
7. Use of calculator is not permitted.
8. Try to attempt questions in serial order.

Write your email id.....

**SECTION - A**

1. What is the value of  $\sin 31\frac{\pi}{3}$ ?
2. Let  $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$  Define a relation R from A to A by  $R = \{(x, y) : 2x - y = 0, \text{ Where } x, y \in A\}$
3. Write the domain of the function  $f(x) = \frac{x+1}{x^2+6x+5}$ .
4. Let  $f(x) = \begin{cases} x+3 & \text{if } x < 1 \\ 4x-2 & \text{if } 1 \leq x \leq 4 \\ x^2+5 & \text{if } x > 4 \end{cases}$  find  $f(-1), f(3)$ .
5. Find the angle between two streets in a town given by  $11x + 7y + 19 = 0$  and  $7x - 11y + 23 = 0$
6. An Income Tax officer is free to visit 4 cities A, B, C, D in any order he likes. What is the probability that he visits in the reverse order D, C, B and A?

**SECTION - B**

7. In any  $\Delta ABC$ , prove that
 
$$\frac{a^2 + b^2}{a^2 + c^2} = \frac{1 + \cos(A - B)\cos C}{1 + \cos(A - C)\cos B}$$
8. For every positive integer n, prove that  $7^n - 3^n$  is divisible by 4

OR

Using PMI prove that

$$1^2 + 3^2 + 5^2 + \dots + (2n-1)^2 = \frac{n(2n-1)(2n+1)}{3} \quad \forall n \in \mathbb{N}$$

M[1]

9. If  $|z| = 1$ , then prove that  $\frac{z-1}{z+1}$  ( $z \neq -1$ ) is a pure imaginary number.

10. Solve the equation

$$3\cos^2x - 2\sqrt{3}\sin x \cos x - 3\sin^2x = 0$$

OR

In any  $\Delta ABC$  prove that  $a\cos A + b\cos B + c\cos C = 2a\sin B \cdot \sin C$ .

11. In how many ways 4 Indian and 4 Pakistani Army Generals can be seated at a round table so that no two Indian Generals may be together?

(ii) If two leaders representing each country desire to sit together without any restriction on the other officers, find the number of seating arrangements?

12. If the sum of an infinite geometric series is 15 and the sum of the squares of these terms is 45. Find the series.

OR

If the sum of first  $p$  terms of an A.P. is equal to the sum of the first  $q$  terms, then find the sum of the first  $(p + q)$  terms.

13. Find the image of the point  $P(-8, 12)$  with respect to the line mirror  $4x + 7y + 13 = 0$

14. Find the vertex, focus, directrix and Latus rectum of the parabola  $y^2 - 4x = 4y$

OR

Find the equation of the circle concentric with the circle  $x^2 + y^2 - 4x - 6y - 9 = 0$  and passing through the point  $(-4, -5)$

15. Find the ratio in which  $yz$  plane divides the line segment joining the points  $(-2, 4, 7)$  and  $(3, -5, 8)$ ?

16. Evaluate :-

(a)  $\lim_{x \rightarrow 0} \frac{(x+1)^5 - 1}{x}$

(b)  $\lim_{x \rightarrow \pi} \frac{\sin(\pi - x)}{\pi(\pi - x)}$

17. Find the derivative of  $f(x) = \tan x$ , using first principle.

18. Out of 100 students, two sections of 40 and 60 are formed. If you and your friend are among the 100 students. What is the probability that

(a) You both enter the same section?

(b) You both enter the different section?

19. Write the contra positive and converse of the following statements.

(a) If  $x$  is a prime number, then  $x$  is odd.

(b) Something is cold implies that it has low temperature.

M[2]

**SECTION - C**

20. Prove that :  $\cos 2x \cos \frac{x}{2} - \cos 3x \cos \frac{9x}{2} = \sin 5x \sin \frac{5x}{2}$

OR

If  $\tan x = \frac{3}{4}, \pi < x < 3\frac{\pi}{2}$ , find the value of  $\sin \frac{x}{2}, \cos \frac{x}{2}$ , and  $\tan \frac{x}{2}$ .

21. (i) Solve the inequality for real x.

$$37 - (3x + 5) \geq 9x - 8(x - 3)$$

(ii) Solve the following system of inequalities graphically :

$$2x - y > 1$$

$$x - 2y < -1$$

22. In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random find the probability that.

(i) the student opted for NCC or NSS.

(ii) the student has opted neither NCC nor NSS.

(iii) the student has opted NSS but not NCC.

23. Find the coefficient of  $x^5$  in the expansion of the product  $(1 + 2x)^6 (1 - x)^7$

OR

Show that the middle term in the expansion of  $(1 + x)^{2n}$  is.

$$\frac{1.3.5 \dots (2n-1)}{n!} 2^n x^n \text{ where } n \text{ is a positive integer.}$$

24. (i) Let the sum of  $n, 2n, 3n$  terms of an AP be  $S_1, S_2$  and  $S_3$  respectively. Show that  $S_3 - 3(S_2 - S_1)$ .

(ii) Find the sum of  $n$  terms of the sequence 8, 88, 888, 8888, .....

25. In a survey it is found that 105 people take pan-masala, 130 take gutka and 145 take opium. If 70 people take pan-masala as well as gutka, 75 take gutka as well as opium, 60 take pan-masala as well as opium and 40 take all the three. Find how many people are surveyed? How many take opium only? All the three are dangerous for health. What should be done to get rid of such harmful products?

26. Calculate mean, Variance and standard deviation for the following distribution.

Classes	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	3	7	12	15	8	3	2

**M[3]**