B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024 (JAN – 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) (20 × 1 = 20 Marks)
Answer ALL Questions

		Marks	K-Level	CO

1. The domain and range of $y = \sqrt{1 - x^2}$ is _____.   *(1 K2 CO1)*
   (a) $[-1, 0]$ and $[0, 1]$ (b) $[-1, 0]$ and $[-1, 1]$ (c) $[-1, 1]$ and $[0, 1]$ (d) $[-1, 1]$ and $[-1, 1]$

2. Which of the following is an even function?   *(1 K2 CO1)*
   (a) $x + x^3$ (b) $\sin x$ (c) $\cos x$ (d) $\sin x \cos x$

3. $\lim_{x \to 0} \dfrac{\sin x}{x} = $ _____.   *(1 K1 CO1)*
   (a) 0   (b) ∞ (c) $-\infty$ (d) 1

4. The value of $\int_{1}^{2} \left(\dfrac{x}{2} - \dfrac{2}{x} \right) dx$ is _____.   *(1 K2 CO2)*
   (a) $\dfrac{3}{4} - 2\log 2$ (b) $\dfrac{3}{4} + 2\log 2$ (c) $\dfrac{1}{4} - \log 4$ (d) $\dfrac{1}{4} + \log 4$

5. The value of $\int_{0}^{\frac{\pi}{2}} \cos^6 x\, dx$ is _____.   *(1 K2 CO2)*
   (a) $\dfrac{5\pi}{32}$ (b) $\dfrac{3\pi}{16}$ (c) $\dfrac{\pi}{4}$ (d) 0

6. The value of $\int_{0}^{a} \int_{0}^{\sqrt{a^2 - x^2}} dy\, dx$ is _____.   *(1 K2 CO2)*
   (a) $\dfrac{\pi a}{2}$ (b) $\dfrac{\pi a^2}{2}$ (c) $\dfrac{\pi a^2}{4}$ (d) $\dfrac{\pi a}{2}$

7. When A and B are mutually exclusive events   *(1 K1 CO3)*
   (a) $P(A \cup B) = P(A) + P(B) + P(A \cap B)$ (b) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
   (c) $P(A \cup B) = P(A) + P(B)$ (d) $P(A \cup B) = P(A) - P(B)$

8. If $P(B) > 0$, then   *(1 K1 CO3)*
   (a) $P(A/B) = \dfrac{P(A \cup B)}{P(B)}$ (b) $P(A/B) = \dfrac{P(A \cap B)}{P(B)}$
   (c) $P(A/B) = \dfrac{P(A \cup B)}{P(A)}$ (d) $P(A/B) = \dfrac{P(A \cap B)}{P(A)}$

9. The value of $E(2X + 3)$ is   *(1 K1 CO3)*
   (a) $2E(X)$ (b) $2E(X) - 3$ (c) $2E(X) + 3$ (d) $E(X) + 3$

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **13332**

10. The S.D. of a binomial distribution is   *1 K1 CO4*

(a) np (b) $\sqrt{np}$ (c) npq (d) $\sqrt{npq}$

11. The variance of a Poisson distribution is   *1 K1 CO4*

(a) $\dfrac{1}{\lambda}$ (b) $\dfrac{1}{\lambda^2}$ (c) λ (d) λ^2

12. The M.G.F. of the geometric distribution is   *1 K1 CO4*

(a) $\dfrac{qe^t}{1-pe^t}$ (b) $\dfrac{pe^t}{1-qe^t}$ (c) $\dfrac{qe^t}{1+pe^t}$ (d) $\dfrac{pe^t}{1+qe^t}$

13. The square of standard normal variate is   *1 K1 CO5*
(a) Normal Distribution   (b) F distribution
(c) Chi-square Distribution   (d) t Distribution

14. Choose the distribution where the memory less property holds good.   *1 K1 CO5*
(a) Normal Distribution   (b) Binomial Distribution
(c) Uniform Distribution   (d) Exponential Distribution

15. The degrees of freedom of t distribution with sample size n is   *1 K1 CO5*
(a) n (b) $n-1$ (c) $n-2$ (d) $n-3$

16.   *1 K2 CO5*

The mean of the distribution $f(x) = \begin{cases} \dfrac{1}{3}e^{-\frac{x}{3}}, & x > 0 \\ 0, & otherwise \end{cases}$ is

(a) $\dfrac{1}{3}$ (b) 1   (c) 3   (d) 4

17. The data which have already been collected by someone are called _____.   *1 K1 CO6*
(a) Raw data   (b) Array data   (c) Secondary data   (d) Fictitious data

18. When data are observed over a period of time, the type of classification is known as _____.   *1 K1 CO6*

(a) geographical classification   (b) chronological classification
(c) qualitative classification   (d) quantitative classification

19. In the statistical table column headings are called _____.   *1 K1 CO6*
(a) stubs   (b) captions   (c) body   (d) source note

