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B.Tech. 5th Semester (Civil Engg.) F-Scheme

Examination, July–2015

NUMERICAL METHODS AND COMPUTING TECHNIQUES

Paper–CE–309–F

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt **five** questions in total taking at least **one** from each section. **Question No. 1 is compulsory.***

1. (a) Explain how B-spline curves differ from Bezier curves.

   (b) Gauss-Seidel method is similar in principle to Jacobi method. Then, what is the difference between them ?

   (c) Prove that the bisection method is linearly convergent.

   (d) State the formula of Euler's method. Illustrate its concept graphically.

   (e) Write normal equations for evaluating the parameters a and b to fit data to

   (i) $y = a + bx$

   (ii) $y = a\,e^{bx}$.

Section–A

2. (a) Find the Lagrange interpolation polynomial to the following data

x :	0	1	2	3
$e^x - 1$:	0	1.7183	6.3891	19.0855

use the polynomial to estimate the value of $e^{1.5}$.

(b) Given the set of data points (1, – 8), (2, – 1) and (3, 18), find the cubic splines. Find also the approximate values of y (2.5) and y′ (2.0). Here given data satisfying the function $y = f(x)$.

3. (a) Find the root of the equation $f(x) = x^2 - 3x + 2 = 0$ by using Newton-Raphson method.

(b) Using Muller's method, find the root of the equation $f(x) = x^3 - x - 1 = 0$ with the initial approximations $x_{i-2} = 0, x_{i-1} = 1, x_i = 2$.

Section–B

4. (a) Solve the system $2x_1 + 4x_2 - 6x_3 = -8$, $x_1 + 3x_2 + x_3 = 10$, $2x_1 - 4x_2 - 2x_3 = -12$ using Gauss-Jordan method.

(b) Solve the system of equations $9x - 2y + z = 50$, $x + 5y - 3z = 18$, $-2x + 2y + 7z = 19$ by Relaxation method.

5. (a) The distances travelled by a vehicle at intervals of 2 minutes are given as follows :

Time	:	0	2	4	6	8	10	12	14	16
Distance	:	0	0.25	1	2.2	4	6.5	8.5	11	13

Evaluate the velocity of the vehicle at time 5, 10 and 13.

(b) Evaluate $\int_0^1 \frac{x^2}{1+x^3} dx$ using Simpson's $\frac{1}{3}$rd rule.

Section–C

6. Using Runge-Kutta method, find y for x = 0.1, 0.2, 0.3 given that $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$. Continue the solution at x = 0.4 using Milne's method.

7. Find the largest eigenvalue and the corresponding eigenvector of the matrix

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

using Power method. Take $[0, 1, 0]^T$ as initial eigen vector.

Section–D

8. Solve the heat equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ in $0 < x < 5, t \geq$

given that $u(x, 0) = 20$, $u(0, t) = 0$, $u(5, t) = 10$

Compute u for the time-step with h = 1 t

Crank-Nicholson method.

9. Solve the Laplace equation $u_{xx} + u_{yy} = 0$ given that