Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FOURTH SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, JUNE2024

ENGINEERING MATHEMATICS-IV [MAT-2225]

REVISED CREDIT SYSTEM

Time:3 Hrs Time:2:30-5:30pm Date: 14 JUNE 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 $(x^3+1)y''+x^2y'-4xy=2, y(0)=0,$ $y(2)=4$ and $h=0.5$ using finite difference method	3	1	1,2,8,12	3
1B.	Solve $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0, 0<x<1, 0<y<1$ subjected to the conditions $u(x,1)=u(0,y)=0, u(1,y)=9(y-y^2), u(x,0)=9(x-x^2)$ by taking $h=1$.	3	1	1,2,8,12	3
1C.	Solve the given LPP using Graphical Method: $Minimize\ Z=20x+10y$ Subject to, $x+2y\leq 40$ $3x+y\geq 30$ $4x+3y\geq 60$ $x\geq 0, y\geq 0$	4	4	1,2,8,12	5
2A.	Solve $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$, $0<x<4,\ t>0,\ u(x,0)=\frac{x}{3}(16-x^2)$, and the boundary conditions are $u(0,t)=u(4,t)=0, h=1$. Find u for one-time step by Crank-Nicholson's method with $\lambda=1$.	3	1	1,2,8,12	3
2B.	Let X be a continuous random variable with p.d.f $f(x)=\frac{1}{\pi(1+x^2)}$ for $-\infty\leq x\leq\infty$. Find the pdf of $Y=\frac{1}{X}$.	3	3	1,2,8,12	3
2C.	The average test marks in a particular class is 79 and the standard deviation is 5. If the marks are normally distributed then, how many students in a class of 200 did not receive marks between 75 and 82?	4	2	1,2,8,12	4
3A.	Show that the geodesics on a plane are straight lines.	3	5	1,2,8,12	3

3B.	After correcting 50 pages of the proof of a book, the proof reader finds that there are on an average, 2 errors per 5 pages. How many pages would one expect to find with 0,1,2,3 and 4 errors in 1000 pages of the first print of the book?	*3*	*2*	*1,2,8,12*	*4*
3C.	If X, Y and Z are independent random variables $M_X(t) = e^{2t(1+t)}, M_Y(t) = e^{3t(1+t)}$ and $M_Z(t) = e^{4t(1+t)}$ respectively. Find the moment generating function $U = 4X + Y + 2Z$. Hence obtain $E\left(\frac{U}{2}\right)$.	*4*	*3*	*1,2,8,12*	*4*
4A.	Let $\bar{X}$ be the sample mean of a sample of size 25 from the distribution which has $N(3,100)$. Evaluate $P(0 < \bar{X} < 6)$.	*3*	*3*	*1,2,8,12*	*3*
4B.	Find the extremals of the functional $\int_{x_1}^{x_2} \frac{(y\prime)^2}{x^3} dx$	*3*	*5*	*1,2,8,12*	*3*
4C.	Solve the wave equation $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$, $0 < x < 1, t > 0$, $u(x,0) = 100(x - x^2)$, $\frac{\partial u}{\partial t}(x,0) = 0$ and the boundary conditions are $u(0,t) = u(1,t) = 0$, $h = 0.25$. Find u for 4-time steps	*4*	*1*	*1,2,8,12*	*4*
5A.	Use Simplex method and solve $Maximize\ Z = 3x + 4y$ Subject to, $2x + y \leq 40$ $2x + 5y \leq 180$ $x, y \geq 0$	*5*	*4*	*1,2,8,12*	*5*
5B.	Obtain the basic feasible solution by Vogel's approximation and check for the optimality of transportation problem (table below)	*5*	*4*	*1,2,8,12*	*5*

To→ / From↓	A	B	C	D	Supply
S1	27	23	31	69	150
S2	10	45	40	32	40
S3	30	54	35	57	80
Demand	90	70	50	60	