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(2)	–	–	**4(9)**
4.	Determinants	1(1)	–	–	1(5)*	**1(1)**
5.	Continuity and Differentiability	2(2)#	1(2)	2(6)#	–	**5(10)**
6.	Application of Derivatives	–	2(4)	1(3)	–	**3(7)**
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	1(1)* + 1(4)	–	–	–	**2(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.

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. If $y = x^x$, then find $\dfrac{dy}{dx}$.

OR

If $y = \log\left(\dfrac{x^2}{e^x}\right)$, then find $\dfrac{d^2y}{dx^2}$.

2. If $A = \begin{bmatrix} \cos x & -\sin x \\ \sin x & \cos x \end{bmatrix}$, then find AA^T.

3. Solve the differential equation $\sec x \, dy + \operatorname{cosec} y \, dx = 0$.

OR

Solve the differential equation $\dfrac{dy}{dx} + y = e^{-2x}$.

4. Check whether $f(x) = \dfrac{(4x+3)}{(3x+4)}$ is one-one or not.

5. Vectors drawn from the origin O to the points A, B and C are respectively $\vec{a}$, $\vec{b}$ and $4\vec{a} - 3\vec{b}$. Find $\overrightarrow{AC}$.

OR

If $|\vec{a}|=10, |\vec{b}|=2$ and $\vec{a}\cdot\vec{b}=12$, then find the value of $|\vec{a}\times\vec{b}|$.

6. If A and B are events such that $P(A) > 0$ and $P(B) \neq 1$, then find the value of $P(A' \mid B')$.

7. Evaluate : $\int \frac{2^x+3^x}{5^x}dx$

OR

Evaluate : $\int_0^{\pi/4} \sin 2x\, dx$

8. If $\Delta = \begin{vmatrix} 5 & 3 & 8 \\ 2 & 0 & 1 \\ 1 & 2 & 3 \end{vmatrix}$, then write the minor of the element a_{23}.

9. Find the distance between the planes $2x - y + 2z = 5$ and $5x - 2.5y + 5z = 20$.

OR

If a line makes angles α, β, γ with the positive direction of coordinate axes, then find the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$.

10. Using principal values, write the value of $\cos^{-1}\left(\frac{1}{2}\right)+2\sin^{-1}\left(\frac{1}{2}\right)$.

11. If $f(x) = -\cos x$, then find $f'\left(\frac{3\pi}{4}\right)$.

12. The probability that a person will get an electric contract is $\frac{2}{5}$ and the probability that he will not get plumbing contract is $\frac{4}{7}$. If the probability of getting at least one contract is $\frac{2}{3}$, what is the probability that he will get both?

13. If $\begin{bmatrix} 2a+b & a-2b \\ 5c-d & 4c+3d \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 11 & 24 \end{bmatrix}$, then find the value of $3a - b + 9c + 2d$.

14. Find the area of the region bounded by the curve $x = 2y + 3$ and the lines $y = 1$ and $y = -1$.

15. Find the distance of the plane $2x - 3y + 6z + 14 = 0$ from the origin.

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

Section - II

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

17. Three hoardings are to be placed on a beach at the points A, B and C displaying A (Do not litter)), B (Keep you place clean) and C (Go green). The coordinates of these points should be (4, 2, 1), (4, 8, 2) and (8, 4, 3). Take centre of beach as origin.

Based on the above information, answer the following questions :

(i) Let $\vec{a}, \vec{b}$ and $\vec{c}$ be the position vectors of points A, B and C respectively, then $\vec{a}+\vec{b}+\vec{c}$ is equal to

(a) $8\hat{i}+7\hat{j}+3\hat{k}$

(b) $2(8\hat{i}+7\hat{j}+3\hat{k})$

(c) $7\hat{i}+8\hat{j}+3\hat{k}$

(d) $2(7\hat{i}+8\hat{j}+3\hat{k})$

(ii) Which of the following is not true?

(a) $\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{CA}=\vec{0}$ (b) $\overrightarrow{AB}+\overrightarrow{BC}-\overrightarrow{AC}=\vec{0}$

(c) $\overrightarrow{AB}+\overrightarrow{BC}-\overrightarrow{CA}=\vec{0}$ (d) $\overrightarrow{AB}-\overrightarrow{CB}+\overrightarrow{CA}=\vec{0}$

(iii) Area of triangle ABC is

(a) 0 (b) $\sqrt{692}$ (c) $\frac{1}{2}\sqrt{692}$ (d) $\sqrt{592}$

(iv) Suppose, if the given hoardings are to be placed on a same line, then the value of $|\vec{a}\times\vec{b}+\vec{b}+\vec{c}+\vec{c}\times\vec{a}|$ will be equal to

(a) –1 (b) 2 (c) 0 (d) –2

(v) Equation of plane containing all the given point is

(a) $5x + 2y - 12z = 0$ (b) $5x + 2y - 12x = 12$ (c) $5x + 2y = 0$ (d) none of these

18. An advertising executive is studying television-viewing habits of married couples during prime time hours. Based on past viewing records he has determined that during prime time husbands are watching television 60% of the time. It has also been determined that when the husband is watching television, 40% of the time the wife is also watching. When the husband is not watching television, 30% of the time the wife is watching television.

