Mathematics – XI

Time : 3 hr | Max Marks : 80

GENERAL INSTRUCTIONS

1. This question paper contains two parts A & B, each part is compulsory. $Part\ A$ carries 24 marks and $Part\ B$ carries 56 marks
2. $Part - A$ has Objective Type Questions and $Part - B$ has Descriptive Type Questions
3. Both $Part\ A$ and $Part\ B$ have choices.

PART – A

1. It consists of two sections $Sections - I$ & $Sections - II$
2. $Sections - I$ comprises of 16 very short answer type questions.
3. $Sections - II$ contains 2 case studies. Each case study comprises of 5 case-based $MCQs$. An examinee is to attempt any 4 out of 5 $MCQs$.

PART – B

1. It consists of three sections $Sections - III$, $Sections - IV$ & $Sections - V$
2. $Sections - III$ comprises of 10 questions of 2 marks each.
3. $Sections - IV$ comprises of 7 questions of 3 marks each.
4. $Sections - V$ comprises of 3 questions of 5 marks each.
5. Internal choice is provided in 4 questions of $Sections - I$, 2 questions of $Sections - III$, 2 questions of $Sections - IV$ & 2 questions of $Sections - V$. An examinee has to attempt only one of the alternatives in all such questions.

PART – A **SECTION – I**

All questions are compulsory. In case of internal choices attempt any one.

Q. 1. Evaluate: $[-1\ \ 6[-]2\ \ 8]$

Q. 2. Show that $A \not\subset B$ & $B \not\subset C$ need not imply $A \not\subset C$.

OR

Write the set $A = \{-1, 1, 2\}$ in set builder form.

Q. 3.State $g(x) = \begin{cases} x^2\ ; 0 \le x \le 3 \\ 3x\ ; 3 \le x \le 10 \end{cases}$ is a function or relation? Justify.

Q. 4. Find the argument of the complex number $-2i$.

Q. 5. Evaluate : $(i^{18} + i^{-25})^3$

OR

Find the number of non-zero integral solutions of the equation $|1 - i|^x = 2^x$

Q. 6. Solve the inequation : $\frac{2x+4}{x-1} \ge 5;\ x \in R$

Q. 7. Find n, if $P(n,5) = 42P(n,3)$

OR

In how many ways can 5 girls and 3 boys be seated in a row so that no two boys are together?

Q. 8. Find the sum of integers between $1\ to\ 100$ that are divisible by $2\ or\ 5$.

Q. 9. Find the fixed point from which the line $ax + by + c = 0$ will pass through, if a, b, c are in $A.P.$

Q. 10. The base of an equilateral triangle with side $2a$ lies along the y-axis such that the mid-point of the base is at the origin. Find vertices of the triangle.

OR

Point $R(h, k)$ divides a line segment between the axes in the ratio $1: 2$. Find equation of the line.

Q. 11. Find the image of the point $(3, 2, -1)$ if $z - axis$ is the mirror.

Q. 12. Three vertices of a parallelogram $ABCD$ are $A(3, -1, 2)$, $B\ (1, 2, -4)$ & $C(-1, 1, 2)$. Find the coordinates of the fourth vertex.

Q. 13. If $y = x^3 . e^x . \sin x$, find $\frac{dy}{dx}$

Q. 14. Evaluate: $\lim_{x\to 5} \left\{\frac{e^x - e^5}{x - 5}\right\}$

Q. 15. If a leap year is selected at random, what is the chance that it will contain 53 tuesdays?

Q. 16. Given that the events A and B are such that $P(A) = 0.6$ & $P(B) = p$. Find p if A and B are mutually exclusive and exhaustive events.

SECTION – II

Both the Case study based questions are compulsory. Attempt all sub parts from each question $Q.17$ and $Q.18$. Each question carries 1 mark

Q. 17. A square is drawn by joining the mid points of the sides of a given square. A third square is drawn inside the second square in the same way, and this process continues indefinitely. If a side of the first square is $16\ cm$. Answer the following:

(i) Find the sum of the areas of the squares.

$(a)\ 256\ cm^2$ $(b)\ 512\ cm^2$ $(c)\ 1024\ cm^2$ (d) *none of these*

(ii) Find the sum of the perimeters of the squares.

$(a)\ 128\ cm$ $(b)\ 32\ cm$ $(c)\ 256\ cm$ (d) *none of these*

(iii) Find the area of the third squares.

$(a)\ 4\ cm^2$ $(b)\ 64\ cm^2$ $(c)\ 16\ cm^2$ (d) *none of these*

(iv) Find the perimeter of fourth square.

$(a)\ 16\ cm$ $(b)\ 32\ cm$ $(c)\ 64\ cm$ (d) *none of these*

Q. 18. If the lines $4x - 3y + 12 = 0$ and $3x + 4y = 16$ are tangents to a circle at the points $(-3, 0)$ and $(4, 1)$ respectively. Answer the followings:

(i) Find the center of circle.

