# SRM VALLIAMMAI ENGINEERING COLLEGE

## (An Autonomous Institution)

**(S.R.M.NAGAR, KATTANKULATHUR-603203)**

## DEPARTMENT OF MATHEMATICS

## QUESTION BANK

## II SEMESTER

## MA3222 – STATISTICS AND NUMERICAL METHODS

**Regulation – 2023**

**Academic Year – 2024- 2025**

*Prepared by*

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# VALLIAMMAI ENGINEERING COLLEGE
## (An Autonomous Institution)

**SRM Nagar, Kattankulathur – 603 203.**

**DEPARTMENT OF MATHEMATICS**

**SUBJECT : MA3222 – STATISTICS AND NUMERICAL METHODS**

**SEM / YEAR : II/ I**

**UNIT I :STATISTICAL HYPOTHESIS TESTS**

Sampling distributions - Tests for single mean and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

| Q.No | Question | Bloom's Taxonomy Level | Domain | Course Outcome |
|---|---|---|---|---|
| | **PART – A** | | | |
| **1**. | Define Statistics | **BTL -1** | Remembering | **CO 1** |
| **2**. | Define Parameter. | **BTL -2** | Understanding | **CO 1** |
| **3.** | Define Standard Error. | **BTL -2** | Understanding | **CO 1** |
| **4**. | What are the parameters and statistics in sampling. | **BTL -1** | Remembering | **CO 1** |
| **5**. | Explain null and alternate hypothesis. | **BTL -2** | Understanding | **CO 1** |
| **6**. | Define Type I and Type II error. | **BTL -1** | Remembering | **CO 1** |
| **7**. | Mention the various steps involved in testing of hypothesis. | **BTL -2** | Understanding | **CO 1** |
| **8**. | What is the essential difference between confidence limits and tolerance limits? | **BTL -1** | Remembering | **CO 1** |
| **9**. | Define level of significance. | **BTL -2** | Understanding | **CO 1** |
| **10**. | State the applications of Z-test. | **BTL -1** | Remembering | **CO 1** |
| **11.** | When does the Z-test apply? | **BTL -1** | Remembering | **CO 1** |
| **12**. | Write down the formula of test statistic 't' to test the significance of difference between the population mean and sample mean. | **BTL -1** | Remembering | **CO 1** |
| **13**. | Write down the formula of test statistic 't' to test the significance of difference between two sample means. | **BTL -2** | Understanding | **CO 1** |

| | | | | |
|---|---|---|---|---|
| **14**. | What are the applications of t-test? | **BTL -1** | Remembering | **CO 1** |
| **15**. | What is the assumption of t-test? | **BTL -2** | Understanding | **CO 1** |
| **16**. | Write the application of 'F' test. | **BTL -2** | Understanding | **CO 1** |
| **17**. | Define 'F' variate. | **BTL -2** | Understanding | **CO 1** |
| **18**. | What are the properties of "F" test? | **BTL -1** | Remembering | **CO 1** |
| **19**. | Write the formula for the chi- square test of goodness of fit of a random sample to a hypothetical distribution. | **BTL -1** | Remembering | **CO 1** |
| **20**. | State the main use of $\psi^2$-test | **BTL -1** | Remembering | **CO 1** |
| **21.** | What are the expected frequencies of 2x2 contingency table?<br>a b<br>c d | **BTL -2** | Understanding | **CO 1** |
| **22.** | State any two applications of $\psi^2$-test. | **BTL -1** | Remembering | **CO 1** |
| **23.** | What are the conditions for Large samples? | **BTL -2** | Understanding | **CO 1** |
| **24.** | What are the conditions for small samples? | **BTL -1** | Remembering | **CO 1** |
| **25.** | Given a sample mean of 83, a sample standard deviation of 12.5 and a sample size of 22, test the hypothesis that the value of the population mean is 70 against the alternative that it is more than 70. Use the 0.25 significance level. | **BTL -2** | Understanding | **CO 1** |
| | **PART-B** | | | |
| **1.** | A simple sample of heights of 6400 Englishmen has a mean of 170cms and a standard deviation of 6.4cms, while a simple sample of heights of 1600 Americans has a mean of 172 cm and a standard deviation of 6.3cms. Do the data indicate that Americans are, on the average, taller than Englishmen? | **BTL -3** | Applying | **CO 1** |
| **2.(b)** | A sample of 100 students is taken from a large population. The mean height of the students in this sample is 160cms. Can it be reasonably regarded that this sample is from a population of mean 165 cm and standard deviation 10 cm? | **BTL -3** | Applying | **CO 1** |
| **2.(b)** | In a certain factory there are two independent processes manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120 Ozs, with a standard deviation of 12 Ozs, while the corresponding figures in a sample of 400 items from the other process are 124 and 14. Is the difference between the two sample means significant? | **BTL -3** | Applying | **CO 1** |
| **3.(a)** | Two random sample of size 400 and 500 have mean 10.9 and 11.5 respectively can the sample regarded as drawn from the same | **BTL -3** | Applying | **CO 1** |

<table>
<tr><td></td><td>population variance 25</td><td></td><td></td><td></td></tr>
<tr><td>3.(b)</td><td>The Intelligence on two groups of boys and girls gave the following results<br><table><tr><td></td><td>Mean</td><td>S.D</td><td>Sample Size</td></tr><tr><td>Girls</td><td>75</td><td>15</td><td>150</td></tr><tr><td>Boys</td><td>70</td><td>20</td><td>250</td></tr></table></td><td>BTL -3</td><td>Applying</td><td>CO 1</td></tr>
<tr><td>4.</td><td>Two independent samples of sizes 8 and 7 contained the following values.<br><table><tr><td>Sample I</td><td>19</td><td>17</td><td>15</td><td>21</td><td>16</td><td>18</td><td>16</td><td>14</td></tr><tr><td>Sample II</td><td>15</td><td>14</td><td>15</td><td>19</td><td>15</td><td>18</td><td>16</td><td></td></tr></table>Test if the two populations have the same mean.</td><td>BTL -3</td><td>Applying</td><td>CO 1</td></tr>
<tr><td>5.</td><td>Two independent samples of 8 and 7 items respectively had the following Values of the variable (weight in kgs.) Use 0.05 LOS<br><table><tr><td>Sample I</td><td>9</td><td>11</td><td>13</td><td>11</td><td>15</td><td>9</td><td>12</td><td>14</td></tr><tr><td>Sample II</td><td>10</td><td>12</td><td>10</td><td>14</td><td>9</td><td>8</td><td>10</td><td>-</td></tr></table>Test if the two populations have the same mean.</td><td>BTL -4</td><td>Analyzing</td><td>CO 1</td></tr>
<tr><td>6.(a)</td><td>Given a sample mean of 83, a sample standard deviation of 12.5 and a sample size of 22, test the hypothesis that the value of the population mean is 70 against the alternative that it is more than 70. Use the 0.25 significance level.</td><td>BTL -4</td><td>Analyzing</td><td>CO 1</td></tr>
<tr><td>6.(b)</td><td>Random samples drawn from two places gave the following data relating to the heights of male adults:<br><table><tr><td></td><td>Place A</td><td>Place B</td></tr><tr><td>Mean height (in inches)</td><td>68.50</td><td>65.50</td></tr><tr><td>S.D ( in inches)</td><td>2.5</td><td>3.0</td></tr><tr><td>No. of adult males in sample</td><td>1200</td><td>1500</td></tr></table>Test at 5 % level, that the mean height is the same for adults in the two places.</td><td>BTL -4</td><td>Analyzing</td><td>CO 1</td></tr>
<tr><td>7.</td><td>A certain stimulus administered to each of 12 patients resulted in the following increase of blood pressure 5,2,8, -1,3,0, -2,1,5,0, 4 & 6. Can it be concluded that the stimulus will, in general, be accompanied by an increase in blood pressure?</td><td>BTL -4</td><td>Analyzing</td><td>CO 1</td></tr>
</table>

