Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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I SEMESTER M.TECH. (MECHANICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: APPLIED NUMERICAL METHODS [MAT 5101]

REVISED CREDIT SYSTEM
(8/12/20`7)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Use synthetic division and perform two iterations of Birge-Vieta method to find the smallest positive root of the polynomial $x^4 - 3x^3 + 3x^2 - 3x + 2 = 0$. Take the initial approximation as 0.5. **4**

1B. A slider in a machine moves along a fixed straight rod. Its distance x cm along the rod is given below for various time t seconds. Find the velocity and acceleration of the slider when $t = 0.6$ seconds. **3**

t	0	0.1	0.2	0.3	0.4	0.5	0.6
x	30.13	31.62	32.87	33.64	33.95	33.81	33.24

1C. Solve the tri-diagonal system of equations **3**

$$2x + y = 0 \; ; \; 3x + y + z = 1 \; ; \; 2y + z + u = 0 \; ; \; 3z - u = 2 .$$

2A. Determine the largest eigen value and the corresponding eigen vector of the matrix **4**

$$\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$ carry out 4 iterations with $X^{(0)} = [1 \quad 1 \quad 0]^T$.

2B. Apply Milne's method to find $y(0.3)$ of the differential equation $y' = x^2 + y^2$ for $y(0) = 1$. Find the values $y(-0.1), y(0.1), y(0.2)$ from the Taylor series method, correct to 4 decimal places. **3**

2C. What is finite element method? Define functionals and base function in finite element method. **3**

3A. Find the real root of the system of the equations $x^2 + y^2 = 1.12$, $xy = 0.23$ by taking the initial approximation $x_0 = 1, y_0 = 0.2$ correct for 2 decimal places. **4**

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3B.	Using Shooting method, Solve the boundary value problem $y''(x) = y(x), y(0) = 0,\ y(1) = 1.17$.	**3**
3C.	Obtain error formula for Trapezoidal Rule.	**3**
4A.	Using Crank-Nickolson's Scheme, solve $u_t = \frac{1}{16}u_{xx}$; $0 < x < 1$, $t > 0$, $u(x,0) = 100\sin \pi x$, $u(0,t) = 0,\ \ u(1,t) = 0$. Take k=1 and compute "u" for 1 time step with $h = 0.25$.	**4**
4B.	Derive Newton-Cotes quadrature formula	**3**
4C.	Solve the equation $\frac{d^4y}{dx^4} + 81y = \phi(x)$, $y(0) = y'(0) = y''(1) = y'''(1) = 0$ where $\phi(x)$ is given by the table: x: 1/3, 2/3, 1 $\phi(x)$: 81, 162, 243	**3**
5A.	Solve the equation $\nabla^2 u = 8x^2y^2$ for the square with sides $x = -2, y = -2$, $x = 2, y = 2$ with $u = 0$ on the boundary of mesh length 1, using finite difference method.	**4**
5B.	Solve the equations by Gauss-Seidel method $2x + y + 6z = 9$; 8x+3y+2z=13 ; x+5y+z=7 , carryout three iterations.	**3**
5C.	Evaluate f(9) using Newton's divided difference formula, given: x: 5 7 11 13 17 f(x) 150 392 1452 2366 5202	**3**