



R20 Regulation

**TKR COLLEGE OF ENGINEERING AND TECHNOLOGY**

(Autonomous, Accredited by NAAC with 'A+' Grade)

Subject code: 3B4AA

**B.Tech IV Semester Supplementary Examinations, February 2024**

**PROBABILITY & STATISTICS**

(Common to CE, CSE & IT)

**Maximum Marks: 70**

Date:16.02.2024 Duration: 3 hours

**Part-A**

| All the following questions carry equal marks (10x2M=20 Marks) |                                                                                                                         | CO  | Bloom Tx |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----|----------|
| 1                                                              | What is Probability density function?                                                                                   | CO1 | L1       |
| 2                                                              | The mean and standard deviation of binomial distribution are 5 and 2. Find the distribution function.                   | CO1 | L1       |
| 3                                                              | Write down the different types of estimation.                                                                           | CO2 | L2       |
| 4                                                              | Explain point estimation.                                                                                               | CO2 | L2       |
| 5                                                              | Explain Null Hypothesis and Alternative Hypothesis.                                                                     | CO3 | L2       |
| 6                                                              | Define critical region.                                                                                                 | CO3 | L1       |
| 7                                                              | What are the assumptions of F-test?                                                                                     | CO4 | L1       |
| 8                                                              | Find the standard error of the sample mean for the following data<br>$n = 14, \mu = 18.5, \bar{x} = 17.85, S = 1.955$ . | CO4 | L1       |
| 9                                                              | Write down any two properties of correlation coefficient.                                                               | CO5 | L2       |
| 10                                                             | Write down any two properties of regression coefficients.                                                               | CO5 | L2       |

**Part-B**

| Answer All the following questions. (5X10M=50Marks)                                                                             |                                                                                                                                                                                                                                          |      |   |   |    |    |    |                |                 |                     |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---|----|----|----|----------------|-----------------|---------------------|
| 11                                                                                                                              | A random variable X has the following probability distribution. [10]                                                                                                                                                                     |      |   |   |    |    |    |                | CO1             | L3                  |
|                                                                                                                                 |                                                                                                                                                                                                                                          | x    | 0 | 1 | 2  | 3  | 4  | 5              | 6               | 7                   |
|                                                                                                                                 |                                                                                                                                                                                                                                          | P(x) | 0 | k | 2k | 2k | 3k | k <sup>2</sup> | 2k <sup>2</sup> | 7k <sup>2</sup> + k |
| Find (i) the value of k(ii) P(x < 5) and P(1 < x < 6)<br>(iii) the distribution function of X .<br>(iv) mean and variance of X. |                                                                                                                                                                                                                                          |      |   |   |    |    |    |                |                 |                     |
| OR                                                                                                                              |                                                                                                                                                                                                                                          |      |   |   |    |    |    |                |                 |                     |
| 12                                                                                                                              | The cumulative distribution function of a random variable X is<br>$F(x) = 1 - (1 + x)e^{-x}, x > 0$ . Find the probability density function of X and<br>also find the mean and variance of X. [10]                                       |      |   |   |    |    |    |                | CO1             | L3                  |
| 13                                                                                                                              | Let $X_1, X_2, X_3$ are independent random variable having Poisson distribution with<br>parameter $\lambda$ .<br>Show that $\frac{X_1 + X_2 + X_3}{3}$ and $\frac{5X_1 + 3X_2 + X_3}{9}$ are also unbiased estimator of $\lambda$ . [10] |      |   |   |    |    |    |                | CO2             | L2                  |

