



BLUE PRINT

Time Allowed : 3 hours

Maximum Marks : 80

S. No.	Chapter	VSA / Case based (1 mark)	SA-I (2 marks)	SA-II (3 marks)	LA (5 marks)	Total
1.	Relations and Functions	3(3) [#]	–	1(3)	–	4(6)
2.	Inverse Trigonometric Functions	–	1(2)	–	–	1(2)
3.	Matrices	2(2) [#]	–	–	–	2(2)
4.	Determinants	1(1)	1(2)*	–	1(5)*	3(8)
5.	Continuity and Differentiability	–	1(2)	2(6) [#]	–	3(8)
6.	Application of Derivatives	1(4)	1(2)	1(3)	–	3(9)
7.	Integrals	1(1)*	1(2)*	1(3)	–	3(6)
8.	Application of Integrals	1(1)	1(2)	1(3)	–	3(6)
9.	Differential Equations	1(1)	1(2)	1(3)*	–	3(6)
10.	Vector Algebra	3(3) [#]	1(2)*	–	–	4(5)
11.	Three Dimensional Geometry	2(2) [#]	1(2)	–	1(5)*	4(9)
12.	Linear Programming	–	–	–	1(5)*	1(5)
13.	Probability	2(2) + 1(4)	1(2)	–	–	4(8)
	Total	18(24)	10(20)	7(21)	3(15)	38(80)

*It is a choice based question.

[#]Out of the two or more questions, one/two question(s) is/are choice based.

MATHEMATICS

Time allowed : 3 hours

Maximum marks : 80

General Instructions :

1. This question paper contains two parts A and 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 internal choices.

Part - A :

1. It consists of two Sections-I and II.
2. Section-I comprises of 16 very short answer type questions.
3. Section-II contains 2 case study-based questions.

Part - B :

1. It consists of three Sections-III, IV and V.
2. Section-III comprises of 10 questions of 2 marks each.
3. Section-IV comprises of 7 questions of 3 marks each.
4. Section-V comprises of 3 questions of 5 marks each.
5. Internal choice is provided in 3 questions of Section-III, 2 questions of Section-IV and 3 questions of Section-V. You have to attempt only one of the alternatives in all such questions.

PART - A

Section - I

1. Find the magnitude of the vector $\vec{a} = 3\hat{i} - 2\hat{j} + 6\hat{k}$.

OR

Find the number of vectors of unit length perpendicular to both the vectors $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = \hat{j} + \hat{k}$.

2. Suppose that five good fuses and two defective ones have been mixed up. To find the defective fuses, we test them one-by-one, at random and without replacement. What is the probability that we are lucky and find both of the defective fuses in the first two tests?
3. State the reason for the relation R in the set $\{1, 2, 3\}$ given by $R = \{(1, 2), (2, 1)\}$ not to be transitive.

OR

Let R be the equivalence relation in the set $A = \{0, 1, 2, 3, 4, 5\}$ given by $R = \{(a, b) : 2 \text{ divides } (a - b)\}$. Write the equivalence class $[0]$.

4. Find the direction cosines of the line $\frac{4-x}{2} = \frac{y}{6} = \frac{1-z}{3}$.

5. If the matrix $A = \begin{bmatrix} 0 & a & -3 \\ 2 & 0 & -1 \\ b & 1 & 0 \end{bmatrix}$ is skew symmetric, then find the value of 'a' and 'b'.

OR

Write the element a_{23} of a 3×3 matrix $A = [a_{ij}]$ whose elements a_{ij} are given by $a_{ij} = \frac{|i-j|}{2}$.

6. If $\begin{vmatrix} x & \sin \theta & \cos \theta \\ -\sin \theta & -x & 1 \\ \cos \theta & 1 & x \end{vmatrix} = 8$, then find the value of x .

7. Find the value of $\int \frac{\sin^2 x - \cos^2 x}{\sin^2 x \cos^2 x} dx$.

OR

Evaluate : $\int_2^4 \frac{x}{x^2 + 1} dx$

8. Let $A = \{1, 2, 3\}$, $B = \{4, 5, 6, 7\}$ and let $f = \{(1, 4), (2, 5), (3, 6)\}$ be a function from A to B , state whether f is one-one or not.
9. If a line makes an angle θ_1 , θ_2 and θ_3 with the x , y and z -axes respectively, then find the value of $\cos 2\theta_1 + \cos 2\theta_2 + \cos 2\theta_3$.

