IV SEMESTER B.TECH. REGULAR EXAMINATION JUNE 2022
SUBJECT: ENGINEERING MATHEMATICS IV [MAT 2254]
(COMMON TO BT/CHEM)

Date of Exam: 14-6-2022   Time of Exam:2-5pm   Max. Marks: **50**

Instruction to candidates: Answer all questions

1A	Solve $x^2 y'' + x y' + (x^2 - 3)y = 0$, $y(1) = 0$, $y(2) = 2$ with h=0.25.	3
1B	2 dice are thrown. Let X denote sum of the numbers showing up. Compare Chebyshev's inequality for P $(|X - 7| |\geq 3$ with the analytical solution.	3
1C	Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0, 0 < x < 1, 0 < y < 1, u(0, y) = 0,$ $u(x, 1) = 0$, $u(1, y) = 9(y - y^2)$, $u(x, 0) = 9(x - x^2)$ with $h = \frac{1}{3}$.	4
2A	Let (X, Y) be a continuous random variable with joint probability distribution $f(x, y) = \begin{cases} e^{-(x+y)}, x \geq 0, y \geq 0 \\ 0, \ elsewhere \end{cases}$ Find (i) $P(X \leq Y)$ (ii) $P(X + Y \leq 1)$.	3
2B	Find the Z transform of the function $sin(3n + 5) + a^{n+3} + 7n^2$.	3
2C	Solve the following LPP by simplex method Maximize $Z = 4x + 10y$ Subject to $2x + y \leq 50$ $\quad\quad\quad\quad 2x + 5y \leq 100$ $\quad\quad\quad\quad 2x + 3y \leq 90$ $\quad\quad\quad\quad x, y \geq 0$	4
3A	Find the inverse Z Transform of $\frac{z^2+z}{(z+2)(z^2+4)}$.	3
3B	The probability of a shooter hitting a target is $^1/_3$. If he fires 5 times, what is the probability of his hitting the target at least twice?	3

	How many times he should shoot so that the probability of hitting the target at least once is more than 90%?	
3C	In an examination marks scored by the students follow the normal distribution. It is known that a student passes the examination if he secures 40% or more marks. He is placed in first, second and third division if he secures 60% or more, between 50% and 60% and between 40% and 50% respectively. He gets a distinction if he gets 70% or more marks. It is given that 10% of the students have failed in the examination and 5% of them obtained distinction. Find the percentage of students getting second division.	4
4A	Two independent random variables X and Y have mean values 5 and 10 and variance 4 and 9. Find the covariance between U=3X+4Y and V=3X-Y.	3

4B	In a partially destroyed laboratory record, only the lines of regression of y on x and x on y are available as 4x-5y+33=0 and 20x-9y=107 respectively. Calculate
	   (i) mean values of x and y
	   (ii) the correlation coefficient between x and y .
		3

4C	Solve the following LPP by graphical method Maximize $Z = 3x + 2y$ Subject to $-2x + y \leq 10$ $\quad\quad x + y \leq 3$ $\quad\quad x \leq 2$ $\quad\quad x, y \geq 0$	4
5A	Solve the difference equation $y_{n+1} - 3y_n = 3^n(n + 2)$.	3
5B	The chance that a doctor A diagnose a disease correctly is 60%. Chance that a patient of A die after proper diagnosis is 40%. Chance that patient of A will die after wrong diagnosis is 70%. If patient of A dies, what is the probability that his disease was correctly diagnosed?	3
5C	Solve $u_t = \frac{1}{16}u_{xx}$, $0 < x < 1, t > 0, u(x,0) = 100 \sin\pi x$, u(0, t)=u(1, t)=0. Compute u (x, t) for one-time step using Crank Nicolson method, taking h=$\frac{1}{4}$.	4