SAMPLE QUESTION PAPER

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	2(2)	–	1(3)	–	**3(5)**
2.	Inverse Trigonometric Functions	1(1)*	1(2)	–	–	**2(3)**
3.	Matrices	2(2)	–	–	1(5)*	**3(7)**
4.	Determinants	1(1)	1(2)	–	–	**2(3)**
5.	Continuity and Differentiability	1(1)*	1(2)	2(6)	–	**4(9)**
6.	Application of Derivatives	1(1)	2(4)	1(3)	–	**4(8)**
7.	Integrals	2(2)#	1(2)*	1(3)*	–	**4(7)**
8.	Application of Integrals	–	1(2)	1(3)	–	**2(5)**
9.	Differential Equations	1(1)	1(2)	1(3)*	–	**3(6)**
10.	Vector Algebra	1(4)	1(2)*	–	–	**2(6)**
11.	Three Dimensional Geometry	3(3)#	–	–	1(5)*	**4(8)**
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.

Subject Code : **041**

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. Evaluate : $\int \frac{dx}{\sqrt{x+1}+\sqrt{x+2}}$

OR

Evaluate : $\int \frac{dx}{\sqrt{2+4x-x^2}}$

2. If $A = \begin{bmatrix} 0 & 0 \\ x & 0 \end{bmatrix}$, then find A^{16}.

3. If an equation of the plane passing through the points (3, 2, –1), (3, 4, 2) and (7, 0, 6) is $5x + 3y - 2z = \lambda$, then find λ.

OR

Find the distance of the plane $2x - 3y + 4z - 6 = 0$ from the origin.

4. If $A = \{1, 2, 3\}$, $B = \{1, 4, 6, 9\}$ and R is a relation from A to B defined by 'x is greater than y'. Then find the range of R.

5. A box contains 3 orange balls, 3 green balls and 2 blue balls. Three balls are drawn at random from the box without replacement. Find the probability of drawing 2 green balls and one blue ball.

OR

If A and B are two events such that $P(A) = \frac{4}{5}$ and $P(A \cap B) = \frac{7}{10}$, then find $P(B|A)$.

6. Find the order and degree of $\frac{d^5y}{dx^5} + e^{dy/dx} + y^2 = 0$.

7. If $y = \tan^{-1}(\sqrt{3}) + \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$, then find $\frac{dy}{dx}$.

OR

Show that $f(x) = x^3$ is continuous at $x = 2$.

8. If a line makes angle α, β and γ with the coordinate axes, then find the value of $\cos 2\alpha + \cos 2\beta + \cos 2\gamma$.

9. Evaluate : $\operatorname{cosec}^{-1}(2/\sqrt{3})$

OR

Evaluate : $\sec^2(\tan^{-1} 2)$

10. Evaluate : $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$

11. If matrix $A = [a_{ij}]_{2 \times 2}$, where $a_{ij} = \begin{cases} 1 & \text{if} \quad i \neq j \\ 0 & \text{if} \quad i = j \end{cases}$ then find A^3.

12. If A and B are events such that $P(A) = 0.4$, $P(B) = 0.3$ and $P(A \cup B) = 0.5$, then find $P(B' \cap A)$.

13. How many one-one functions from set $A = \{1, 2, 3\}$ to itself are possible?

14. Write the direction cosines of the line segment joining the points $A(7, -5, 9)$ and $B(5, -3, 8)$.

15. If the area of a triangle with vertices $(-3, 0)$, $(3, 0)$ and $(0, k)$ is 9 sq. units, then find the value of k.

16. Find the interval on which $f(x) = 2x^3 - 6x + 5$ is a strictly increasing function.

Section - II

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

17. A graduate student is preparing for competitive examinations. The probabilities that the student is selected in competitive examination of B.S.F., C.D.S. and Bank P.O. are a, b and c respectively. Of these examinations, students has 70% chance of selection in at least one, 50% chance of selection in at least two and 30% chance of selection in exactly two examinations. Based on the above answer the following :

