



Question Paper Code

14204

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

First Semester

Computer Science and Business Systems

24BSMA102 - INTRODUCTORY TOPICS IN CALCULUS, PROBABILITY AND STATISTICS

Regulations - 2024

(Use of statistical table is permitted)

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

- |  | Marks | K-Level | CO  |
|--|-------|---------|-----|
| 1. The domain of $f(x) = \frac{x+4}{x^2-9}$ is _____.  | 1     | K3      | CO1 |
| (a) $(-\infty, -3) \cup (-3, 3) \cup (3, \infty)$  |       |         |     |
| (b) $(-\infty, -2) \cup (-2, 2) \cup (2, \infty)$  |       |         |     |
| (c) $(-3, 3)$  |       |         |     |
| (d) $(-2, 2)$  |       |         |     |
| 2. Which of the following is an odd function?  | 1     | K2      | CO1 |
| (a) $\cos x$   |       |         |     |
| (b) $\sin x$   |       |         |     |
| (c) $1 - x^4$  |       |         |     |
| (d) $ \sin x $   |       |         |     |
| 3. The value of $\int_0^2 (6x^2 - 4x + 5) dx$ is _____.  | 1     | K2      | CO2 |
| (a) 7  |       |         |     |
| (b) 9  |       |         |     |
| (c) 18   |       |         |     |
| (d) 15   |       |         |     |
| 4. The value of $\int x e^x dx$ is _____.  | 1     | K2      | CO2 |
| (a) $x e^x + c$  |       |         |     |
| (b) $\frac{x^2}{2} e^x + c$  |       |         |     |
| (c) $(x-1)e^x + c$   |       |         |     |
| (d) $(x+1)e^x + c$   |       |         |     |
| 5. Two events A and B are said to be independent if  | 1     | K1      | CO3 |
| (a) $P(A \cap B) = P(A) + P(B)$  |       |         |     |
| (b) $P(A \cap B) = P(A) - P(B)$  |       |         |     |
| (c) $P(A \cap B) = P(A)P(B)$   |       |         |     |
| (d) $P(A \cap B) = P(A) / P(B)$  |       |         |     |
| 6. Letting X denote the random variable that is defined as the sum of two fair dice; the $P(X = 2) =$ _____. | 1     | K2      | CO3 |
| (a) $\frac{1}{36}$   |       |         |     |
| (b) $\frac{2}{36}$   |       |         |     |
| (c) $\frac{3}{36}$   |       |         |     |
| (d) $\frac{4}{36}$   |       |         |     |
| 7. The M.G.F. of the Poisson distribution is   | 1     | K1      | CO4 |
| (a) $e^{\lambda(-e^t-1)}$  |       |         |     |
| (b) $e^{\lambda(e^t-1)}$   |       |         |     |
| (c) $e^{\lambda(1-e^t)}$   |       |         |     |
| (d) $e^{\lambda(1+e^t)}$   |       |         |     |
| 8. What are the parameters of the binomial distribution?   | 1     | K1      | CO4 |
| (a) $p, q$   |       |         |     |
| (b) $n, p, q$  |       |         |     |
| (c) $n, p$   |       |         |     |
| (d) $q$  |       |         |     |
| 9. If X is uniformly distributed over (0,5) then $P(X < 2)$ is   | 1     | K3      | CO5 |
| (a) $\frac{2}{5}$  |       |         |     |
| (b) $\frac{1}{5}$  |       |         |     |
| (c) 5  |       |         |     |
| (d) 2  |       |         |     |
| 10. If the standard deviation of a population is 9, the population variance is _____.                        | 1     | K2      | CO6 |
| (a) 9  |       |         |     |
| (b) 3  |       |         |     |
| (c) 21   |       |         |     |
| (d) 81   |       |         |     |

