

--	--	--	--	--	--	--	--	--	--



# GIET UNIVERSITY, GUNUPUR - 765022

Ph.D. (First Semester) Regular Examinations, January - 2024

## 23SPPEMT1011 - Computational Mathematics

(Mathematics)

Time: 3 hrs

Maximum: 70 Marks

The figures in the right hand margin indicate marks.

### Answer ANY FIVE Questions

(14 x 5 = 70 Marks)

- |  | Marks |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
|--|-------|-----|-----|-----|------|------|----|--------|----|-----|-----|-----|------|------|---|
| 1.a. Derive the two-step Adams-Bashforth method by using Taylor's theorem.   | 14    |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| 2.a. Find $f(6)$ by using Gregory-Newton Forward Difference Interpolation formula from the following data.   |       |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| <table border="1" style="display: inline-table;"> <tr> <td>x</td><td>5</td><td>10</td><td>15</td><td>20</td><td>25</td></tr> <tr> <td>y</td><td>80</td><td>75</td><td>71</td><td>65</td><td>50</td></tr> </table>  | x     | 5   | 10  | 15  | 20   | 25   | y  | 80     | 75 | 71  | 65  | 50  | 7    |      |   |
| x  | 5     | 10  | 15  | 20  | 25   |      |    |        |    |     |     |     |      |      |   |
| y  | 80    | 75  | 71  | 65  | 50   |      |    |        |    |     |     |     |      |      |   |
| b. Find the value of $f(x)$ at $x=15$ from the following table   |       |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| <table border="1" style="display: inline-table;"> <tr> <td>x</td><td>4</td><td>5</td><td>7</td><td>10</td><td>11</td><td>13</td></tr> <tr> <td><math>f(x)</math></td><td>48</td><td>100</td><td>294</td><td>900</td><td>1210</td><td>2028</td></tr> </table> | x     | 4   | 5   | 7   | 10   | 11   | 13 | $f(x)$ | 48 | 100 | 294 | 900 | 1210 | 2028 | 7 |
| x  | 4     | 5   | 7   | 10  | 11   | 13   |    |        |    |     |     |     |      |      |   |
| $f(x)$   | 48    | 100 | 294 | 900 | 1210 | 2028 |    |        |    |     |     |     |      |      |   |
| 3.a. Transform the equation to normal form and solve it. $2U_{xx} + 8 U_{xy} + 8 U_{yy} = 0$   | 7     |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| b. Transform the equation to normal form and solve it. $U_{xx} - 4 U_{xy} + 3 U_{yy} = 0$  | 7     |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| 4.a. Solve the differential equation using Laplace Transform $4 y'' - 4y' + 37 y = 0, y(0)=3, y'(0)=10$  | 7     |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| b. Find the interpolating polynomial by using Newton divided difference formula for the following data:  |       |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| <table border="1" style="display: inline-table;"> <tr> <td>X</td><td>-1</td><td>0</td><td>2</td><td>3</td></tr> <tr> <td>F(x)</td><td>-8</td><td>3</td><td>1</td><td>12</td></tr> </table>   | X     | -1  | 0   | 2   | 3    | F(x) | -8 | 3      | 1  | 12  | 7   |     |      |      |   |
| X  | -1    | 0   | 2   | 3   |      |      |    |        |    |     |     |     |      |      |   |
| F(x)   | -8    | 3   | 1   | 12  |      |      |    |        |    |     |     |     |      |      |   |
| 5.a. Apply Milne's method to find the solution of the differential equation $y' = x - y^2$ in the range $0 < x < 1$ for the boundary condition $y=0$ at $x=0$ .  | 7     |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| b. Solve the system of equations by using Comparison method $3x - 2y = 1, 5x + 2y = 24$  | 7     |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| 6.a. Derive the D'Alembert's solution of the one dimensional wave equation.  |       |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| 7.a. Solve the differential equation using Laplace Transform $y'' + 9 y = \sin t$ if $0 < t < \pi$ , and $0$ if $t > \pi, y(0)=0$ and $y'(0)=4$  | 7     |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| b. Find the Laplace inverse transform of $L^{-1} \left\{ \frac{1}{s^2 + 4a^4} \right\}$  | 7     |     |     |     |      |      |    |        |    |     |     |     |      |      |   |
| 8.a. Explain about boundary value problem of second order differential equation.   | 14    |     |     |     |      |      |    |        |    |     |     |     |      |      |   |

---End of Paper---