OR

If the equation of a line AB is $\frac{x-3}{1} = \frac{y+2}{-2} = \frac{z-5}{4}$, then find the numbers to which direction ratios of a line parallel to AB , are proportional.

10. Find the order and degree of $y = px + \sqrt{a^2 p^2 + b^2}$, where $p = \frac{dy}{dx}$.
11. Find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.
12. Find the sum of the vectors $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = -2\hat{i} + 4\hat{j} + 5\hat{k}$ and $\vec{c} = \hat{i} - 6\hat{j} - 7\hat{k}$.
13. Check whether the relation R in the set \mathbb{R} of real numbers defined as $R = \{(a, b) : a < b\}$ is (i) symmetric, (ii) transitive.
14. If A is a square matrix such that $A^2 = A$, then show that $(I - A)^3 + A = I$.
15. Find the value of $P(A \cup B)$, if $2P(A) = P(B) = \frac{5}{13}$ and $P(A | B) = \frac{2}{5}$.
16. If $(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2 = 400$ and $|\vec{a}| = 4$, then find $|\vec{b}|$.

Section - II

Case study-based questions are compulsory. Attempt any 4 sub parts from each question. Each sub-part carries 1 mark.

17. Neelam and Ved appeared for first round of an interview for two vacancies. The probability of Neelam's selection is $1/6$ and that of Ved's selection is $1/4$.
Based on the above information, answer the following questions :



- (i) The probability that both of them are selected, is
 (a) $\frac{1}{12}$ (b) $\frac{1}{24}$ (c) $\frac{1}{6}$ (d) $\frac{1}{2}$
- (ii) The probability that none of them is selected, is
 (a) $\frac{2}{7}$ (b) $\frac{3}{8}$ (c) $\frac{5}{8}$ (d) $\frac{1}{3}$
- (iii) The probability that only one of them is selected, is
 (a) $\frac{5}{8}$ (b) $\frac{2}{3}$ (c) $\frac{2}{7}$ (d) $\frac{1}{3}$
- (iv) The probability that atleast one of them is selected, is
 (a) $\frac{3}{8}$ (b) $\frac{1}{8}$ (c) $\frac{3}{7}$ (d) $\frac{2}{7}$
- (v) Suppose Neelam is selected by the manager and told her about two posts P and Q for which selection is independent. If the probability of selection for post P is $\frac{1}{6}$ and for post Q is $\frac{1}{7}$, then the probability that Neelam is selected for at least one post, is
 (a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{3}{8}$ (d) $\frac{1}{2}$

18. Sonam wants to prepare a sweet box for Diwali at home. For making lower part of box, she takes a square piece of cardboard of side 18 cm.

Based on the above information, answer the following questions :

- (i) If x cm be the length of each side of the square cardboard which is to be cut off from corner of the square piece of side 18 cm, then x must lie in
 (a) $[0, 18]$ (b) $(0, 9)$
 (c) $(0, 3)$ (d) None of these
- (ii) Volume of the open box formed by folding up the cutting corner can be expressed as
 (a) $V = x(18 - 2x)(18 - 2x)$ (b) $V = \frac{x}{2} (18 + x)(18 - x)$
 (c) $V = \frac{x}{3} (18 - 2x)(18 + 2x)$ (d) $V = x(18 - 2x)(18 - x)$
- (iii) The values of x for which $\frac{dV}{dx} = 0$, are
 (a) 3, 2 (b) 0, 3 (c) 0, 9 (d) 3, 9
- (iv) Sonam is interested in maximising the volume of the box. So, what should be the side of the square to be cut off so that the volume of the box is maximum?
 (a) 13 cm (b) 8 cm (c) 3 cm (d) 2 cm
- (v) The maximum value of the volume is
 (a) 144 cm^3 (b) 232 cm^3 (c) 256 cm^3 (d) 432 cm^3



PART - B

Section - III

19. Differentiate $\sin^2 x$ w.r.t. $e^{\cos x}$.

20. Find $\int \frac{dx}{\sqrt{5-4x-2x^2}}$.

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Class 12

OR

Evaluate : $\int \frac{\sin 2x}{\sin\left(x - \frac{\pi}{3}\right)\sin\left(x + \frac{\pi}{3}\right)} dx$

21. Prove that the area enclosed between the x -axis and the curve $y = x^2 - 1$ is $\frac{4}{3}$ sq. units

22. Find the value of $\cos^{-1}\left(\frac{1}{2}\right) + 2\sin^{-1}\left(\frac{1}{2}\right)$.

23. If $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$, find $\vec{a} \times \vec{b}$ and $|\vec{a} \times \vec{b}|$.

