MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL (A constituent institution of MAHE, Manipal)

SEMESTER-I, M. TECH (DEFENCE TECHNOLOGY) MAKE UP END-SEMESTER EXAMINATION, APRIL, 2022 COURSE: Advanced Engineering Mathematics (MAT5164)

Duratio	n: 3 Hrs	Date: 20/04/2022	MAX. MARKS: 50
Note:	All questions are com Draw a neat diagram necessary	pulsory > Stepwise of wherever	inswers carry marks
Q1a.	How can we obtain I expression?	Mean Time To Failure (MTT	F) using reliability [2M]
Q1b.	Find the inverse Lapla	ace Transform of $\frac{1}{(s^2+4)^2}$.	[3 M]
Q1c.	(i) What is the method of (ii) What are to (iii) Given y(4) = 1, find the value of $y(4.5)$	e interpretation of "order" in 4 th order? he 1 st and 2 nd order Runge -Ku $5x \frac{dy}{dx} + y^2 - 2 = 0,$ $y(4.1) = 1.0049, y(4.2)$ $y(4.3) = 1.0143, y(4.4)$ 5) using Milne's Predictor-Co	Runge-Kutta [5M] utta Methods? f(t) = 1.0097, f(t) = 1.0187, rrector method.
Q2a.	If <i>u</i> is a function of <i>x</i> formula for $\frac{\partial^2 u}{\partial x^2}$.	and <i>y</i> , write the difference ap	proximation [2M]

Q2b. Prove that $J_2(x) - J_0(x) = J_0''(x)$, where $J_n(x)$ is the Bessel's [3M] function.

Q2c. Solve the wave equation $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$, where $0 \le x \le 1, t \ge 0$ with the initial conditions $u(x, 0) = sin\pi x$, $\left(\frac{\partial u}{\partial t}\right)(x, 0) = 0$ and the boundary conditions u(0, t) = u(1, t) = 0, t > 0, using explicit scheme taking h = k = 0.2, for $0 \le x \le 1$ and $0 \le t \le 0.4$, corrected up to 4 decimal places.

- Q3a. What do you mean by series solution of a differential equation? [2M]
- Q3b. The number of typing mistakes made by a secretary has a Poisson [3M] distribution. The mistakes are made at an average rate of 1.65 per page. Calculate the probability that a three-page letter contains no mistakes.
- Q3c. If the amount of cosmic radiations to which a person exposed while [5M] flying across a specific continent is a normal random variable with mean 4.35 units and SD 0.59 units, then find the probabilities that the amount of exposure during such a flight is
 - (i) Between 4.00 and 5.00 units,
 - (ii) At least 5.50 units.

Q4a. What is the characteristic polynomial of a matrix? [2M]

Q4b. Find the largest eigen value and corresponding eigen vector of the [5M] following matrix:

$$A = \begin{pmatrix} 2 & -12 \\ 1 & -5 \end{pmatrix},$$

Assuming the initial eigen vector $X^{(0)} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}.$

Q4c. Find the general solution of the given system of ODE by using eigen [3M] value eigen vector method:

- Q5a. Mention any two different methods of generating random numbers. [2M]
- **Q5b.** List the steps for developing a Mathematical model. [4M]
- Q5c. (i) What is the meaning of the expression $qc_4 + (1-q)c_2 \le c_3$ in [4M] the de-escalation game?
 - (ii) Has this policy worked in Ladakh?