

# SAMPLE QUESTION PAPER

## BLUE PRINT

Time Allowed : 2 hours

Maximum Marks : 40

S. No.	Unit / Chapter	Section-A (2 marks)	Section-B (3 marks)	Section-C (4 marks)	Total
1.	Unit-III Integrals	1(2)	1(3)	–	7(18)
2.		1(2)	1(3)*	–	
3.		2(4)	–	1(4)	
4.	Unit-IV Vector Algebra	–	1(3)*	1(4)	4(14)
5.		–	1(3)	1(4)	
6.	Unit-VI Probability	2(4) <sup>#</sup>	–	1(4)*	3(8)
	<b>Total Questions</b>	<b>6(12)</b>	<b>4(12)</b>	<b>4(16)</b>	<b>14(40)</b>

\*It is a choice based question.

<sup>#</sup>Out of the two or more questions only one question is choice based.

# MATHEMATICS

Maximum Marks : 40

Time Allowed : 2 hours

## General Instructions :

1. This question paper contains three sections - A, B and C. Each part is compulsory.
2. Section - A has 6 short answer type (SA1) questions of 2 marks each.
3. Section - B has 4 short answer type (SA2) questions of 3 marks each.
4. Section - C has 4 long answer type questions (LA) of 4 marks each.
5. There is an internal choice in some of the questions.
6. Q14 is a case-based problem having 2 sub parts of 2 marks each.

## SECTION - A

1. Find the solution of the differential equation  $\frac{x + \frac{x^3}{3!} + \frac{x^5}{5!} + \dots}{1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \dots} = \frac{dx - dy}{dx + dy}$ .

2. A random variable  $X$  has the following distribution.

$X$	1	2	3	4	5	6	7	8
$P(X)$	0.15	0.23	0.12	0.10	0.20	0.08	0.07	0.05

For the event  $E = \{X \text{ is prime number}\}$ , find  $P(E)$ .

OR

If the probability distribution of  $X$  is 

$X = x$	0	1	2	3	4
$P(X = x)$	$k$	$2k$	$4k$	$2k$	$k$

, then find  $P(X \leq 1)$ .

3. Find :  $\int \frac{2x}{\sqrt[3]{x^2+1}} dx$

4. Let  $A$  and  $B$  be independent events with  $P(A) = 1/5$  and  $P(A \cup B) = 2P(B) - P(A)$ . Find  $P(B)$ .

5. Find the integrating factor of the differential equation  $\frac{xdy}{dx} - y = x^4 - 3x$ .

6. Find the area between the curve  $y = 4 + 3x - x^2$  and  $x$ -axis.

## SECTION - B

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

8. If two vectors  $\vec{a}$  and  $\vec{b}$  are such that  $|\vec{a}| = 2$ ,  $|\vec{b}| = 1$  and  $\vec{a} \cdot \vec{b} = 1$ , then find the value of  $(3\vec{a} - 5\vec{b}) \cdot (2\vec{a} + 7\vec{b})$ .

OR

Find the area of a parallelogram whose adjacent sides are represented by the vectors  $2\hat{i} - 3\hat{k}$  and  $4\hat{j} + 2\hat{k}$ .

9. Find the equation of the plane through the line of intersection of the planes  $x + y + z = 1$  and  $2x + 3y + 4z = 5$  which is perpendicular to the plane  $x - y + z = 0$ . Then find the distance of plane thus obtained from the point  $A(1, 3, 6)$ .
10. Find the area of the region bounded by  $y = |x - 1|$  and  $y = 1$ .

OR

If the area bounded the curve  $y^2 = 16x$  and line  $y = mx$  is  $\frac{2}{3}$ , then find the value of  $m$ .

### SECTION - C

11. Consider the experiment of tossing a coin. If the coin shows head, toss it again, but if it shows tail, then throw a die. Find the conditional probability of the event that 'the die shows a number greater than 4' given that 'there is at least one tail'.

OR

In a group of 400 people, 160 are smokers and non-vegetarian, 100 are smokers and vegetarian and the remaining are non-smokers and vegetarian. The probabilities of getting a special chest diseases are 35%, 20% and 10% respectively. A person is chosen from the group at random and is found to be suffering from the disease. What is the probability that the selected person is a smoker and non-vegetarian?

12. If  $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$ ,  $\vec{b} = 2\hat{i} + \hat{j}$  and  $\vec{c} = 3\hat{i} - 4\hat{j} - 5\hat{k}$ , then find a unit vector perpendicular to both of the vectors  $(\vec{a} - \vec{b})$  and  $(\vec{c} - \vec{b})$ .
13. A variable plane which remains at a constant distance  $3p$  from the origin cuts the coordinates axes at  $A$ ,  $B$ ,  $C$ . Show that the locus of the centroid of triangle  $ABC$  is  $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{p^2}$ .

### CASE-BASED/DATA-BASED

14. A rumour on whatsapp spreads in a population of 5000 people at a rate proportional to the product of the number of people who have heard it and the number of people who have not. Also, it is given that 100 people initiate the rumour and a total of 500 people come to know about the rumour after 2 days.

Based on the above information, answer the following questions.

(i) Find the derivative of  $y$  with respect to  $t$ .

(ii) Find the value of  $y$ , if  $t = 0$  in the equation  $y = \frac{5000}{49e^{-5000kt} + 1}$ .

