

QP CODE: D2BST2501

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Reg. No : .....

Name : .....

**SECOND SEMESTER FYUGP EXAMINATION, APRIL 2026****(Regular/Improvement/Supplementary)****Discipline Specific Core (DSC) Courses - Minor****STA2MN101 : Probability Theory I****(Credits: 4)****Time: 2 Hours****Maximum Marks: 70****Section A****Answer the following questions. Each carries 3 marks (Ceiling: 24 marks)**

1. Verify whether the following is a probability distribution or not

BL2 CO2

|        |      |     |     |      |     |
|--------|------|-----|-----|------|-----|
| $x$    | -1   | 0   | 1   | 2    | 3   |
| $P(x)$ | 0.25 | 0.2 | 0.3 | 0.15 | 0.1 |

2. What are the properties of moment generating function?

BL2 CO2

3. Define Poisson random variable.

BL2 CO3

4. State the additive property of 2 normal random variables. Generalise it to
- $n$
- random variables.

BL2 CO3

5. For what value of
- $k$
- is
- $f(x) = k(x + x^2)$
- ,
- $0 < x < 1$
- , a probability distribution? Find
- $P(X < 0.5)$
- .

BL3 CO2

6. Two models have
- $R^2$
- values of 0.85 and 0.65, respectively. Which model explains more variance, and by how much?

BL2 CO4

7. What is meant by curvilinear regression?

BL2 CO4

8. What is standard error? Give an example.

BL2 CO5

9. What is the sampling distribution of sample mean from a normal distribution with mean
- $\mu$
- and unknown variance
- $\sigma^2$
- ?

BL2 CO5

10. Suppose
- $X \sim N(\mu, \sigma^2)$
- , what is the distribution of
- $\left(\frac{X-\mu}{\sigma}\right)^2$
- ?

BL2 CO5

**(PTO)**

## Section B

**Answer the following questions. Each carries 6 marks (Ceiling: 36 Marks)**

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |     |     |   |   |   |   |   |   |   |   |   |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|-----|---|---|---|---|---|---|---|---|---|--|--|--|
| 11. A player is to toss three coins. He wins ₹10 if 3 heads appear, ₹5 if 2 heads appears and ₹1 if one head appears. He will lose ₹12 if no head appears. What is the expected amount?                                                                                                                                                                                                                                                                                                                                                 |   | BL3 | CO2 |   |   |   |   |   |   |   |   |   |  |  |  |
| 12. If $X$ and $Y$ are two independent variates and $V(X) = 2$ and $V(Y) = 3$ . Find $V(2X + 3Y)$ .                                                                                                                                                                                                                                                                                                                                                                                                                                     |   | BL3 | CO2 |   |   |   |   |   |   |   |   |   |  |  |  |
| 13. Suppose $X \sim B(10, 0.3)$ . Find $P(X < 2)$ .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   | BL3 | CO3 |   |   |   |   |   |   |   |   |   |  |  |  |
| 14. Obtain the mean and variance of rectangular distribution.                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   | BL2 | CO3 |   |   |   |   |   |   |   |   |   |  |  |  |
| 15. If a random variable $X$ follows an exponential distribution with mean 3, what is the probability that $X > 1$ ?                                                                                                                                                                                                                                                                                                                                                                                                                    |   | BL3 | CO3 |   |   |   |   |   |   |   |   |   |  |  |  |
| 16. Find the regression coefficients and hence obtain the correlation coefficient for the given data.                                                                                                                                                                                                                                                                                                                                                                                                                                   |   | BL3 | CO4 |   |   |   |   |   |   |   |   |   |  |  |  |
| <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 5px;">X</td> <td style="padding: 5px;">8</td> <td style="padding: 5px;">6</td> <td style="padding: 5px;">4</td> <td style="padding: 5px;">7</td> <td style="padding: 5px;">5</td> </tr> <tr> <td style="padding: 5px;">Y</td> <td style="padding: 5px;">9</td> <td style="padding: 5px;">8</td> <td style="padding: 5px;">5</td> <td style="padding: 5px;">6</td> <td style="padding: 5px;">2</td> </tr> </table> | X | 8   | 6   | 4 | 7 | 5 | Y | 9 | 8 | 5 | 6 | 2 |  |  |  |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8 | 6   | 4   | 7 | 5 |   |   |   |   |   |   |   |  |  |  |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9 | 8   | 5   | 6 | 2 |   |   |   |   |   |   |   |  |  |  |
| 17. Suppose $X_1, X_2$ and $X_3$ are independent $\chi^2(1)$ random variables, obtain the distribution of $\frac{X_1 + X_2}{X_3}$ .                                                                                                                                                                                                                                                                                                                                                                                                     |   | BL2 | CO5 |   |   |   |   |   |   |   |   |   |  |  |  |
| 18. Suppose $X_1, X_2$ and $X_3$ are independent $N(0, 1)$ random variables, obtain the distribution of $\frac{\sqrt{2}X_1}{\sqrt{X_2^2 + X_3^2}}$ .                                                                                                                                                                                                                                                                                                                                                                                    |   | BL2 | CO5 |   |   |   |   |   |   |   |   |   |  |  |  |

## Section C

**Answer any one question. Each carries 10 marks (1 x 10 = 10 Marks)**

- |                                                                                                                                                                                                                                                     |  |     |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|-----|
| 19. A random variable $X$ follows normal distribution with mean 80 and standard deviation 10. Find the probability that the variable takes value (i) less than 80 (ii) greater than 100 (iii) between 53 and 62 (vi) between 53 and 82.             |  | BL3 | CO3 |
| 20. In a partially destroyed laboratory record of correlation data, only the following results are legible. Variance of $Y$ is 16, regression equations are $y = x + 5$ and $16x = 9y - 94$ . Find the variance of $X$ and correlation coefficient. |  | BL3 | CO4 |

**CO : Course Outcome**

**BL : Bloom's Taxonomy Levels** (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)