Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– I (New course)• REMEDIAL EXAMINATION – SUMMER 2015

Subject Code: 2710002 **Date:12/05/2015**

Subject Name: **Computational Method for Mechanical Engineering**

Time: 10:30 am to 1:00 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)** Find the transient motion of the massï spring system modeled by the ODE $2y'' + 4y' + 6.5y = 4sin1.5t$ **07**

(b) Find Fourier coefficient of periodic function **07**

$$f(x) = \begin{cases} -k \ if \ -\pi < x < 0 \\ k \ \ if \ \ \ 0 < x < \pi \end{cases}, f(x+2\pi) = f(x)$$

Q.2 **(a)** Using Laplace Transform solve: $y'' + 4y = 0,\ y(0) = 1,\ y'(0) = 6$ **07**

(b) 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 Newtonôs method. **07**

OR

(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**

Q.3 **(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) Verify dimension theorem for the linear operator $T: R^3 \to R^3$ defined by $T(x,y,z) = (x+y-z, x-2y+z, -2x-2y+2z)$ **07**

OR

Q.3 **(a)** Solve $\begin{aligned} x + y + 2z &= 9, \\ 2x + 4y - 3z &= 1, \\ 3x + 6y - 5z &= 0 \end{aligned}$ by Gaussian elimination. **07**

(b) Find the initial acceleration $(at\ t = 0\,sec)$ using the given the table: **07**

$Time\, t(sec):$	0	5	10	15	20
$Velocity\, v(m/sec):$	0	3	14	69	228

Q.4 **(a)** The table below gives the temperature T (in ^{0}C) and lengths l (in mm) of a heated rod. If $l = \alpha_u + \alpha_1 T$, find the best values for α_u *and* α_1. **07**

T	20^0C	30^0C	40^0C	50^0C	60^0C	70^0C
l	800.3	800.4	800.6	800.7	800.9	801.0

(b) Find the dominant eigen value of $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ by power method & hence find the other eigen value also. **07**

OR

Q.4 **(a)** Evaluate $\int_c F \cdot r' ds$, where C is the circle $x^2 + y^2 = 4,\ z = -3,$ oriented counterclockwise as seen by a person standing at the origin, and, with respect to right-handed Cartesian coordinates, $F = \left[y, xz^3, -zy^3 \right] = yi + xz^3 j - zy^3 k$. **07**

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

Q.5 **(a)** A copper ball is heated to a temperature of 100ęC and at time $t = 0$ it is placed in water that is maintained at a temperature of 40ęC. At the end of the 4 minutes the temperature of the ball is reduced to 60ęC. Find the time at which the temperature of the ball is reduced to 50ęC. **07**

(b) Suppose that a manufactured product has 2 defects per unit of product inspected. Using Poisson distribution, calculate the probabilities of finding a product without any defect, 3 defects and 4 defects. **07**

OR

Q.5 **(a)** Fit an equation of the form $y = ab^x$ to the following data: **07**

x :	2	3	4	5	6
y :	144	172.8	207.4	248.8	298.6

(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**

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