Based on the above information, answer the following questions :

(i) The probability that the husband is not watching television during prime time, is

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

(ii) If the wife is watching television, the probability that husband is also watching television, is

(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{1}{6}$ (d) $\frac{5}{6}$

(iii) The probability that both husband and wife are watching television during prime time, is

(a) 0.24 (b) 0.2 (c) 0.3 (d) 0.4

(iv) The probability that the wife is watching television during prime time, is

(a) 0.24 (b) 0.36 (c) 0.3 (d) 0.4

(v) If the wife is watching television, then the probability that husband is not watching television, is

(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{1}{6}$ (d) $\frac{5}{6}$

PART - B

Section - III

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

20. Find the points on the line $\frac{x+2}{3}=\frac{y+1}{2}=\frac{z-3}{2}$ at a distance of 5 units from the point $P(1, 3, 3)$.

OR

Find the direction cosines of the line passing through the two points (–2, 4, –5) and (1, 2, 3).

21. Find the maximum and minimum values (if any) of $x + 1$ in [–1, 1].

22. If $A=\begin{bmatrix}-\cos x & -\sin x\\ -\sin x & \cos x\end{bmatrix}$, then find A^{-1}.

23. Evaluate : $\int \frac{x^3 - 3x^2 + 5x - 7 + x^2 a^x}{2x^2} dx$

OR

Evaluate $\int \frac{2\cos x - 3\sin x}{6\cos x + 4\sin x} dx$ by using substitution method.

24. A four digit number is formed using the digits 1, 2, 3, 5 with no repetitions. Write the probability that the number is divisible by 5.

25. Prove that $\tan^{-1}\left\{\frac{\sqrt{1+\cos x} + \sqrt{1-\cos x}}{\sqrt{1+\cos x} - \sqrt{1-\cos x}}\right\} = \frac{\pi}{4} + \frac{x}{2}, 0 < x < \frac{\pi}{2}$.

26. Find the area of the region bounded by the X-axis, $y = \sin x$ and the lines $x = -\frac{\pi}{2}, x = \frac{\pi}{2}$.

27. At what points will the tangent to the curve $y = 2x^3 - 15x^2 + 36x - 21$ be parallel to x-axis?

28. Solve the differential equation $(e^y + 1)\cos x \, dx + e^y \sin x \, dy = 0$.

OR

Find the general solution of the differential equation $x(1 + y^2)\, dx + y\,(1 + x^2)\, dy = 0$.

Section - IV

29. Find the interval in which the function $x^4 - 2x^2$ is increasing.

30. Using the method of integration, find the area of the region bounded by the lines $5x - 2y - 10 = 0$, $x + y - 9 = 0$, $2x - 5y - 4 = 0$.

31. If the function $f(x)$ defined by $f(x) = \begin{cases} \frac{\log(1+ax) - \log(1-bx)}{x}, & \text{if } x \neq 0 \\ k, & \text{if } x = 0 \end{cases}$ is continuous at $x = 0$, then find k.

OR

If $f(x) = \begin{cases} 3+2x, & -\frac{3}{2} \leq x < 0 \\ 3-2x, & 0 \leq x \leq \frac{3}{2} \end{cases}$, then show that at $x = 0$, $f(x)$ is continuous but not differentiable.

32. Evaluate : $\int \frac{1}{\sin(x-a)\sin(x-b)} dx$

33. Let n be a fixed positive integer. Let a relation R be defined in I (the set of all integers) as follows: aRb iff $n|(a - b)$, that is, iff $a - b$ is divisible by n. Show that relation R is an equivalence relation.

34. Find the solution of differential equation $\cos(x + y)\, dy = dx$.

OR

Solve : $x^2 y\, dx - (x^3 + y^3) dy = 0$

35. If $y = (\sin x)^{\tan x} + (\cos x)^{\sec x}$, then find $\frac{dy}{dx}$.

Section - V

36. Find the equation of plane in vector form which is passing through the points (1, 0, 1), (1, –1, 1) and (4, –3, 2).

OR

Find the length of the perpendicular drawn from the point (2, 4, –1) to the line $\vec{r} = \hat{i} + \lambda(2\hat{i} + \hat{j} + 2\hat{k})$.

37. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}, 10\,B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$ and B is the inverse of A, then find the value of α. Also, find $|B|$.

OR

For any two matrices $A = \begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 8 \\ 7 & 9 \end{bmatrix}$ prove that, $(A + B)^{-1} \neq A^{-1} + B^{-1}$.

38. Solve graphically the maximum value of $z = 40x + 50y$, subject to constraints :

$4x + 2y \leq 16$

$2x + 6y \leq 18$

$x \geq 0, y \geq 0.$

OR

Find the maximum and minimum values of $z = 400x + 500y$, subject to constraints :

$2x + y \leq 90$

$x + 2y \leq 80$

$x \geq 0, y \geq 0.$