<table>
<tr><td>8.</td><td>The nicotine content in milligram of two samples of tobacco where found to be as follows, test the significant difference between means of the two samples.<br><table><tr><td>Sample I</td><td>21</td><td>24</td><td>25</td><td>26</td><td>27</td><td>-</td></tr><tr><td>Sample II</td><td>22</td><td>27</td><td>28</td><td>30</td><td>31</td><td>36</td></tr></table></td><td>BTL -3</td><td>Applying</td><td>CO 1</td></tr>
<tr><td>9.</td><td>The nicotine content in milligram of two samples of toacco where found to be as follows<br>Sample 1 24 27 26 21 25<br>Sample 2 27 30 28 31 22 36<br>Can it be said that this samples where from normal population.</td><td>BTL -3</td><td>Applying</td><td>CO 1</td></tr>
<tr><td>10.</td><td>Samples of two types of electric bulbs were tested for length of life and following data were obtained.<br><table><tr><td></td><td>Type I</td><td>Type II</td></tr><tr><td>Sample Size</td><td>8</td><td>7</td></tr><tr><td>Sample Mean</td><td>1234hrs</td><td>1036hrs</td></tr><tr><td>Sample S.D</td><td>36hrs</td><td>40hrs</td></tr></table>Analyze that, is the difference in the means sufficient to warrant that type I is superior to type II regarding the length of life?</td><td>BTL -3</td><td>Applying</td><td>CO 1</td></tr>
<tr><td>11.</td><td>Two random samples gave the following results:<br><table><tr><td>Sample</td><td>Size</td><td>Sample mean</td><td>Sum of squares of deviation from the mean</td></tr><tr><td>1</td><td>10</td><td>15</td><td>90</td></tr><tr><td>2</td><td>12</td><td>14</td><td>108</td></tr></table>Analyze whether the samples have come from the same normal population.</td><td>BTL -4</td><td>Analyzing</td><td>CO 1</td></tr>
<tr><td>12.</td><td>Two independent samples of size 7 and 6 have the following values<br><table><tr><td>Sample A</td><td>28</td><td>30</td><td>32</td><td>33</td><td>31</td><td>29</td><td>34</td></tr><tr><td>Sample B</td><td>29</td><td>30</td><td>30</td><td>24</td><td>27</td><td>28</td><td>-</td></tr></table></td><td>BTL -3</td><td>Applying</td><td>CO 1</td></tr>
<tr><td>13.</td><td>The following data gives the number of aircraft accidents that occurred during the various days of a week. Find whether the accidents are uniformly distributed over the week<br><table><tr><td>Days</td><td>Sun</td><td>Mon</td><td>Tue</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr><tr><td>No. of</td><td>14</td><td>16</td><td>08</td><td>12</td><td>11</td><td>9</td><td>14</td></tr></table></td><td>BTL -4</td><td>Analyzing</td><td>CO 1</td></tr>
</table>

| | | | | |
|---|---|---|---|---|
| | accidents | | | |
| **14.** | The theory predicts that the population of beans in the four groups A, B, C and D should be 9:3:3:1. In an experiment among 1600 beans, the number in the four groups was 882,313,287 and 118. Do the experimental results support the survey? | **BTL -4** | Analyzing | **CO 1** |
| **15.** | 5 coins were tossed 320 times. The number of heads observed is given below :<br>No. of heads: 0 \| 1 \| 2 \| 3 \| 4 \| 5<br>Observed frequencies: 15 \| 45 \| 85 \| 95 \| 60 \| 20<br>Examine whether the coin is unbiased .Use 5% level of significance. | **BTL -3** | Applying | **CO 1** |
| **16.** | Records taken of the number of male and female births in 800 families having four Children are as follows :<br>Number of male births : 0 1 2 3 4<br>Number of female births : 4 3 2 1 0<br>Number of Families : 32 178 290 236 64<br>Infer whether the data are consistent with the hypothesis that the binomial law holds the chance of a male birth is equal to female birth, namely p = ½ = q. | **BTL -4** | Analyzing | **CO 1** |
| **17.** | Given the following table for hair color and eye color, identify the value of Chi-square. Is there good association between hair color and eye color?<br>Hair color / Eye color: Fair / Brown / Black / Total<br>Blue: 15 / 5 / 20 / 40<br>Grey: 20 / 10 / 20 / 50<br>Brown: 25 / 15 / 20 / 60<br>Total: 60 / 30 / 60 / 150 | **BTL -3** | Applying | **CO 1** |
| **18.** | A sample of 200 persons with a particular disease was selected. Out of these, 100 were given a drug and the others were not given any drug. The result are as follows:<br>Number of persons: Drug / No drug / Total<br>Cured: 65 / 55 / 120<br>Not cured: 35 / 45 / 80 | **BTL -3** | Applying | **CO 1** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total | 100 | 100 | 200 | | |
| | Test whether the drug is effective or not? | | | | | | |