(i) The value of $a + b + c - ab - bc - ca + abc$ is

(a) 0.3 (b) 0.5 (c) 0.7 (d) 0.6

(ii) The value of $ab + bc + ac - 2abc$ is

(a) 0.5 (b) 0.3 (c) 0.4 (d) 0.6

(iii) The value of *abc* is

(a) 0.2 (b) 0.5 (c) 0.7 (d) 0.3

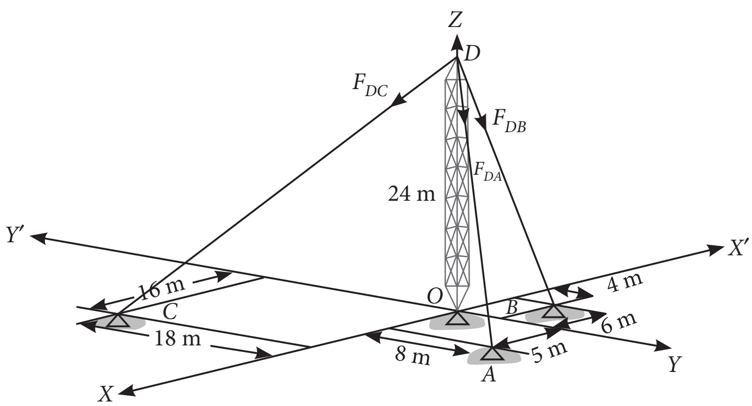
(iv) The value of *ab* + *bc* + *ac* is

(a) 0.1 (b) 0.9 (c) 0.5 (d) 0.3

(v) The value of *a* + *b* + *c* is

(a) 1.9 (b) 1.5 (c) 1.6 (d) 1.4

18. Consider the following diagram, where the forces in the cable are given.



Based on the above answer the following :

(i) The equation of line along the cable *AD* is

(a) $\frac{x}{5}=\frac{y}{8}=\frac{z-24}{24}$ (b) $\frac{x}{8}=\frac{y}{5}=\frac{z-24}{24}$ (c) $\frac{x}{5}=\frac{y}{8}=\frac{24-z}{24}$ (d) $\frac{x}{8}=\frac{y}{5}=\frac{24-z}{24}$

(ii) The length of cable *DC* is

(a) 43 m (b) 34 m (c) 54 m (d) 45 m

(iii) The vector *DB* is

(a) $-6\hat{i}+4\hat{j}-24\hat{k}$ (b) $6\hat{i}-4\hat{j}+24\hat{k}$ (c) $6\hat{i}+4\hat{j}+24\hat{k}$ (d) none of these

(iv) Find the sum of vectors along the cables.

(a) $15\hat{i}+6\hat{j}+72\hat{k}$ (b) $15\hat{i}-6\hat{j}-72\hat{k}$ (c) $15\hat{i}+6\hat{j}-72\hat{k}$ (d) none of these

(v) The sum of lengths, *i.e.*, *OA* + *OB* + *OC*, is

(a) $\sqrt{89}+\sqrt{52}+\sqrt{580}$ (b) $\sqrt{52}+\sqrt{580}+\sqrt{48}$ (c) $\sqrt{89}+\sqrt{560}+\sqrt{49}$ (d) none of these

PART – B

Section - III

19. Solve for x : $\cos(2\sin^{-1}x)=\frac{1}{9}$, $x>0$.

20. A man speaks truth in 75% cases. He throws a die and reports that it is a six. Find the probability that it is actually a six.

OR

Amit and Nisha appear for an interview in a company. The probability of Amit's selection is $\frac{1}{5}$ and that of Nisha's selection is $\frac{1}{6}$. What is the probability that only one of them is selected?

21. If $\tan^{-1}\left(\frac{y}{x}\right)=\frac{1}{2}\log(x^2+y^2)$, then prove that $\frac{dy}{dx}=\frac{x+y}{x-y}$.

22. Find the point on the curve $y = x^3 - 11x + 5$ at which the equation of tangent is $y = x - 11$.

23. Let $ABCD$ be the parallelogram whose sides AB and AD are represented by the vector $2\hat{i}+4\hat{j}-5\hat{k}$ and $\hat{i}+2\hat{j}+3\hat{k}$ respectively. If $\vec{a}$ is a unit vector parallel to $\overrightarrow{AC}$, then find $\vec{a}$.