OR

Prove by vector method that the area of ΔABC is $\frac{a^2 \sin B \sin C}{2 \sin A}$.

24. If A and B are events such that $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{4}$ and $P(A \cap B) = \frac{1}{12}$, then find $P(\text{not } A \text{ and not } B)$.

25. Show that the function $f(x) = 4x^3 - 18x^2 + 27x - 7$ is always increasing on R .

26. If the solution of the differential equation $\frac{dy}{dx} = \frac{ax + 3}{2y + f}$ represents a circle, then find the value of 'a'.

27. Find the vector equation of the line passing through the point $A(1, 2, -1)$ and parallel to the line $5x - 25 = 14 - 7y = 35z$.

28. If A is a non-singular 3×3 matrix such that $|5 \cdot \text{adj}A| = 5$, then find $|A|$.

OR

If there are two values of a which makes determinant, $\Delta = \begin{vmatrix} 1 & -2 & 5 \\ 2 & a & -1 \\ 0 & 4 & 2a \end{vmatrix} = 86$, then find the sum of these values.

Section - IV

29. Find the value of k , for which

$$f(x) = \begin{cases} \frac{\sqrt{1+kx} - \sqrt{1-kx}}{x}, & \text{if } -1 \leq x < 0 \\ \frac{2x+1}{x-1}, & \text{if } 0 \leq x < 1 \end{cases}$$

is continuous at $x = 0$.

30. Evaluate : $\int_0^{\pi/2} \sin 2x \tan^{-1}(\sin x) dx$

31. Differentiate the function $\log\left(\frac{a+b \sin x}{a-b \sin x}\right)$ with respect to x .

OR

Find $\frac{dy}{dx}$, when $y = \sqrt{a + \sqrt{a + \sqrt{a + x^2}}}$, where a is a constant.

32. Find area of the region in the first quadrant enclosed by the x -axis, the line $y = x$ and the circle $x^2 + y^2 = 32$.

33. If the equation of tangent at $(2, 3)$ on the curve $y^2 = ax^3 + b$ is $y = 4x - 5$, then find the values of a and b .

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34. Solve the differential equation :

$$(1+x^2)\frac{dy}{dx} + 2xy - 4x^2 = 0, \text{ subject to the initial condition } y(0) = 0.$$

OR

Find the particular solution of the differential equation $\frac{dy}{dx} = \frac{x(2\log x + 1)}{\sin y + y \cos y}$, given that $y = \frac{\pi}{2}$, when $x = 1$.

35. Show that the function $f: (-\infty, 0) \rightarrow (-1, 0)$ defined by $f(x) = \frac{x}{1+|x|}$, $x \in (-\infty, 0)$ is one-one and onto.

Section - V

36. Find the inverse of the matrix $A = \begin{bmatrix} 8 & 4 & 2 \\ 2 & 9 & 4 \\ 1 & 2 & 8 \end{bmatrix}$.

OR

If $A = \begin{bmatrix} 2 & 3 \\ 1 & -4 \end{bmatrix}$, $B = \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$, verify that $(AB)^{-1} = B^{-1} A^{-1}$.

37. Find the equation of the plane passing through the points $(2, 2, -1)$ and $(3, 4, 2)$ and parallel to the line whose direction ratios are 7, 0, 6.

OR

Consider the lines

$$L_1: \frac{x+1}{3} = \frac{y+2}{1} = \frac{z+1}{2}, L_2: \frac{x-2}{1} = \frac{y+2}{2} = \frac{z-3}{3}$$

Find the distance of the point $(1, 1, 1)$ from the plane passing through the point $(-1, -2, -1)$ and whose normal is perpendicular to both the lines L_1 and L_2 .

38. Solve the following LPP graphically.

$$\text{Maximize, } Z = 150x + 250y$$

Subject to the constraints

$$x + y \leq 35$$

$$1000x + 2000y \leq 50000$$

$$x, y \geq 0$$

OR

Find the number of point(s) at which the objective function $Z = 4x + 3y$ can be minimum subjected to the constraints $3x + 4y \leq 24$, $8x + 6y \leq 48$, $x \leq 5$, $y \leq 6$; $x, y \geq 0$.