|                     | OR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |        |        |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------|--------|--------|-------|----------|-----|-----|-----|-----|---------|-----|----|----|-----|-----------|-----|----|-----|-----|-------|-----|-----|-----|-----|-----|----|
| 14                  | If T is an unbiased estimator of $\theta$ show that $T^2$ is not an unbiased estimator of $\theta$ and $\sqrt{T}$ is not an unbiased estimator of $\sqrt{\theta}$ . [10]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CO2                 | L2     |        |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| 15                  | A manufacturer claims that his synthetic fishing line has a mean breaking strength of 8kg and S.D 0.5kg. Can we accept his claim if a random sample of 50 lines yields a mean breaking of 7.8kg at 1%level of significance? [10]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CO3                 | L3     |        |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
|                     | OR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |        |        |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| 16                  | Random samples of 400 men and 600 women asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favour of the proposal. Test the hypothesis that proportions of men and women in favour of the proposal are same against that they are not, at 5% level. [10]                                                                                                                                                                                                                                                                                                                                                                                                                                   | CO3                 | L3     |        |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| 17                  | Two athletes A and B were tested according to the time (in seconds) to run a particular track with the following results. <table border="1"><tr><td>A</td><td>28</td><td>30</td><td>32</td><td>33</td><td>33</td><td>29</td><td>34</td></tr><tr><td>B</td><td>29</td><td>30</td><td>30</td><td>24</td><td>27</td><td>29</td><td></td></tr></table> Test whether the two athletes have the same running capacity. [10]                                                                                                                                                                                                                                                                                                                       | A                   | 28     | 30     | 32     | 33    | 33       | 29  | 34  | B   | 29  | 30      | 30  | 24 | 27 | 29  |           | CO4 | L4 |     |     |       |     |     |     |     |     |    |
| A                   | 28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 30                  | 32     | 33     | 33     | 29    | 34       |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| B                   | 29                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 30                  | 30     | 24     | 27     | 29    |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
|                     | OR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |        |        |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| 18                  | A survey was conducted to know the preference of the workers of a factory, regarding the types of incentives. The data collected through the survey are detailed in the table below <table border="1"><tr><th>Category of Workers</th><th>Type 1</th><th>Type 2</th><th>Type 3</th><th>Total</th></tr><tr><td>Laborers</td><td>125</td><td>40</td><td>20</td><td>185</td></tr><tr><td>Scribes</td><td>160</td><td>65</td><td>75</td><td>300</td></tr><tr><td>Technical</td><td>65</td><td>50</td><td>100</td><td>215</td></tr><tr><td>Total</td><td>350</td><td>155</td><td>195</td><td>700</td></tr></table> Test whether the choice of the type of incentive scheme is independent of the category of workers or not. Use 5% (l.o.s) [10] | Category of Workers | Type 1 | Type 2 | Type 3 | Total | Laborers | 125 | 40  | 20  | 185 | Scribes | 160 | 65 | 75 | 300 | Technical | 65  | 50 | 100 | 215 | Total | 350 | 155 | 195 | 700 | CO4 | L4 |
| Category of Workers | Type 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Type 2              | Type 3 | Total  |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| Laborers            | 125                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 40                  | 20     | 185    |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| Scribes             | 160                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 65                  | 75     | 300    |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| Technical           | 65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 50                  | 100    | 215    |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| Total               | 350                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 155                 | 195    | 700    |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| 19                  | Fit a least squares quadratic curve to the following data <table border="1"><tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Y</td><td>1.7</td><td>1.8</td><td>2.3</td><td>3.2</td></tr></table> Estimate Y(2.4). [10]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | X                   | 1      | 2      | 3      | 4     | Y        | 1.7 | 1.8 | 2.3 | 3.2 | CO5     | L5  |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| X                   | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2                   | 3      | 4      |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| Y                   | 1.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1.8                 | 2.3    | 3.2    |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
|                     | OR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |        |        |        |       |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| 20                  | Fit a straight line to the following data. [10] <table border="1"><tr><td>x</td><td>1</td><td>6</td><td>11</td><td>16</td><td>20</td><td>26</td></tr><tr><td>Y</td><td>13</td><td>16</td><td>17</td><td>23</td><td>24</td><td>31</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | x                   | 1      | 6      | 11     | 16    | 20       | 26  | Y   | 13  | 16  | 17      | 23  | 24 | 31 | CO5 | L4        |     |    |     |     |       |     |     |     |     |     |    |
| x                   | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 6                   | 11     | 16     | 20     | 26    |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |
| Y                   | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 16                  | 17     | 23     | 24     | 31    |          |     |     |     |     |         |     |    |    |     |           |     |    |     |     |       |     |     |     |     |     |    |