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

11. Evaluate  $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x - 1}$ . 2 K3 CO1
12. Find  $F'(x)$  if  $F(x) = \sqrt{x^2 + 1}$ . 2 K2 CO1
13. Evaluate  $\int_0^2 (2x - 3)(4x^2 + 1) dx$ . 2 K3 CO2
14. Evaluate  $\int_0^a \int_0^b \int_0^c (x + y + z) dz dy dx$ . 2 K3 CO2
15. State the theorem of total probability. 2 K1 CO3
16. A random variable  $X$  has the probability function  $f(x) = \frac{1}{2^x}$  for  $x = 1, 2, 3, \dots$ . Find its moment generating function. 2 K2 CO3
17. What is meant by memoryless property? Which discrete distribution follows this property? 2 K2 CO4
18. The mean and variance of binomial distribution are 5 and 4. Determine the distribution. 2 K2 CO4
19. Define Type – I and Type – II error. 2 K1 CO5
20. Write any two applications of  $\chi^2$  - test. 2 K1 CO5
21. Define sample. 2 K1 CO6
22. If the value of mode and median is 60 and 66 respectively, find the value of median. 2 K2 CO6

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

23. a) Find the values of  $a$  and  $b$  that make  $f$  continuous on  $(-\infty, \infty)$ , 11 K3 CO1

$$f(x) = \begin{cases} \frac{x^3 - 8}{x - 2} & \text{if } x < 2 \\ ax^2 - bx + 3 & \text{if } 2 \leq x \leq 3. \\ 2x - a + b & \text{if } x \geq 3 \end{cases}$$

**OR**

- b) For the function  $f(x) = 3x^4 - 4x^3 - 12x^2 - 5$ , where is it increasing and decreasing? 11 K3 CO1

24. a) Find, by double integration, the area enclosed by the curves  $y^2 = 4ax$  and  $x^2 = 4ay$ . 11 K3 CO2

**OR**

- b) Using triple integration, find the volume of the ellipsoid  $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ . 11 K3 CO2

25. a) There are 3 boxes containing respectively, 1 white, 2 red, 3 black balls; 2 white, 3 red, 1 black balls; 3 white, 1 red, 2 black balls. A box is chosen at random and from it two balls are drawn at random. The two balls are 1 red and 1 white. What is the probability that they came from second box? 11 K3 CO3

**OR**

- b) The probability mass function of a discrete R.V.  $X$  is given in the following table: 11 K3 CO3

$x:$	-2	-1	0	1	2	3
$P(X = x):$	0.1	$k$	0.2	$2k$	0.3	$k$

Find (1) the value of  $k$  (2)  $P(X < 1)$  (3)  $P(-1 < X \leq 2)$  (4)  $E(X)$ .

26. a) Out of 800 families with 4 children each, how many families would be expected to have (1) 2 boys & 2 girls, (2) at least one boy, (3) at most 2 girls, (4) children of both sexes. 11 K3 CO4

**OR**

- b) The number of typing mistakes that a typist makes on a given page has a Poisson distribution with a mean of 3 mistakes. What is the probability that she makes  
 1. Exactly 7 mistakes  
 2. Fewer than 4 mistakes  
 3. No mistakes on a given page. 11 K3 CO4

27. a) Suppose that the length of a phone call in minutes is an exponential random variable with parameter  $\lambda = \frac{1}{10}$ . If someone arrives immediately ahead of you at a public telephone booth, find the probability that you will have to wait  
 i) more than 10 minutes;  
 ii) between 10 and 20 minutes. 11 K3 CO5

**OR**

- b) The table below gives the number of aircraft accidents that occurred during the various days of the week. Test whether the accidents are uniformly distributed over the week. 11 K3 CO5

Days	Mon	Tue	Wed	Thu	Fri	Sat
Number of accidents	14	18	12	11	15	14

28. a) Draw a histogram and frequency curve for the following data: 11 K3 CO6

Profit range ₹ ('000)	0-15	15-30	30-45	45-60	60-75	75-90	90-105	105-120	120-135
No. of Companies	3	7	18	25	20	12	6	5	2

**OR**

- b) Calculate  $Q_1, Q_3, D_2, P_5, P_{90}$  from the following data: 11 K3 CO6

Marks	0-10	10-20	20-30	40-60	60-80	80-100
No. of students	3	10	17	7	6	4