**UNIT II- EXPERIMENTAL DESIGN FOR ANOVA**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design

| Q. No. | Question | BT Level | Competence | |
|---|---|---|---|---|
| | **PART – A** | | | |
| **1**. | What is the aim of design of experiments? | **BTL -1** | Remembering | **CO 2** |
| **2**. | Write the basic assumptions in analysis of variance. | **BTL -2** | Understanding | **CO 2** |
| **3.** | When do you apply analysis of variance technique? | **BTL -2** | Understanding | **CO 2** |
| **4**. | Define Randomization. | **BTL -1** | Remembering | **CO 2** |
| **5**. | Define Replication. | **BTL -2** | Understanding | **CO 2** |
| **6**. | Define Local control. | **BTL -1** | Remembering | **CO 2** |
| **7**. | What is meant by tolerance limits? | **BTL -2** | Understanding | **CO 2** |
| **8**. | What is a completely randomized design. | **BTL -1** | Remembering | **CO 2** |
| **9**. | Explain the advantages of a Latin square design? | **BTL -2** | Understanding | **CO 2** |
| **10**. | What are the basic elements of an Completely Randomized Experimental Design? | **BTL -1** | Remembering | **CO 2** |
| **11.** | Demonstrate the purpose of blocking in a randomized block design? | **BTL -1** | Remembering | **CO 2** |
| **12**. | Manipulate the Basic principles of the design of experiment? | **BTL -1** | Remembering | **CO 2** |
| **13**. | Why a 2x2 Latin square is not possible? Explain. | **BTL -2** | Understanding | **CO 2** |
| **14**. | Analyze the advantages of the Latin square design over the other design. | **BTL -1** | Remembering | **CO 2** |
| **15**. | Demonstrate main advantage of Latin square Design over Randomized Block Design? | **BTL -2** | Understanding | **CO 2** |
| **16**. | Write any two differences between RBD and LSD. | **BTL -2** | Understanding | **CO 2** |
| **17**. | What is ANOVA? | **BTL -2** | Understanding | **CO 2** |
| **18**. | What are the uses of ANOVA? | **BTL -1** | Remembering | **CO 2** |
| **19**. | Define experimental error. | **BTL -1** | Remembering | **CO 2** |

<table>
<tr><td>20.</td><td>What is the Degree is of freedom by one way classification.</td><td>BTL -1</td><td>Remembering</td><td>CO 2</td></tr>
<tr><td>21.</td><td>Explain SSB and SSW in ANOVA.</td><td>BTL -2</td><td>Understanding</td><td>CO 2</td></tr>
<tr><td>22.</td><td>What is the advantages of CRD?</td><td>BTL -1</td><td>Remembering</td><td>CO 2</td></tr>
<tr><td>23.</td><td>What is RBD?</td><td>BTL -2</td><td>Understanding</td><td>CO 2</td></tr>
<tr><td>24.</td><td>What is the disadvantages of RBD?</td><td>BTL -1</td><td>Remembering</td><td>CO 2</td></tr>
<tr><td>25.</td><td>Write any two differences between RBD and CRD.</td><td>BTL -2</td><td>Understanding</td><td>CO 2</td></tr>
<tr><td colspan="4">PART –B</td><td></td></tr>
<tr><td>1.</td><td>In order to determine whether the significant difference in the durability of 3makes of computers, samples of size 5 are selected from each make and the frequency of repair during the first year of purchase is observed. The results are as follows: In view of the above data, what conclusion can you draw?
<table>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>5</td><td>8</td><td>7</td></tr>
<tr><td>6</td><td>10</td><td>3</td></tr>
<tr><td>8</td><td>11</td><td>5</td></tr>
<tr><td>9</td><td>12</td><td>4</td></tr>
<tr><td>7</td><td>4</td><td>1</td></tr>
</table></td><td>BTL -3</td><td>Applying</td><td>CO 2</td></tr>
<tr><td>2.</td><td>Apply ANOVA technique and write your comment regarding the performance of the 4 machines? Test at 5% level of significance.
<table>
<tr><td rowspan="4">Machines</td><td>A</td><td>8</td><td>9</td><td>11</td><td>12</td></tr>
<tr><td>B</td><td>6</td><td>8</td><td>10</td><td>4</td></tr>
<tr><td>C</td><td>14</td><td>12</td><td>18</td><td>9</td></tr>
<tr><td>D</td><td>20</td><td>22</td><td>25</td><td>23</td></tr>
</table></td><td>BTL -4</td><td>Analyzing</td><td>CO 2</td></tr>
<tr><td>3.</td><td>The following are the number of mistakes made in 5 successive days by four technicians working for a photographic laboratory. Test whether the difference among the four sample means can be attributed to chance. Test at a level of significance $\alpha = 0.05$.
<table>
<tr><td colspan="4">Technician</td></tr>
<tr><td>I</td><td>II</td><td>III</td><td>IV</td></tr>
<tr><td>6</td><td>14</td><td>10</td><td>9</td></tr>
<tr><td>14</td><td>9</td><td>12</td><td>12</td></tr>
<tr><td>10</td><td>12</td><td>7</td><td>8</td></tr>
<tr><td>8</td><td>10</td><td>15</td><td>10</td></tr>
<tr><td>11</td><td>14</td><td>11</td><td>11</td></tr>
</table></td><td>BTL -4</td><td>Analyzing</td><td>CO 2</td></tr>
<tr><td>4.</td><td>A completely randomized design experiment with 10 plots and 3 treatments gave the results given below. Analyze the results for the</td><td>BTL -3</td><td>Applying</td><td>CO 2</td></tr>
</table>

<table>
<tr><td></td><td>effects of treatments.<br><table><tr><td>Treatment</td><td colspan="4">Replications</td></tr><tr><td>A</td><td>5</td><td>7</td><td>1</td><td>3</td></tr><tr><td>B</td><td>4</td><td>4</td><td>7</td><td></td></tr><tr><td>C</td><td>3</td><td>1</td><td>5</td><td></td></tr></table></td><td></td><td></td><td></td></tr>
<tr><td>5.</td><td>As part of the investigation of the collapse of the roof of a building, a testing laboratory is given all the available bolts that connected all the steel structure at three different positions on the roof. The forces required to shear each of these bolts (coded values) are as follows:<br>Position 1: 90 82 79 98 83 91<br>Position 2: 105 89 93 104 89 95 86<br>Position 3: 83 89 80 94<br>Analyze an analysis of variance to test at 0.05 level of significance whether the differences among the sample means at the three positions are significant.</td><td>BTL -4</td><td>Analyzing</td><td>CO 2</td></tr>
<tr><td>6.</td><td>As head of a department of a consumers research organization you have the responsibility of testing and comparing life times of four brands of electric bulbs.<br>BRANDS<br><table><tr><td>A</td><td>B</td><td>C</td><td>D</td></tr><tr><td>20</td><td>25</td><td>24</td><td>23</td></tr><tr><td>19</td><td>23</td><td>20</td><td>20</td></tr><tr><td>21</td><td>21</td><td>22</td><td>20</td></tr></table></td><td>BTL -4</td><td>Analyzing</td><td>CO 2</td></tr>
<tr><td>7.</td><td>Four machines A,B,C,D are used to produce a certain kind of cotton fabric.<br><table><tr><td>A</td><td>B</td><td>C</td><td>D</td></tr><tr><td>8</td><td>6</td><td>14</td><td>20</td></tr><tr><td>9</td><td>8</td><td>12</td><td>22</td></tr><tr><td>11</td><td>10</td><td>18</td><td>25</td></tr><tr><td>12</td><td>4</td><td>9</td><td>23</td></tr></table>Do you think there is a significant difference in the performance of four machines</td><td>BTL -4</td><td>Analyzing</td><td>CO 2</td></tr>
<tr><td>8.</td><td>A company appoints 4 salesmen A, B, C and D and observes their sales in 3 seasons, summer winter and monsoon. The figures are given in the following table:<br><table><tr><td></td><td colspan="4">Salesmen</td></tr><tr><td>Season</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Summer</td><td>45</td><td>40</td><td>28</td><td>37</td></tr><tr><td>Winter</td><td>43</td><td>41</td><td>45</td><td>38</td></tr><tr><td>Monsoon</td><td>39</td><td>39</td><td>43</td><td>41</td></tr></table>Carry out an Analysis of variances.</td><td>BTL -3</td><td>Applying</td><td>CO 2</td></tr>
<tr><td>9.</td><td>Five doctors each test five treatments for a certain disease and observe the number of days each patient takes to recover. The results are as follows (recovery time in days)<br><table><tr><td></td><td colspan="5">Treatment</td></tr><tr><td>Doctor</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>A</td><td>10</td><td>14</td><td>23</td><td>18</td><td>20</td></tr></table></td><td>BTL -3</td><td>Applying</td><td>CO 2</td></tr>
</table>

