Hall Ticket No | | | | | | | | | | | Question Paper Code: BST003

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech I Semester End Examinations (Supplementary) - July, 2017

Regulation: IARE–R16

COMPUTER ORIENTED NUMERICAL METHODS

(Structural Engineering)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Solve the following system of equations using Gaussion Elimination method. **[7M]**
x+y+z=9, 2x–3y+4z=13, 3x+4y+5z=40

   (b) Solve the following equations using Jacobi's iteration method up to third iteration. **[7M]**
3x+4y+15z=54.8, x+12y+3z=39.66, 10x+y-2z=7.74

2. (a) Solve the following equation Using relaxation method. **[7M]**
5x-y-3=3, -x+10y-2z=17, -x-y+10z=8

   (b) Determine the largest Eigen value and the corresponding Eigen vector of the matrix. **[7M]**

$$\begin{pmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{pmatrix}$$

UNIT – II

3. (a) Prove that if g(x) is a continuous function on some interval [a, b] and differentiable on (a, b) and if g(a)=0, g(b)=0, then there is a least point ζ inside (a, b) for which $g'(\zeta)=0$. **[7M]**

   (b) Determine the step size h that can be used in the tabulation of f(x)=sinx in the interval [1,3] so that linear interpolation will be correct to 4-decimal places after rounding. **[7M]**

4. (a) Construct the divided difference table for the data given in table 1. **[7M]**

Table 1

x	0.5	1.5	3.0	5.0	6.5	8.0
f(x)	1.625	5.875	31.0	131.0	282.125	521.0

Hence find the interpolating polynomial and an approximation to the value of f(7).

   (b) Given the set of data points (1,-8), (2,-8) & (3,18) satisfying the function y=f(x), find splines satisfying the given data. Find the approximate value of y (2.5), $y'(2.0)$.

UNIT – III

5. (a) Fit a second degree Parabola **[7M]**
   $Y = a_0 + a_1x + a_2x_2$ to the data (x : y) : (1,0.63), (3,2.05), (4,4.08), (6,10.78).
   (b) For linear interpolation, in the case of equispaced tabular data, show that the error does not exceed 1/8 of 2nd difference. **[7M]**

6. (a) Obtain the rational approximation of the form $\frac{a_0+a_1x}{1+b_1x}$ to e^x. **[7M]**
   (b) Find the value of y from the following data given in table 2 at x = 2.65. **[7M]**

Table 2

x	-1	0	1	2	3
y	-21	6	15	12	3

UNIT – IV

7. (a) Given $u_0 = 5$, $u_1 = 15$, $u_2 = 57$ and du/dx = 4 at x = 0 and 72 at x = 2. Find the $\Delta^3 u_0$ and $\Delta^4 u_0$. **[7M]**
   (b) The population of a certain town is shown in the following table 3 **[7M]**

Table 3

Year x	1931	1941	1951	1961	1971
Year y	40.62	60.80	79.65	103.56	132.65

Find the rate of the population in 1961.

8. (a) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule with h = 0.2. Hence determine the value of π. **[7M]**
   (b) Calculate $e^{-x}\, x^{\frac{1}{2}}\, dx$ taking 5 ordinates by simpson's 1/3 rule. **[7M]**

UNIT – V

9. (a) Given the differential equation y''-xy$'$-y=0 with condition y (0) = 1 and $y'(0) = 0$. Find the value of y (0.1) using Taylor's series method, **[6M]**
   (b) Solve the boundary value problem with y (0) = 0 and y (2) = 3.62686 where $\frac{d^2y}{dx^2} - y = 0$. **[8M]**

10. (a) Consider a boundary-value problem is defined by y''+y+1=0, $0 \le x \le 1$. Where h=0.5 use finite – difference method to determine the value of y (0.5). **[7M]**
    (b) Given the boundary – value problem $x^2y'' + xy' + y = 0$, $y(1) = 1, y(2) = 0.5$, apply the cubic spline method to determine the value of y (1). **[7M]**

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