Seat No.: ________ Enrolment No.___________

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER –I-(New) EXAMINATION – SUMMER 2019

Subject Code: 3710812 **Date: 08/05/2019**

Subject Name: Computational Method for Mechanical Engineering

Time: 02:30 PM TO 05:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Solve the differential equation : $x^2y'' - 4xy' + 6y = 21x^{-4}$ **07**

(b) Find the steady state oscillation of the mass spring system governed by the equation. $Y'' + 3y' + 2y = 20\cos 2t$ **07**

Q.2 **(a)** Find the transient motion of the mass- spring modeled by the ODE **07**

$$2y'' + 4y' + 6.5y = 4\sin 1.5t$$

(b) Solve by Gaussian elimination method. **07**

$$x + y + 2z = 9$$
$$2x + 4y - 3z = 1$$
$$3x + 6y - 5z = 0.$$

OR

(b) Using Laplace Transform Solve: $y'' - y = t;\ y(0) = y'(0) = 1.$ **07**

Q.3 **(a)** Verify dimension theorem for the linear transformation $T : R^4 \rightarrow R^3$ given by the formula. $T(x, y, z, w) = (4x+y-2z-3w,\ 2x+y+z-4w,\ 6x-9z+9w)$. **07**

(b) Determine the largest eigen value and corresponding eigen vector of the matrix. **07**

$$A = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 2 & 1 \\ -1 & 1 & 2 \end{bmatrix}$$

OR

Q.3 **(a)** A function f(x) has the values, **07**

x	0.1	0.2	0.3	0.4
f(x)	0.76	0.58	0.44	0.35

Obtain a least square fit to above data of the form $f(x) = a\, b^x$

(b) A class consist of 80 students, 25 of them are girls and 55 boys, 10 of them are rich and remaining are poor. 20 of them are fair complexioned. What is the probability of selecting a fair complexioned rich girl? **07**

Q.4	**(a)**	Find a matrix P that diagonalizes $A = \begin{bmatrix} 2 & 0 & -2 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ and determine $P^{-1}AP$.	**07**
	(b)	In sampling, a large number of parts manufactured by a machine, the mean number of defectives in a sample of 20 is 2.Out of 1000 such samples, how many would be expected to contain at least 3 defective parts as per binomial distribution.	**07**

OR

Q.4	**(a)**	Find one root of $e^x - 3x = 0$, correct to two decimal places using the method of Bisection.	**07**
	(b)	By method of least squares, find the curve y = ax + bx2 that best fit the following data:	**07**

X	1	2	3	4	5
Y	1.9	5.4	9.3	14.6	18.8

Q.5	**(a)**	The function $f(x) = e^{2x} - e^x - 2$ has a zero in the interval [0, 1]. Find this zero correct to four significant digits using Newton's method.	**07**
	(b)	Define Partial pivoting. Solve the following system of equations using Gauss – Seidel iteration:	**07**

$$x + y + 54z = 110$$
$$27x + 6y - z = 85$$
$$6x + 15y + 2z = 72$$

OR

Q.5	**(a)**	Find the initial acceleration (at t = 0 sec.) using the given the table:	**07**

Time t (sec)	0	5	10	15	20
Velocity v (m / s)	0	3	14	69	228

	(b)	Find a change of variables that reduces the quadratic form $2x_1^2 + 2x_2^2 - 2x_1x_2$ to a sum of squares and express the quadratic form in terms of the new variables.	**07**

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