OR

The vector $\hat{i}+x\hat{j}+3\hat{k}$ is rotated through an angle θ and doubled in magnitude, then it becomes $4\hat{i}+(4x-2)\hat{j}+2\hat{k}$. Find the value of x.

24. If $\left(\frac{2+\sin x}{1+y}\right)\frac{dy}{dx} = -\cos x,\ y(0) = 1,$ then find $y\left(\frac{\pi}{2}\right)$.

25. If $A = \begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}$, then find $|A|\ |\text{adj } A|$.

26. Find the area bounded by the curve $y = x^4$, x-axis and lines $x = -2$, $x = 2$.

27. Show that the function $f(x) = 3 - 4x + 2x^2 - \frac{1}{3}x^3$ is decreasing on R.

28. Evaluate : $\int \frac{1+\sin x}{1+\cos x}dx$

OR

If $I_1 = \int_e^{e^2} \frac{dx}{\log x}$ and $I_2 = \int_1^2 \frac{e^x}{x}dx$, then show that $I_1 = I_2$.

Section - IV

29. Prove that the derivative of $\tan^{-1}\left(\frac{\sqrt{1+(ax)^2}-1}{ax}\right)$ with respect to $\tan^{-1}\left(\frac{2x\sqrt{1-x^2}}{1-2x^2}\right)$ at $x = 0$ is $\frac{a}{4}$.

30. Find the intervals in which the function $f(x) = (x - 1)^3 (x + 2)^2$ is strictly increasing or strictly decreasing. Also, find the points of local maximum and local minimum if any.

31. Evaluate : $\int \frac{5x+3}{\sqrt{x^2+4x+10}}dx$

OR

Evaluate : $\int_0^{\pi} x\cos^2 x\,dx$

32. Using integration, find the area bounded by the ellipse $\frac{x^2}{4}+\frac{y^2}{25}=1$.

33. Show that $f : \mathbb{R} \to \mathbb{R}$, given by $f(x) = x - [x]$, is neither one-one nor onto.

34. Find the particular solution of $(x + y)dy + (x - y)dx = 0$, given that $y = 1$ when $x = 1$.

OR

Solve the differential equation : $xdy - ydx = \sqrt{x^2+y^2}\,dx$

35. If $f(x) = \begin{cases} 4 & , \text{ if } x \le -1 \\ ax^2+b, & \text{if } -1 < x < 0 \\ \cos x & , \text{ if } x \ge 0 \end{cases}$ is continuous. Find the value of a and b.

Section - V

36. If $A=\begin{bmatrix}1 & -1\\ 2 & -1\end{bmatrix}$ and $B=\begin{bmatrix}a & 1\\ b & -1\end{bmatrix}$ and $(A+B)^2 = A^2 + B^2$, then find the values of a and b.

OR

If $A=\begin{bmatrix}1 & 2 & 5\\ 1 & -1 & -1\\ 2 & 3 & -1\end{bmatrix}$, then find A^{-1}. Hence solve the following system of equations :

$x + 2y + 5z = 10$, $x - y - z = -2$, $2x + 3y - z = -11$

37. Solve the following Linear Programming Problem (LPP) graphically.

Maximize $Z = 20x + 10y$

Subject to constraints : $x + 2y \leq 28$; $3x + y \leq 24$; $x, y \geq 0$

OR

Solve the following Linear Programming Problem (LPP) graphically.

Maximize $Z = 4500x + 5000y$

Subject to constraints : $x + y \leq 250$; $25000x + 40000y \leq 7000000$; $x, y \geq 0$

38. Find the image of the point having position vector $\hat{i}+3\hat{j}+4\hat{k}$ in the plane $\vec{r}\cdot(2\hat{i}-\hat{j}+\hat{k})+3=0$.

OR

Find the coordinates of the points on the line $\frac{x-1}{1}=\frac{y-2}{2}=\frac{z-3}{3}$, which are at a distance of 1 unit from the point (1, 2, 3).

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