

Q22. Find the n th term of the series $3 + 7 + 13 + 21 + 31 + \dots$ and hence find the sum of first n terms.

Q23. Find the image of the point $(3, 8)$ with respect to the line $x + 3y = 7$, assuming the line to be a plane mirrors.

OR

Find the equations of the lines through the point $(3, 2)$ which make an angle of 45° with the line $x - 2y = 3$.

Q24. (a) Evaluate the limit $\lim_{x \rightarrow 0} \frac{2\sin x - \sin 2x}{x^3}$

(b) Find the derivative of $\frac{x^5 - \cos x}{\sin x}$ (3+3)

Q25. 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 |

Q26. On her vacations Veena visits four cities (A, B, C and D) in a random order. What is the probability that she visits

- (i) A before B?
- (ii) A before B and B before C?
- (iii) A first and B last?

Summer vacations gives one an opportunity to go out and explore places. Do you think one should take a break from the monotonous routine and go out to enjoy. Do you agree? Why/why not?

OR

Find the probability that when a hand of 7 cards is drawn from a well shuffled deck of 52 cards, it contains (i) all Jacks (ii) 3 Jacks (iii) atleast 3 Jacks. Playing cards for money is bad habit. Explain.

SUBJECT : MATHEMATICS (SET-I)

Time : 3 Hrs.

M.M.: 100

General Instructions :

- (i) All questions are compulsory.
- (ii) The question paper consists of 26 questions divided into three sections A, B and C. Section-A comprises of 6 questions of one mark each. Section-B comprises of 13 questions of 4 marks each and Section-C comprises of 7 questions of 6 marks each.
- (iii) All questions in Section-A are to be answered in one word, one sentence or as per the exact requirement of the question.
- (iv) There is no overall choice. However, internal choice has been provided in two questions of 4 marks each and two questions of 6 marks each.
- (v) Use of calculators is not permitted.

SECTION-A

- Q1. If $U = \{\text{all digit is our number system}\}$ and $A = \{x : x \text{ is a multiple of } 3\}$ then write $n(A)$.
- Q2. Find the modulus and arguments of $z = -\sqrt{3} + i$
- Q3. Solve $\frac{2x+1}{3} \geq \frac{3x-2}{5}, x \in \mathbb{R}$
- Q4. Find the values of k for which the line, $(K-3)x - (4-K^2)y + K^2 - 7K + 6 = 0$ is parallel to y-axis.
- Q5. Write the contrapositive of the following statement. If two lines are parallel, then they do not intersect in the same plane.
- Q6. Find the equation fo the parabola with vertex at origin and directrix is the line $y + 3 = 0$

SECTION-B

Q7. If $P(A) = P(B)$, show that $A = B$.

Q8. Find the domain and range of $\frac{x}{1+x^2}$

Q9. Prove by using Principle of mathematical induction $\forall n \in \mathbb{N}$

$$\frac{1}{3.5} + \frac{1}{5.7} + \frac{1}{7.9} + \dots + \frac{1}{(2n+1)(2n+3)} = \frac{n}{3(2n+3)}$$

Q10. How many numbers greater than 1000000 can be formed by using the digits 1, 2, 0, 2, 4, 2, 4?

Q11. A committee of 8 persons is to be formed from 7 men and 5 women. In how many ways can this be done if atleast 3 women have to be included in the committee? In how many of these (i) the women are in majority. (ii) men are in majority? Should women be given equal rights? What values are being promoted?

Q12. The Coefficients of the $(r-1)$ th, r th and $(r+1)$ th terms in the expansion of $(x+1)^n$ are in the ratio 1:3:5 find n and r .

Q13. Find a if the 17th and 18th terms of the expansion $(2+a)^{50}$ are equal.

Q14. If $a \left(\frac{1}{b} + \frac{1}{c} \right)$, $b \left(\frac{1}{c} + \frac{1}{a} \right)$, $c \left(\frac{1}{a} + \frac{1}{b} \right)$ are in A.P., Prove that a, b, c are in A.P.

OR

If the p th, q th and the r th terms of a G.P. are a, b, c respectively, Prove that $a^{q-r} b^{r-p} c^{p-q} = 1$

Q15. Find the distance of the line $4x + 7y + 5 = 0$ from the point $P(1, 2)$ along the line $2x - y = 0$.

Q16. Find the equation of a circle concentric with the $2x^2 + 2y^2 - 6x + 8y + 1 = 0$ and of double its area.

OR

Find the equation of the ellipse with centre at origin, major axis on the x -axis and passing through the points $(4, 3)$ and $(6, 2)$.

Q17. Find the ratio in which the line segment joining the points $(4, 8, 10)$ and $(6, 10, -8)$ is divided by the YZ -plane.

Q18. Two students Anil and Ashima appeared in an examination. The probability that Anil will qualify the examination is 0.05 and that Ashima will qualify the examination is 0.10. The probability that both will qualify the examination is 0.02. Find the probability that

- (a) Both Anil and Ashima will not qualify the examination
- (b) Atleast one of them will not qualify the examination and
- (c) Only one of them will qualify the examination.

Some students study throughout the year some do late night studies before exams. Do you think to qualify a exam it is a right procedure. Justify.

Q19. Prove that $2\cos \frac{\pi}{13} \cos \frac{9\pi}{13} + \cos \frac{3\pi}{13} + \cos \frac{5\pi}{13} = 0$

OR

In any ΔABC , prove that

$$a \sin (B - C) + b \sin (C - A) + c \sin (A - B) = 0$$

SECTION-C

Q20. Solve the equation : (3+3)

(a) $2 \cos^2 x + 3 \sin x = 0$

(b) If $\tan x = \frac{3}{4}$ and $x \in \text{III quadrant}$, find the value of $\sin x/2, \cos x/2$

Q21. Solve the following system of inequalities graphically :

$$2x + y \leq 24, x + y < 11, 2x + 5y \leq 40, x > 0, y \geq 0$$