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | B | 11 | 15 | 24 | 17 | 21 | | | |
| | C | 9 | 12 | 20 | 16 | 19 | | | |
| | D | 8 | 13 | 17 | 17 | 20 | | | |
| | E | 12 | 15 | 19 | 15 | 22 | | | |

Estimate the difference between (a) doctors and(b)treatments for the above data at 5% level.

**10.** Perform a 2-way ANOVA on the data given below:

| | | Treatment 1 | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| Treatment 2 | 1 | 30 | 26 | 38 |
| | 2 | 24 | 29 | 28 |
| | 3 | 33 | 24 | 35 |
| | 4 | 36 | 31 | 30 |
| | 5 | 27 | 35 | 33 |

Use the coding method subtracting 30 from the given no.

**BTL -3** Applying **CO 2**

**11.** A chemist wishes to test the effect of four chemical agents on the strength of a particular type of cloth. Because there might be variability from one bolt to another , the chemist decides to use a randomized block design ,with the bolts of cloth consider as blocks ,she selects five bolts and applies all four chemical in random order to each bolt, The resulting tensile strength follows

| | | BOLT | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| CHEMICAL | 1 | 73 | 68 | 74 | 71 | 67 |
| | 2 | 73 | 67 | 75 | 72 | 70 |
| | 3 | 75 | 68 | 78 | 73 | 68 |
| | 4 | 73 | 71 | 75 | 75 | 69 |

Does the tensile strength depend on chemical? Test at 5% level of significance.

**BTL -3** Applying **CO 2**

**12.** Analyze the RBD at 5% level of significance.

| | Variety | | |
|---|---|---|---|
| Treatment | 1 | 2 | 3 |
| 1 | 8 | 10 | 12 |
| 2 | 2 | 6 | 7 |
| 3 | 4 | 10 | 9 |
| 4 | 3 | 5 | 9 |

**BTL -3** Applying **CO 2**

**13.** The following table gives the number of Acs sold by 4 salesman in three months.

| | Salesmen | | | |
|---|---|---|---|---|
| Season | 1 | 2 | 3 | 4 |
| Summer | 45 | 40 | 28 | 37 |
| Winter | 43 | 41 | 45 | 38 |
| Monsoon | 39 | 39 | 43 | 41 |

Analyze the RBD at 5% level of significance

**BTL -3** Applying **CO 2**

| | | | | |
|---|---|---|---|---|
| **14.** | The following data resulted from an experiment to compare three burners A, B, C. A Latin square design was used as the tests were made on 3 engines and were spread over 3 days.<br>A 16 B 17 C 20<br>B 16 C 21 A 15<br>C 15 A 12 B 13<br>Test the hypothesis and infer that there is no difference between the burners. | **BTL -4** | Analyzing | **CO 2** |
| **15.** | A farmer wishes to test the effects of four different fertilizers A,B,C,D on the yield of Wheat. In order to eliminate sources of error due to variability in soil fertility, he uses the fertilizers, in a Latin square arrangement a syndicated in the following table, where the numbers indicate yields per unit area.<br>A18 C21 D25 B11<br>D22 B12 A15 C19<br>B15 A20 C23 D24<br>C22 D21 B10 A17<br>Design an analysis of variance to determine if there is a significant difference between the fertilizers at $\alpha = 0.05$ levels of significance. | **BTL -3** | Applying | **CO 2** |
| **16.** | Set up the analysis of variance for the following results of a Latin Square Design<br>A12 C19 B10 D8<br>C18 B12 D6 A7<br>B22 D10 A5 C21<br>D12 A7 C27 B17 | **BTL -4** | Analyzing | **CO 2** |
| **17.** | The following data resulted from an experiment to compare three Machine A, B, C. A Latin square design was used as the tests were made on 3 engines and were spread over 3 days.<br>A 10 B 11 C 9<br>B 14 C 12 A 15<br>C 16 A 15 B 13<br>Test the hypothesis and infer that there is no difference between the burners. | **BTL -3** | Applying | **CO 2** |
| **18.** | In a 5x5 Latin square experiment, the data collected is given in the matrix below Yield per plot is given in quintals for the five different cultivation treatments A, B, C,D and E. Perform the analysis of variance.<br>A48 E66 D56 C52 B61<br>D64 B62 A50 E64 C63<br>B69 A53 C60 D61 E67<br>C57 D58 E67 B65 A55<br>E67 C57 B66 A60 D57 | **BTL -3** | Applying | **CO 2** |

**UNIT-III: SOLUTION OF EQUATIONS AND EIGENVALUEPROBLEMS**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton - Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative

method of Gauss Seidel –Dominant Eigenvalue of a matrix by Power method.

