

SUBJECT : MATHEMATICS (SET-II)

Time : 3 Hrs.

M.M.: 100

General Instructions :

- (i) All questions are compulsory.
- (ii) Question Nos. 1 to 6 are of 1 mark each.
- (iii) Question Nos. 7 to 19 are of 4 marks each.
- (iv) Question Nos. 20 to 26 are of 6 marks each.
- (v) Use of calculators is not permitted.

SECTION-A

- Q1. Find the domain of the function $f(x) = \frac{x^2 + 3x + 5}{x^2 - 5x + 4}$
- Q2. Find $\sin \frac{x}{2}$ if $\tan x = \frac{-4}{3}$, x lies in second quadrant.
- Q3. Evaluate : $\lim_{x \rightarrow 0} \frac{\sin 2x}{x}$
- Q4. Find n if $P(n, 4) = 20P(n, 2)$
- Q5. Find the coefficient of a^5b^7 in the expansion of $(a - 2b)^{12}$.
- Q6. There are 15 points in a plane, no three of which are in the same straight line except four which are collinear. Find the number of straight lines.

SECTION-B

- Q7. (a) Find the derivative of $\frac{2\sqrt{x} - 1}{\sqrt{x}}$
- (b) Using Binomial Theorem, find the value of $(103)^5$.
- Q8. Prove that $\cos 5x = 16\cos^5 x - 20\cos^3 x + 5\cos x$
- Q9. Find the domain and the range of $f(x) = \frac{x^2}{1 + x^2}$
- Q10. Find the derivative of the function $f(x) = \frac{x^5 - \cos x}{\sin x}$

- Q11. Prove that :
 $\sin 3x + \sin 2x - \sin x = 4 \sin x \cos \frac{x}{2} \cos \frac{3x}{2}$
- Q12. Solve the following inequality, and graph the solution set on the number line :
 $2y - 3 < y + 2 \leq 3y + 5$
- Q13. Find the term independent of x in the expansion of
 $\left(\sqrt{x} + \frac{1}{2\sqrt{x}} \right)^{18}, x > 0$
- Q14. Out of 6 boys and 4 girls, a committee of 5 is to be formed. In how many ways can this be done if atleast 2 girls are included? Should girls be given equal rights? What values are being promoted?
- Q15. A wheel of a motor is rotating at 1200 revolutions per minute. If the radius of the wheel is 35 cm, what linear distance does a point of its rim transverse in 30 seconds? What steps should be taken to discourage reckless driving?
- Q16. Prove that $7^{2n} + 2^{3n-3} 3^{n-1}$ is divisible by 25, for all $n \in \mathbb{N}$ using principle of mathematical induction.
- Q17. Find the derivative of $f(x) = \cot x$ using first principle.
- Q18. Using properties of sets prove the following :
 (i) $(A \cap B) \cup (A - B) = A$
 (ii) $A \cup (B - A) = A \cup B$
- Q19. Let S be a relation on $\mathbb{Z}$ defined by $S = \{(a, b) : b = |a - 1|, a \in \mathbb{Z} \text{ and } |a| \leq 3\}$.
 (i) Write S in roster form.
 (ii) Depict this relation using an arrow diagram.
 (ii) Write down the range and codomain of S .

SECTION-C

- Q20. Solve the following equation : $\sin 2x - \sin 4x + \sin 6x = 0$

- Q21. By principle of Mathematical Induction, prove that for all $n \in \mathbb{N}$

$$\frac{1}{2.5} + \frac{1}{5.8} + \dots + \frac{1}{(3n-1)(3n+2)} = \frac{n}{6n+4}$$

- Q22. Solve the following system of inequalities graphically :

$$3y - 2x \leq 4, \quad x + 3y > 3, \quad x + y \geq 5, \quad y < 4$$

- Q23. If the 2nd, 3rd and 4th terms in the expansion $(x + a)^n$ are 240, 720 and 1080 respectively, find the values of x , a and n .

- Q24. In a survey of 25 people, it was found that 15 buy newspaper A, 12 buy newspaper B and 11 buy newspaper C, 5 buy newspaper A and C, 9 buy newspaper A and B, 4 buy newspaper B and C and 3 buy all the three newspapers. Find the number of people that buy

- (i) only newspaper C
- (ii) only newspaper A
- (iii) only newspaper B
- (iv) atleast one of the three newspapers.

Name few newspapers in India. Explain the role of media in democracy.

- Q25. In how many ways can the letters of the word PERMUTATIONS be arranged such that (i) word start with P and end with S; (ii) all vowels together; (iii) P comes before S and there are always 4 letters between P and S; (iv) there are four letters between P and S.

- Q26. Evaluate (any two):

(i) $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - 1}{x}$

(ii) $\lim_{x \rightarrow 0} \frac{\cos 2x - 1}{\cos x - 1}$

(iii) $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\tan 2x}{x - \frac{\pi}{2}}$