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MANIPAL INSTITUTE OF TECHNOLOGY

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I SEMESTER M.TECH. (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: **Computational methods & Applied Linear Algebra [MAT 5109]**

REVISED CREDIT SYSTEM

(28/11/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be assumed suitably.

1A.	In a LCR circuit the voltage V(t) across the capacitor is given by the equation $LC\frac{d^2V}{dt^2}+RC\frac{dV}{dt}+V=0$, subject to t = 0, V = V_0, $\frac{dV}{dt}=0$. Use Runge –Kutta method of order 4 to compute V and $\frac{dV}{dt}$ at t = 0.02 seconds by taking h = 0.02 for the data $V_0=10V,\ C=0.1F,\ L=0.5H,\ R=10\Omega.$	**4**
1B.	Solve the boundary value problem using finite difference method $y''-2x^2y'+2y=0,\quad y(0)+y'(0)=5,\quad y(1)=0,\quad h=0.5$	**3**
1C.	Compute $f'(3)$ *and* $f''(3)$ using the following data X: 3, 3.2, 3.4, 3.6, 3.8, 4 f(x): -14, -10.032, -5.296, -0.256, 6.672, 14	**3**
2A.	Solve the LPP by TWO-Phase method. Maximize $z=5x_1-4x_2+3x_3$, subject to the constraints $2x_1+x_2-6x_3=20$, $6x_1+5x_2+10x_3\le 76,\quad 8x_1-3x_2+6x_3\le 50,\quad x_1\ge 0,\quad x_2\ge 0,\quad x_3\ge 0.$	**4**
2B.	Show that the minimal spanning set of vectors forms a basis for a vector space V over a field F.	**3**
2C.	Solve the system of equations by Gauss Seidal method 10w-x+2y=6, -w+11x-y+3z=25, 2w-x+10y-z=-11, 3x-y+8z=15. Carry out five iterations.	**3**
3A.	Show that the error in Schmidth's formula is least if $\alpha=\frac{1}{6}$	**4**
3B.	Find the bases for the column space of the matrix A= $\begin{bmatrix}1&4&0&2&-1\\3&12&1&5&5\\2&8&1&3&2\\5&20&2&8&8\end{bmatrix}$. Find the dimension of null space of A.	**3**

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3C.	Find the characteristic equation and minimal equation of a matrix A = $\begin{bmatrix} 7 & 4 & -1 \\ 4 & 7 & -1 \\ -4 & -4 & 4 \end{bmatrix}$. Mention the diagonal form of the matrix A.	**3**
Us4A.	A company has three cement factories located in cities 1, 2, 3 which supply cement to four projects located in towns 1, 2, 3, 4. Each plant can supply 6, 1, 10 truckloads of cement daily respectively and the daily cement requirements of the projects are respectively 7, 5, 3, 2 truckloads. The transportation costs per truck load of cement in hundreds of rupees from each plant to each project site are as follows. Project sites $$\text{Factories}\quad \begin{array}{c c} & \begin{array}{cccc} 1 & 2 & 3 & 4 \end{array} \\ \begin{array}{c} 1 \\ 2 \\ 3 \end{array} & \begin{bmatrix} 2 & 3 & 11 & 7 \\ 1 & 0 & 6 & 1 \\ 5 & 8 & 15 & 9 \end{bmatrix} \end{array}$$ Determine the optimal distribution for the company so as to minimize the total transportation cost.	**4**
4B.	Solve the boundary value problem $y''(x) = y(x), \quad y(0) = 0, \quad y(1) = 1.1752$ by the shooting method. Given $m_0 = 0.7, \quad m_1 = 0.8.$	**3**
4C.	Evaluate $\int_0^{30} \left(\frac{z}{z+5} \right) e^{-2z/30} dz$ using Simpson's $1/3$ rd rule, taking n = 10.	**3**
5A.	Use Gram- Schmidth orthogonalization process to compute the orthonormal basis from the basis $S = \{(3,0,4), (-1,0,7), (2,9,11)\}$ of R^3	**4**
5B.	Solve the two dimensional wave equation $u_{tt} = 16u_{xx}$, taking h=1 upto t= 1.25. The boundary conditions are $u(0,t) = u(5,t) = 0, \quad u_t(x,\ 0) = 0 \quad and \quad u(x,\ 0) = x^2(5-x).$	**3**
5C.	Use Euler's modified method to solve $\frac{dy}{dx} = 4e^{0.8x} - 0.5y$ from x=0 to x=2 with a step size of 1. The initial condition at x=0 is y=2.	**3**