| PART – A | | | | |
|---|---|---|---|---|
| **Q. No.** | **Question** | **BT Level** | **Competence** | |
| **1.** | Give two examples of transcendental and algebraic equations | **BTL -1** | Remembering | **CO 3** |
| **2.** | When should we not use Newton Raphson method? | **BTL -2** | Understanding | **CO 3** |
| **3.** | Write the iterative formula of Newton's- Raphson Method | **BTL -2** | Understanding | **CO 3** |
| **4.** | State the rate of Convergence of Newton Raphson method. | **BTL -1** | Remembering | **CO 3** |
| **5.** | Derive the Newton's iterative formula for $P^{th}$ root of a number N. | **BTL -2** | Understanding | **CO 3** |
| **6.** | Find where the real root lies in between, for the equation $x\,tanx = -1$. | **BTL -1** | Remembering | **CO 3** |
| **7.** | State the order and condition for convergence of Iteration method. | **BTL -2** | Understanding | **CO 3** |
| **8.** | State the principle used in Gauss Jordon method. | **BTL -1** | Remembering | **CO 3** |
| **9.** | Find the inverse of A = $\begin{pmatrix} 4 & 1 \\ 1 & 3 \end{pmatrix}$ by Jordon method. | **BTL -2** | Understanding | **CO 3** |
| **10.** | Solve by Gauss Elimination method $x + y = 2$ and $2x + 3y = 5$ | **BTL -1** | Remembering | **CO 3** |
| **11.** | Distinguish the advantages of iterative methods over direct method of solving a system of linear algebraic equations. | **BTL -1** | Remembering | **CO 3** |
| **12.** | Find the inverse of A = $\begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$ by Jordan method. | **BTL -1** | Remembering | **CO 3** |
| **13.** | Compare Gauss Elimination, Gauss Jordan method. | **BTL -2** | Understanding | **CO 3** |
| **14.** | State the condition for the convergence of Gauss Seidel iteration method for solving a system of linear equation. | **BTL -1** | Remembering | **CO 3** |
| **15.** | What is diagonally dominant? | **BTL -2** | Understanding | **CO 3** |
| **16.** | Which of the iterative methods is used for solving linear system of equations it converges fast? | **BTL -2** | Understanding | **CO 3** |
| **17.** | Compare Gauss Seidel method, Gauss Elimination method. | **BTL -2** | Understanding | **CO 3** |
| **18.** | Explain Power method to find the dominant Eigen value of a square matrix A | **BTL -1** | Remembering | **CO 3** |
| **19.** | How will you find the smallest Eigen value of a matrix A. | **BTL -1** | Remembering | **CO 3** |
| **20.** | Find the dominant Eigen value of $A=\begin{pmatrix} 2 & 3 \\ 5 & 4 \end{pmatrix}$ by power method up to | **BTL -1** | Remembering | **CO 3** |

| | | | | |
|---|---|---|---|---|
| | 1 decimal place accuracy. Start with $X^{(0)} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ | | | |
| **21.** | Write the other name of Newton Raphson method? | **BTL -2** | Understanding | **CO 3** |
| **22.** | When Gauss Elimination method fails? | **BTL -1** | Remembering | **CO 3** |
| **23.** | Give two indirect methods to solve system of linear equations. | **BTL -2** | Understanding | **CO 3** |
| **24.** | Is the Iteration method, a self-correcting method always? | **BTL -1** | Remembering | **CO 3** |
| **25.** | Find the root of the equation $x^3 - 2x - 5 = 0$. | **BTL -2** | Understanding | **CO 3** |
| | **PART – B** | | | |
| **1.** | Find the positive real root of $log_{10} x = 1.2$ using Newton – Raphson method. | **BTL -3** | Applying | **CO 3** |
| 2.(a) | Solve using Gauss-Seidel method $4x + 2y + z = 1, x + 5y - z = 10, x + y + 8z = 20$ | **BTL -3** | Applying | **CO 3** |
| 2.(b) | Evaluate the positive real root of $x^2 - 2x - 3 = 0$ using Iteration method, Correct to 3 decimal places. | | | |
| 3.(a) | Find the inverse of the matrix $\begin{pmatrix} 2 & 2 & 3 \\ 2 & 1 & 1 \\ 1 & 3 & 5 \end{pmatrix}$ using Gauss Jordan method. | **BTL -3** | Applying | **CO 3** |
| 3.(b) | Solve by Gauss Elimination method $3x + y - z = 3$ ; $2x - 8y + z = -5$ ; $x - 2y + 9z = 8$ | | | |
| **4.** | Find the dominant Eigen value and vector of A = $\begin{pmatrix} 3 & 2 & 4 \\ -1 & 4 & 10 \\ 1 & 3 & -1 \end{pmatrix}$ using Power method. | **BTL -3** | Applying | **CO 3** |
| 5. (a) | Solve by Gauss Jordan method $10x + y + z = 12$ ; $2x + 10y + z = 13$; $x + y + 5z = 7$. | **BTL -3** | Applying | **CO 3** |
| 5.(b) | Find the positive root of $\cos x = 3x - 1$ correct to 3 decimal places using fixed point iteration method. | | | |
| **6.** | Apply Gauss Seidel method to solve system of equations $x - 2y + 5z = 12, 5x + 2yz = 6, 2x + 6y - 3z = 5$ (Do up to 5 iterations) | **BTL -3** | Applying | **CO 3** |

| | | | | |
|---|---|---|---|---|
| **7.** | Using Newton's method find the iterative formula for $\frac{1}{N}$ where N is positive integer and hence find the value of $\frac{1}{26}$ | **BTL -4** | Analyzing | **CO 3** |
| **8.** | By Gauss seidel method to solve system of equations<br>x + y + 54z = 110; 27x + 6y –z = 85; 6x + 15y – 2z =72. | **BTL -4** | Analyzing | **CO 3** |
| **9.** | Derive the iterative formula for $\sqrt{N}$ where N is positive integer using Newton's method and hence find the value of $\sqrt{142}$ . | **BTL -3** | Applying | **CO 3** |
| **10.** | Evaluate the dominant Eigen value and vector of<br>A = $\begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$ using Power method. | **BTL -4** | Analyzing | **CO 3** |
| **11.** | Find all possible Eigen values by Power method for A = $\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ | **BTL -3** | Applying | **CO 3** |
| **12.** | Using Gauss-Jordan method, find the inverse of the matrix $(8\ -4\ 0\ -4\ 8\ -4\ 0\ -4\ 8)$ | **BTL -3** | Applying | **CO 3** |
| **13.** | Find the positive root of $e^x$ -3x = 0 correct to 3 decimal places using fixed point iteration method. | **BTL -3** | Applying | **CO 3** |
| **14.** | Solve using Gauss-Seidal method<br>$8x - 3y + 2z = 20,\ 4x + 11y - z = 33,\ 6x + 3y + 12z = 35$ . | **BTL -4** | Analyzing | **CO 3** |
| **15.** | Solve by Gauss Elimination method<br>x +3y +3z = 16 ; x +4y +3z = 18 ; x +3y +4z =19. | **BTL -3** | Applying | **CO 3** |
| **16.** | Solve by Gauss Jordan method 10 x -2y + 3z =23 ;<br>2x + 10y -5z = -33; 3x -4y + 10z =41. | **BTL -4** | Analyzing | **CO 3** |
| **17.** | Using Gauss-Jordan method, find the inverse of the matrix<br>$(1\ 1\ 3\ 1\ 3\ -3\ -2\ -4\ -4)$ | **BTL -4** | Analyzing | **CO 3** |
| **18.** | Find the positive real root of $x log_{10} x = 12.34$ using<br>Newton – Raphson method start with $x_0 = 10$. | **BTL -3** | Applying | **CO 3** |