20. The relationship between mean, median and mode is _____.   *1 K1 CO6*
(a) Median = 3 Mode – 2 Mean   (b) Mean = 2 Mode – 3 Median
(c) Mode = 3 Median – 2 Mean   (d) Mode = 3 Mean – 2 Mode

PART - B (10 × 2 = 20 Marks)
Answer ALL Questions

21. Evaluate $\displaystyle\lim_{x\to 1}\frac{x^2-1}{x-1}$.   *2 K3 CO1*

22. If $f(x) = \sin[\cos(\tan x)]$, then find $f'(x)$.   *2 K2 CO1*

23. Evaluate $\displaystyle\int x^3 \cos(x^4+2)\,dx$.   *2 K3 CO2*

24. Evaluate $\displaystyle\int_0^a\int_0^b (x+y)\,dx\,dy$.   *2 K2 CO2*

25. If 3 balls are randomly drawn from a bowl containing 6 white and 5 black balls, what are the probability that one of the balls is white and the other two black?   *2 K3 CO3*

26. Compute $E[X]$ if X has a density function given by $f(x) = \begin{cases} \dfrac{1}{4}xe^{-x/2} & if \quad x > 0 \\ 0 & otherwise \end{cases}$.   *2 K3 CO3*

27. A discrete R.V. X has moment generating function $M_X(t) = \left(\dfrac{1}{4}+\dfrac{3}{4}e^t\right)^5$. Find E(X), Var (X).   *2 K2 CO4*

28. What is memory less property? Which discrete distribution follows this property?   *2 K1 CO4*

29. Define Type – I and Type – II error.   2   *K1*   *CO5*

30. Present the following information in a suitable form.   2   *K2*   *CO6*

       In 2002, the number of workers in the trade union was 3,450 of which 3,200 were men. The number of non-trade union workers was 760 of which 330 were women.

       In 2003, out of a total of 4,000 workers in a factory, 3,300 were members of a trade union. The number of women workers employed was 500 out of which 400 did not belong to any union.

PART - C (6 × 10 = 60 Marks)
Answer ALL Questions

31. a) Find the values of a and b that make f continuous on $(-\infty, \infty)$,   10   *K3*   *CO1*

$$f(x) = \begin{cases} \dfrac{x^3 - 8}{x - 2} & if & x < 2 \\ ax^2 - bx + 3 & if & 2 \le x \le 3 \\ 2x - a + b & if & x \ge 3 \end{cases}.$$

OR

    b) For the function $f(x) = 2x^3 + 3x^2 - 36x$,   10   *K3*   *CO1*

      (1) Find the intervals on which it is increasing or decreasing.

      (2) Find the local maximum and minimum values of f.

      (3) Find the intervals of concavity and the inflection points.

32. a) Evaluate $\int e^{ax} \sin bx \, dx$ by integration by parts.   10   *K3*   *CO2*

OR

    b) Find the volume of the tetrahedron bounded by the plane $\dfrac{x}{a} + \dfrac{y}{b} + \dfrac{z}{c} = 1$ and the   10   *K3*   *CO2*

      co-ordinate plane. $x = 0, y = 0, z = 0$.

33. a) The chances of A, B and C to becoming the general manager of a company are in   10   *K3*   *CO3* the ratio 4:2:3. The probabilities that the bonus scheme will be introduced in the company if A, B and C become general manager are 0.3, 0.7 and 0.8 respectively. If the bonus scheme has been introduced, what is the probability that A has been appointed as a general manager?

OR

    b) Let X be a random variable with probability density function   10   *K3*   *CO3*

$$f(x) = \begin{cases} c(1 - x^2), & -1 < x < 1 \\ 0, & otherwise \end{cases}.$$

      (1) What is the value of c?

      (2) What is the cumulative distribution function of X?

34. a) Out of 800 families with 4 children each, how many families would be expected to   10   *K3*   *CO4* have (1) 2 boys & 2 girls, (2) at least one boy, (3) at most 2 girls, (4) children of both sexes?

OR

    b) The number of monthly breakdowns of a computer is a random variable having a   10   *K3*   *CO4* Poisson distribution with mean equal to 1.8. Find the probability that this computer will function for a month (1) without a breakdown (2) with only one breakdown.

35. a) If X is uniformly distributed over $(0, 10)$, calculate (1) $P(X < 3)$ (2) $P(X > 7)$ and (3) $P(1 < X < 6)$.   10   K3   CO5

OR

b) The theory predicts that the proportion of beans in four given group should be $9 : 3 : 3 : 1$. In an examination with 1600 beans, the numbers in the four groups were 882, 313, 287, and 118. Does the experiment support the theory?   10   K3   CO5

36. a) Calculate the mean, median and mode from the following data: 10   K3   CO6

Age	55-60	50-55	45-50	40-45	35-40	30-35	25-30	20-25
No. of people	7	13	15	20	30	33	28	14

OR

b) Calculate the quartile deviation and coefficient of quartile deviation from the following data: 10   K3   CO6

Age in years:	20	30	40	50	60	70	80
No. of Members:	3	61	132	153	140	51	3