Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FOURTH SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL2024

ENGINEERING MATHEMATICS-IV [MAT-2225]

REVISED CREDIT SYSTEM

Time:3 Hrs Time:2:30-5:30pm **Date: 30 APRIL 2024** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

Q.NO	Questions	*Marks*	*CO*	*PO*	*BTL*
1A.	Solve the boundary value problem by finite difference method with $h = 0.5$. $y'' - 2x^2y' + 2y = 0$ and $y(0) + y'(0) = 5, y(1) = 0$.	3	1	1,2,8,12	3
1B.	Solve the Poisson's equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -10(x^2 + y^2 + 12), 0 < x < 3, 0 < y < 3$ with $h = 1$ and $u \equiv 0$ on the boundary.	3	1	1,2,8,12	3
1C.	Solve the given LPP using Graphical Method: $Minimize\ Z = 5x + 8y$ Subject to, $x + y \leq 10$ $x + 3y \geq 12$ $12x + 2y \geq 42$ $x \geq 0, y \geq 0$	4	4	1,2,8,12	5
2A.	Solve the wave equation $\frac{\partial^2 u}{\partial t^2} = 16\frac{\partial^2 u}{\partial x^2}$, $0 < x < 5$, $t > 0$, $u(x,0) = x^2(5 - x)$, $\frac{\partial u}{\partial t}(x,0) = 0$ and the boundary conditions are $u(0,t) = u(5,t) = 0, h = 1$. Find u for 3-time steps.	3	1	1,2,8,12	3
2B.	The random variable X is uniformly distributed in $\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$. Find the pdf of $Y = \tan X$.	3	3	1,2,8,12	3
2C.	In a normal distribution 7% of the items are below 35 and 89% are below 60. Find the mean and standard deviation of the distribution	4	2	1,2,8,12	4

<table>
<tr><td>3A.</td><td>Prove that the shortest distance between two points in a plane is a straight line.</td><td>3</td><td>5</td><td>1,2,8,12</td><td>3</td></tr>
<tr><td>3B.</td><td>The sum and product of the mean and variance of a Binomial random variate are 24 and 128. Find the distribution completely.</td><td>3</td><td>2</td><td>1,2,8,12</td><td>4</td></tr>
<tr><td>3C.</td><td>If X, Y and Z are independent random variables following $N(2,4), N(3,9)$ and $N(4,25)$ respectively. Find the moment generating function $U = 3X + 2Y + 4Z$. Hence obtain the pdf of U.</td><td>4</td><td>3</td><td>1,2,8,12</td><td>4</td></tr>
<tr><td>4A.</td><td>Let $\bar{X}$ be the sample mean of a sample of size 5 from the normal distribution with mean $\mu = 0$ and variance 125. Find C so that $P\{\bar{X} < C\} = 0.9$.</td><td>3</td><td>3</td><td>1,2,8,12</td><td>3</td></tr>
<tr><td>4B.</td><td>Find the curve on which the functional $\int_0^1((y')^2 + 12xy)dx$ with $y(0) = 0$ and $y(1) = 1$ can be extremized.</td><td>3</td><td>5</td><td>1,2,8,12</td><td>3</td></tr>
<tr><td>4C.</td><td>Solve by Schmidt method $\frac{\partial u}{\partial t} = \frac{1}{32}\frac{\partial^2 u}{\partial x^2}$, $0 < x < 1, t > 0, u(x,0) = 0,\ u(0,t) = 0, u(1,t) = t$. Take $h = \frac{1}{4}$, compute u for 4-time steps.</td><td>4</td><td>1</td><td>1,2,8,12</td><td>4</td></tr>
<tr><td>5A.</td><td>Use Simplex method and solve
$Maximize\ Z = 12x + 16y$
Subject to, $10x + 20y \leq 120$
$8x + 8y \leq 80$
$x, y \geq 0$</td><td>5</td><td>4</td><td>1,2,8,12</td><td>5</td></tr>
<tr><td>5B.</td><td>Obtain the basic feasible solution by Vogel's approximation and check for the optimality of transportation problem
<table>
<tr><th>To→ / From↓</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>Supply</th></tr>
<tr><td>S1</td><td>55</td><td>30</td><td>40</td><td>50</td><td>50</td><td>40</td></tr>
<tr><td>S2</td><td>35</td><td>30</td><td>100</td><td>45</td><td>60</td><td>20</td></tr>
<tr><td>S3</td><td>40</td><td>60</td><td>95</td><td>35</td><td>30</td><td>40</td></tr>
<tr><td>Demand</td><td>25</td><td>10</td><td>20</td><td>30</td><td>15</td><td></td></tr>
</table></td><td>5</td><td>4</td><td>1,2,8,12</td><td>5</td></tr>
</table>