**UNIT-IV:INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical integrations using Trapezoidal, Simpson's rules.

**PART – A**

| **Q. No.** | **Question** | **BT Level** | **Competence** | |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| **1.** | Define interpolation | **BTL -1** | Remembering | **CO 4** |
| **2.** | Write down the Lagrange's interpolation formula | **BTL -2** | Understanding | **CO 4** |
| **3.** | Create Forward interpolation table for the following data<br>X : 0 5 10 15<br>Y : 14 379 1444 3584 | **BTL -2** | Understanding | **CO 4** |
| **4.** | Using Lagrange's formula to fit a polynomial from the data<br>X: 0 1 3<br>Y: 5 6 4 | **BTL -1** | Remembering | **CO 4** |
| **5.** | State Newton Gregory forward interpolation formula. | **BTL -2** | Understanding | **CO 4** |
| **6.** | Write any two properties of divided differences | **BTL -1** | Remembering | **CO 4** |
| **7.** | Find the divided difference table for the following data (0, 0), (1, 2), (2, 2.5), (3, 2.3), (4, 2), (5, 1.7) and (6, 1.5) | **BTL -2** | Understanding | **CO 4** |
| **8.** | State the formula to find the first and second order derivative using the forward differences | **BTL -1** | Remembering | **CO 4** |
| **9.** | State the formula to find the first and second order derivative using backward differences. | **BTL -2** | Understanding | **CO 4** |
| **10.** | Form the divided difference table for the following data:<br>X: 5 15 22<br>Y: 7 36 160 | **BTL -1** | Remembering | **CO 4** |
| **11.** | Find the polynomial which takes the following values given<br>f (0) = -1, f (1) = 1 and f (2) = 4 using the Newton's interpolating formula | **BTL -1** | Remembering | **CO 4** |
| **12.** | Find the divided difference table for the following data (0,1) ,<br>(1, 4), (3,40) and (4,85) . | **BTL -1** | Remembering | **CO 4** |
| **13.** | Find the divided difference table for the following data<br>X : 4 5 7 10 11 13<br>f(x) : 48 100 294 900 1210 2028 . | **BTL -2** | Understanding | **CO 4** |
| **14.** | Write the formula of inverse Lagrange's interpolation formula | **BTL -1** | Remembering | **CO 4** |
| **15.** | Find the divided difference table for the following data<br>x: 2 5 10<br>y: 5 29 109 | **BTL -2** | Understanding | **CO 4** |
| **16.** | Write the Trapezoidal rule to evaluate the single integration . | **BTL -2** | Understanding | **CO 4** |

<table>
<tr><td>17.</td><td>State the Simpson’s 1/3-rule in numerical integration</td><td>BTL -2</td><td>Understanding</td><td>CO 4</td></tr>
<tr><td>18.</td><td>What is the order of error in Trapezoidal and Simpson’s one-third rules?</td><td>BTL -1</td><td>Remembering</td><td>CO 4</td></tr>
<tr><td>19.</td><td>State Trapezoidal for double integration</td><td>BTL -1</td><td>Remembering</td><td>CO 4</td></tr>
<tr><td>20.</td><td>State Simpson’s rule for double integration</td><td>BTL -1</td><td>Remembering</td><td>CO 4</td></tr>
<tr><td>21.</td><td>Calculate $\int_1^4 f(x)dx$ from the table by Simpson’s 1/3 rd rule<br>x : 1 2 3 4<br>f(x): 1 8 27 64</td><td>BTL -2</td><td>Understanding</td><td>CO 4</td></tr>
<tr><td>22.</td><td>Evaluate $\int_{0.5}^{1} \frac{dx}{x}$ by Trapezoidal rule, dividing the range into 4 equal parts</td><td>BTL -1</td><td>Remembering</td><td>CO 4</td></tr>
<tr><td>23.</td><td>Describe in numerical integration, what should be the number of intervals to apply Simpson’s one – third rule.</td><td>BTL -2</td><td>Understanding</td><td>CO 4</td></tr>
<tr><td>24.</td><td>Using Trapezoidal rule, evaluate $\int_0^1 \frac{dx}{1+x^2}$ with h = 0.2 hence obtain an approximate value of $\pi$</td><td>BTL -1</td><td>Remembering</td><td>CO 4</td></tr>
<tr><td>25.</td><td>Evaluate $\int_1^2 \frac{dx}{1+x^2}$ , using Trapezoidal rule, taking h = 0.5</td><td>BTL -2</td><td>Understanding</td><td>CO 4</td></tr>
<tr><td colspan="4">PART-B</td><td></td></tr>
<tr><td>1.(a)</td><td>From the following table, find y at x = 6 using Newton’s divided difference formula<br><table><tr><td>X</td><td>1</td><td>2</td><td>7</td><td>8</td></tr><tr><td>y</td><td>1</td><td>5</td><td>5</td><td>4</td></tr></table></td><td>BTL -3</td><td>Applying</td><td>CO 4</td></tr>
<tr><td>1. (b)</td><td>A Jet fighters position on an air craft carries runway was timed during landing<br><table><tr><td>t(sec)</td><td>1.0</td><td>1.1</td><td>1.2</td><td>1.3</td><td>1.4</td><td>1.5</td><td>1.6</td></tr><tr><td>y(m)</td><td>7.989</td><td>8.403</td><td>8.781</td><td>9.129</td><td>9.451</td><td>9.750</td><td>10.031</td></tr></table>where y is the distance from end of carrier. Estimate the velocity and acceleration at t = 1.0.</td><td>BTL -3</td><td>Applying</td><td>CO 4</td></tr>
<tr><td>2.</td><td>Find the polynomial using Newton’s forward interpolation formula and also find y(1.5) and y (4), given that<br><table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>y</td><td>1</td><td>2</td><td>1</td><td>10</td></tr></table></td><td>BTL -3</td><td>Applying</td><td>CO 4</td></tr>
<tr><td>3.</td><td>Calculate $f'(50), f'(56), f''(50)\ and\ f''(56)$ from the following table</td><td>BTL -3</td><td>Applying</td><td>CO 4</td></tr>
</table>

