t:	1	3	5	7	9
T:	85.3	74.5	67.0	60.5	54.3

Find a Lagrange's interpolating polynomial for this data and temperature at $t = 7.5$. (10)

4. Attempt any TWO parts:

(a) Solve the following differential equation for X_A at $z = 0.1$ using the classic fourth-order Runge-Kutta method. The step size in z may be taken as 0.1. (10)

$$\frac{dX_A}{dz} = \frac{(49.5\times10^{-3})[4.76-1.61(0.7-X_A)](1-X_A)^{2/3}}{1+15(1-X_A)^{1/3}\left[1-(1-X_A)^{1/3}\right]}$$

$X_A = 0$ at $z = 0$.

(b) Solve the following differential equation (10)

$$\frac{dy}{dx} = -3y; \qquad x = 0, y = y_0 = 1.$$

Use a step size of 0.2 in x to compute y values at $x = 0.2$ and $x = 0.4$

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EAS501

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 151501

Roll No. | | | | | | | | | | |

B.Tech. (Sem. V)

SPL. THEORY EXAMINATION, 2014-15

COMPUTER BASED NUMERICAL METHODS

Time : 3 Hours] *[Total Marks : 100*

Note: Attempt ALL questions.

1. Attempt any TWO parts:

(a) Solve the transcendental equation $\frac{A}{5} + e^{-A} = 1$ for A correct to 2 decimal places by Regula-Falsi method. The initial guesses for A may be assumed to be 4 and 6. (10)

(b) Solve the following nonlinear equations for A_{12} and A_{21} by Newton's Method:

$$\ln 2.348 = -\ln(0.332 + 0.668A_{12}) + 0.668$$

$$\left(\frac{A_{12}}{0.332 + 0.668A_{12}} - \frac{A_{21}}{0.332A_{21} + 0.668}\right)$$

$$\ln 1.430 = -\ln(0.668 + 0.332A_{21}) - 0.332$$

$$\left(\frac{A_{12}}{0.332 + 0.668A_{12}} - \frac{A_{21}}{0.332A_{21} + 0.668}\right)$$

The initial guesses may be assumed to be zero for A_{12} and A_{21} both. (10)

(c) Show that the Newton-Raphson method for solving single nonlinear algebraic equation has a second order convergence. (10)

2. Attempt any TWO parts:

(a) Solve the following system of equations by Gauss-elimination method: (10)

$$28x + 4y - z = 32$$
$$x + 3y + 10z = 24$$
$$2x + 17y + 4z = 35$$

(b) Solve the following system of equations by Gauss-Seidel method correct to three decimal places:

$$3x - 2y + 7z = 20$$
$$x + 6y - z = 10 \qquad (10)$$
$$10x - 2y + 7z = 29$$

(c) Solve the following system of equations (10)

$$\begin{bmatrix} 3 & 2 & 0 \\ 2 & 3 & -1 \\ 0 & -1 & 2 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 5 \\ 4 \\ 1 \end{bmatrix}$$

by SOR iteration scheme. Take relaxation parameter $\omega = 1.5$ for the SOR iteration scheme and $x^{(0)} = [0.5 \ \ 0.5 \ \ 0.5]^T$.

3. Attempt any TWO parts:

(a) By dividing the range into 10 equal parts, evaluate

$\int_0^{\pi} \sin x\,dx$ by Simpson's rule. (10)

(b) Using Newton's divided difference formulae, find a polynomial function $f(x)$ from the following table:

x:	4	5	7	10	11	13
y:	48	100	294	900	1210	2028

Hence calculate $f(8)$ and $f(10)$. (10)

(c) The table below gives the results of an observation: T is the observed temperature in degrees centigrade of a vessel of cooling water, t is the time in minutes from the beginning of observation.

(c) Using Milne's method, find $y(4.4)$ given

$$5xy' + y^2 - 2 = 0, \; y(4.0) = 1,$$

$y(4.0) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$

and $y(4.3) = 1.043$. (10)

5. Attempt any TWO parts:

(a) Solve the equation $\frac{d^2y}{dx^2} = x + y$ with the boundary conditions $y(0) = y(1) = 0$. (10)

(b) Solve the following PDE to obtain u at $x = 0.1$ at any value of z. (10)

$$PDE: \; 10\left(1 - \left(\frac{x}{0.2}\right)^2\right)\frac{\partial u}{\partial z} = 2 \times 10^{-5}\frac{\partial^2 u}{\partial x^2}$$

$$BCs: \; u(x,0) = 0$$

$$u(0,z) = 1.5 \times 10^{-5}$$

$$\left.\frac{\partial u}{\partial x}\right|_{(0.2,z)} = 0$$

(c) Solve the boundary value problem (10)

$u'' = 4x$

$u(0) + u'(0) = 1, u(1) = 1$

with $h = 1/3$, using second order method.

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