$(a)\ (1, 3)$ $(b)\ (-1, 3)$ $(c)\ (1, -3)$ (d) *none of these*

(ii) Find the radius of circle

$(a)\ 5\ units$ $(b)\ \sqrt{5}\ units$ $(c)\ \sqrt{19}\ units$ (d) *none of these*

(iii) Find the point not on the circle

$(a)\ (4, -7)$ $(b)\ (5, 0)$ $(c)\ (-3, -6)$ (d) *none of these*

(iv) Find the equation of the circle

$(a)\ x^2 + y^2 - 2x - 6y - 15 = 0$ $(b)\ x^2 + y^2 + 2x + 6y + 5 = 0$

$(c)\ x^2 + y^2 - 2x + 6y - 15 = 0$ (d) *none of these*

PART – B

SECTION – III

Q. 19. A market research group conducted a survey of 1000 consumers and reported that 720 consumers like product A and 450 consumers like product B, what is the least number that must have liked both products?

Q. 20. Prove that : $\cot x . \cot 2x - \cot 2x . \cot 3x - \cot 3x . \cot x = 1$

Q. 21. Find the least positive real value of m if $\left(\frac{1+i}{1-i}\right)^m = 1$

Q. 22. If the different permutations of all the letter of the word $EXAMINATION$ are listed as in a dictionary, how many words are there in this list before the first word starting with E?

Q. 23. A $G.P.$ consists of an even number of terms. If the sum of all the terms is 5 times the sum of terms occupying odd places, then find its common ratio.

OR

If $\dfrac{a^{n+1} + b^{n+1}}{a^n + b^n}$ is the $G.M$ between the two numbers a & b. Then find the value of n.

Q. 24. A ray of light passing through the point $(1, 2)$ reflects on the $x-axis$ at the point A and the reflected ray passes through point $(5, 3)$, then find the coordinate of the point A

Q. 25. Find the equation of the circle passing through origin and making intercepts a & b on the coordinate axes.

Q. 26. If $y = \frac{x}{\sin^n x}$, find $\frac{dy}{dx}$

OR

Evaluate: $\lim\limits_{x \to 1} \left\{\frac{x-2}{x^2 - x} - \frac{1}{x^3 - 3x^2 + 2x}\right\}$

Q. 27. A plumber can be paid under two schemes given as,

$Scheme - I: Rs\ 600$ and $Rs.\ 50$ per hour & $Scheme - II: Rs.\ 170$ per hour.

If the job takes n hours, for what values of n does the scheme I gives the plumber better wages?

Q. 28. Find the equation of the set of points P, the sum of whose distances from $A(4,0,0)$ & $B(-4,0,0)$ is equal to 10.

SECTION – IV

Q. 29. Find the domain and range of the following functions: $f(x) = \frac{1}{\sqrt{16-x^2}}$

Q. 30. Solve the inequalities graphically: $x + y \le 200;\ 4x - y \le 0;\ x \ge 20;\ x, y \ge 0$

Q. 31. Find the number of words with or without meaning which can be made using all the letters of the word $SUCCESS$. If these words are written as in a dictionary, what will be the 50^{th} word?

Q. 32. Find $\lim_{x\to 0} f(x)$ and $\lim_{x\to 1} f(x)$ for the function $f(x) = \begin{cases} 2x+3 & ; x \le 0 \\ 3(x+1) & ; x > 0 \end{cases}$

OR

Using first principle, find derivative of the function $f(x) = x \sin x$

Q. 33. Find the equation of hyperbola having foci $(\pm 4, 0)$ and LLR is 12.

Q. 34. In a relay race there are five teams A, B, C, D & E. (i) What is the probability that A, B & C finish first, second and third, respectively. (ii) What is the probability that, A, B & C are first three to finish

Q. 35. If the first and the n^{th} term of a $G.P.$ are a & b, respectively, and if P is the product of n terms, prove that $P^2 = (ab)^n$

OR

If a, b, c, d and p are different real numbers such that,

$(a^2 + b^2 + c^2)p^2 - 2(ab + bc + cd)p + (b^2 + c^2 + d^2) \le 0$, then show that a, b, c & d are in $G.P.$

SECTION – V

Q. 36. 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

OR

The mean and standard deviation of 100 observations were calculated as 40 and 5.1, respectively by a student who took by mistake 50 instead of 40 for one observation. What are the correct mean and standard deviation?

Q. 37. Find the direction in which a line must be drawn through the point $(-1, 2)$ so that its point of intersection with the line $x + y = 4$ may be at a distance 3 $units$ from this point

Q. 38. Prove that : $\cos^4\left(\frac{\pi}{8}\right) + \cos^4\left(\frac{3\pi}{8}\right) + \cos^4\left(\frac{5\pi}{8}\right) + \cos^4\left(\frac{7\pi}{8}\right) = \frac{3}{2}$

OR

If, $\sin A + \sin B = a, \cos A + \cos B = b$, then prove that,

$(i)\ \sin(A+B) = \frac{2ab}{a^2+b^2}$ $\qquad (ii)\ \tan\left(\frac{A-B}{2}\right) = \frac{\sqrt{4-a^2-b^2}}{\sqrt{a^2+b^2}}$

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