| | | | | | |
|---|---|---|---|---|---|
| | x \| 50 \| 51 \| 52 \| 53 \| 54 \| 55 \| 56<br>f(x) \| 3.6840 \| 3.7084 \| 3.7325 \| 3.7563 \| 3.7798 \| 3.8030 \| 3.8259 | | | | |
| **4.** | Evaluate $\int_0^2 e^x dx$ by using Trapezoidal rule taking 6 subintervals. | **BTL -3** | Applying | **CO 4** |
| **5.** | Evaluate $\int_0^1 \frac{dx}{1+x^2}$, dividing the range into 4 equal parts using Trapezoidal and Simpson's rule. | **BTL -3** | Applying | **CO 4** |
| **6.** | Use Lagrange's interpolation formula, find the value of f(3) from the following data:<br>x \| 0 \| 1 \| 2 \| 5<br>f(x) \| 2 \| 3 \| 12 \| 147 | **BTL -3** | Applying | **CO 4** |
| **7.** | From the data given below, find f(43) and f(71)<br>x \| 40 \| 50 \| 60 \| 70 \| 80<br>f(x) \| 184 \| 204 \| 226 \| 250 \| 276 | **BTL -4** | Analyzing | **CO 4** |
| **8.** | Using Lagrange's Interpolation formula, Find the polynomial f(x) form the following data also find f(3)<br>x \| 0 \| 1 \| 4 \| 5<br>f(x) \| 4 \| 3 \| 24 \| 39 | **BTL -4** | Analyzing | **CO 4** |
| **9.** | Find the first and second derivative of the function f(x) at x=1.5 and x = 4<br>x \| 1.5 \| 2 \| 2.5 \| 3 \| 3.5 \| 4<br>f(x) \| 3.375 \| 7 \| 13.625 \| 24 \| 38.875 \| 59 | **BTL -3** | Applying | **CO 4** |
| **10.** | Determine by Lagrange's interpolation method, find y(10) from the following table<br>X \| 5 \| 6 \| 9 \| 11<br>Y \| 12 \| 13 \| 14 \| 16 | **BTL -4** | Analyzing | **CO 4** |
| **11.** | Use the Newton divided difference formula to calculate $f(2), f(8)$ *and* $f(15)$ from the following table<br>x \| 4 \| 5 \| 7 \| 10 \| 11 \| 13<br>f(x) \| 48 \| 100 \| 294 \| 900 \| 1210 \| 2028 | **BTL -3** | Applying | **CO 4** |
| **12.** | Find f (x) as a polynomial in x from the following data by using Newton's divided difference formula and find the value of f (8). | **BTL -3** | Applying | **CO 4** |

| | | | | |
|---|---|---|---|---|
| | X \| 3 \| 7 \| 9 \| 10<br>f(x) \| 168 \| 120 \| 72 \| 63 | | | |
| **13.** | By dividing the range into 10 equal parts, evaluate $\int_0^{\pi} sin\ sin\ x\ dx$ by Trapezoidal and Simpson's rule. Verify your answer with integration | **BTL -3** | Applying | **CO 4** |
| **14.** | Evaluate $\int_0^1 \int_1^2 \frac{2xy\,dx\,dy}{(1+x^2)(1+y^2)}$ using, Trapezoidal and Simpson's 1/3 rd rule, given that h = k = 0.25. | **BTL -4** | Analyzing | **CO 4** |
| **15.** | The velocity V of a particle at distances from a point on its path is given by the table<br>T feet \| 0 \| 10 \| 20 \| 30 \| 40 \| 50 \| 60<br>V feet/s \| 47 \| 58 \| 64 \| 65 \| 61 \| 52 \| 38<br>Estimate the time taken to travel 60 feet by using Trapezoidal and Simpson's 1/3rd rule. | **BTL -3** | Applying | **CO 4** |
| **16.** | Construct Newton's forward interpolation polynomial for the following data:<br>x \| 1 \| 2 \| 3 \| 4 \| 5<br>f(x) \| 1 \| -1 \| 1 \| -1 \| 1 | **BTL -4** | Analyzing | **CO 4** |
| **17.** | Find $\int_0^1 \int_0^1 \frac{dx\,dy}{1+xy}$ using Simpson's one-third rule with h=k=0.25 | **BTL -4** | Analyzing | **CO 4** |

| | | | | |
|---|---|---|---|---|
| **18.** | Evaluate $\int_0^1 \int_0^1 \frac{dx\,dy}{1+x+y}$ using, Simpson's 1/3 rd rule, given that (i) h = k = 0.25 , (ii) h = k = 0.5. | **BTL -3** | Applying | **CO 4** |

**UNIT-V: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**

Single step methods: Taylor's series method - Euler's method - Modified Euler's method Fourth order Runge-Kutta method for solving first order equations - Multi step methods: Milne's and Adams -Bash forth predictor corrector methods for solving first. order equations.

**PART-A**

| **Q. No.** | **Question** | **BT Level** | **Competence** | |
|---|---|---|---|---|
| **1.** | Give Euler's iteration formula for ordinary differential equation. | **BTL -1** | Remembering | **CO 5** |
| **2.** | Estimate $y(0.2)$ if $\frac{dy}{dx} = \frac{x-y}{2}$ , $y(0) = 1$ taking $h = 0.1$ , using Euler's method. | **BTL -2** | Understanding | **CO 5** |
| **3.** | Estimate $y(0.2)$ given that $y' = x + y, y(0) = 1$, using Euler's method. | **BTL -2** | Understanding | **CO 5** |
| **4.** | Define local truncation error of the Euler's method. | **BTL -1** | Remembering | **CO 5** |
| **5.** | Define initial value problems. | **BTL -2** | Understanding | **CO 5** |
| **6.** | Write the Euler's modified formula for solving $\frac{dy}{dx} = f(x,y), y(x_0) = y_0$ | **BTL -1** | Remembering | **CO 5** |
| **7.** | Using modified Euler's method to find y (0.4) given $y' = xy, y(0) = 1$ | **BTL -2** | Understanding | **CO 5** |
| **8.** | Write the merits and demerits of the Taylor's method. | **BTL -1** | Remembering | **CO 5** |
| **9.** | Find y(0.1), if $\frac{dy}{dx} = y^2 + x$ given $y(0) = 1$, by Taylor series method. | **BTL -2** | Understanding | **CO 5** |
| **10.** | Using Taylor series formula to find y ($x_1$) for solving $y' = f(x,y), y(x_0) = y_0$. | **BTL -1** | Remembering | **CO 5** |
| **11.** | Using Taylor's series up to $x^3$ terms for $2y' + y = x + 1, y(0) = 1$. | **BTL -1** | Remembering | **CO 5** |
| **12.** | Using Taylor series for the function $y' = x + y$ when $y(1) = 0$ find $y$ at $x = 1.2$ with $h = 0.1$. | **BTL -1** | Remembering | **CO 5** |
| **13.** | Write the formula Runge – Kutta method of order 4 for ordinary differential equation. | **BTL -2** | Understanding | **CO 5** |

| | | | | |
|---|---|---|---|---|
| **14.** | What are the advantages of R-K method over Taylor's method. | **BTL -1** | Remembering | **CO 5** |
| **15.** | Using fourth order Runge – Kutta method to find y (0.1) given $\frac{dy}{dx} = x + y$ y (0) = 1, h = 0.1 | **BTL -2** | Understanding | **CO 5** |
| **16.** | State Adam- Bashforth predictor and corrector formulae to solve first order ordinary differential equations. | **BTL -2** | Understanding | **CO 5** |
| **17.** | State Milne's predictor corrector formula. | **BTL -2** | Understanding | **CO 5** |
| **18.** | What are the single step methods available for solving ordinary differential equations. | **BTL -1** | Remembering | **CO 5** |
| **19.** | Adam- Bashforth predictor and corrector method is applicable for….? | **BTL -1** | Remembering | **CO 5** |
| **20.** | Prepare the multi-step methods available for solving ordinary differential equation. | **BTL -1** | Remembering | **CO 5** |
| **21.** | Write the Error for Adam- Bashforth predictor and corrector method. | **BTL -2** | Understanding | **CO 5** |
| **22.** | Estimate $y(0.1)$ given that $y' = xy, y(0) = 2$, using Euler's method. | **BTL -1** | Remembering | **CO 5** |
| **23.** | Using modified Euler's method to find y (0.5) given $y' = x + y$, $y(0) = 1$ | **BTL -2** | Understanding | **CO 5** |
| **24.** | Using Taylor series for the function $\frac{dy}{dx} = 2x + 3y$ when $y(1) = 0$ find $y$ at $x = 1.5$ with $h = 0.5$. | **BTL -1** | Remembering | **CO 5** |
| **25.** | Find $k_1$ given $y' = x^3 + y, y(0) = 1$, using R-K method of fourth order. | **BTL -2** | Understanding | **CO 5** |
| | **PART – B** | | | |
| **1.** | Apply Euler method to find y (0.2) given $\frac{dy}{dx} = y - x^2 + 1$ and y(0) = 0.5. | **BTL -3** | Remembering | **CO 5** |
| **2.** | Find the values of y at x = 0.2 for , y(0) = 1 with step length 0.1 using Taylor series method | **BTL -4** | Analyzing | **CO 5** |
| **3.** | Using Taylor series method find y at x = 0.5, y (0) = -1, with step length 0.1 given $\frac{dy}{dx} = -2x - y$ | **BTL -3** | Remembering | **CO 5** |
| **4.** | Using Euler Method to find y(0.2) and y(0.4) from $\frac{dy}{dx} = x + y$, y (0) = 1 with h = 0.2 | **BTL -4** | Analyzing | **CO 5** |
| **5.** | By Euler method for the function $\frac{dy}{dx} = \log_{10}(x + y)$, y(0) = 2 find the values of y(0.2) y(0.4) and y(0.6) by taking h = 0.2 | **BTL -3** | Understanding | **CO 5** |

| | | | | |
|---|---|---|---|---|
| **6.** | Find y(2) by Milne's method $\frac{dy}{dx}=\frac{1}{2}(x+y)$ , given y(0) = 2 , y(0.5) = 2.636, y(1.0) = 3.595 and y(1.5) = 4.968 | **BTL -3** | Understanding | **CO 5** |
| **7.** | Using Taylor series method find y(0.1), given $\frac{dy}{dx}=x^2\ y-1,$ y (0) = 1 | **BTL -4** | Analyzing | **CO 5** |
| **8.** | Examine $2y'-x-y=0$ given y(0) = 2 , y(0.5) = 2.636, y(1) = 3.595, y(1.5) = 4.968 to get y(2) by Adam's method. | **BTL -4** | Analyzing | **CO 5** |
| **9.** | Solve the equation $\frac{dy}{dx}=x^2(1+y)$ , y(1) = 1 , y(1.1) = 1.233, y(1.2) = 1.548 , y(1.3) = 1.979, evaluate y(1.4) By Adam's Bash forth predictor corrector method | **BTL -3** | Applying | **CO 5** |
| **10.** | Solve the equation $\frac{dy}{dx}=\log(x+y),$ y(0) = 2 find y at x = 0.2 using Modified Euler's method. | **BTL -3** | Remembering | **CO 5** |
| **11.** | Calculate y(0.4) by Milne's predictor – corrector method , Given $\frac{dy}{dx}=\frac{1}{2}\left(1+x^2\right)y^2$ , y(0) = 1, y(0.1) = 1.06, y(0.2) = 1.12, y( 0.3) = 1.21 | **BTL -3** | Applying | **CO 5** |
| **12.** | Find y(4.4) given 5xy' + $y^2$ – 2 = 0 , y(4) = 1; y(4.1) =1.0049; y(4.2) = 1.0097 ; and y(4.3) =1.0143. Using Milne's method. | **BTL -3** | Understanding | **CO 5** |
| **13.** | Find y(0.4) by Milne's method, Given $\frac{dy}{dx}=xy+y^2$ , y(0) = 1,y(0.1) = 1.1169, y(0.2) = 1.2773 Find i) y(0.3) by Runge –kutta method of $4^{th}$ order and ii) y(0.4) by Milne's method. | **BTL -3** | Applying | **CO 5** |
| **14.** | Apply Milne's method find y(0.4) given $\frac{dy}{dx}=xy+y^2$ , y(0) =1 ,using Taylor series method find y(0.1) , Euler Method to find y(0.2) and y(0.3). | **BTL -4** | Analyzing | **CO 5** |
| **15.** | Using Milne's method find y(2) if y(x) is the solution of , $\frac{dy}{dx}=\frac{1}{2}(x+y)$ , given y(0) =2, y(0.5) =2.636, y(1) = 3.595 and y(1.5) =4.968 | **BTL -3** | Applying | **CO 5** |
| **16.** | Apply fourth order Runge-kutta method, to find an approximate value of y when x= 0.2 given that y'= x + y , y(0)=1 with h=0.2 | **BTL -4** | Analyzing | **CO 5** |
| **17.** | Using Euler Method to find y(0.3) and y(0.4) from $\frac{dy}{dx}=\frac{1}{2}(x^2+1)y^2$, y (0.2) = 1.1114 with h = 0.1 | **BTL -3** | Applying | **CO 5** |
| **18.** | Apply fourth order Runge-kutta method, to find an approximate value of y when x= 0.1 given that y'= x + $y^2$, y(0)=1 with h=0.1. | **BTL -3** | Applying | **CO 5** |

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