

Roll No. ....

**24262**

**B. Tech. 5th Sem.**

**(Mechanical Engg.) VII**

**Examination – December, 2013**

**APPLIED NUMERICAL TECHNIQUE & COMPUTING**

**'F' Scheme**

**Paper : ME-311-F**

**Time : Three hours ]**

**[ Maximum Marks : 100**

*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complain in this regard, will be entertained after examination.*

**Note : Question No. 1 is compulsory.** Attempt total Questions with selecting *one* question from each Unit. All questions carry equal marks.

1. (a) What is curve fitting? What is the need for such an exercise? 2.5 × 8 = 20

(b) Define forward differences and backward differences.

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- (c) What are direct methods and iterative method to Solve the system of linear equations?
- (d) Discuss initial value problems and B.V.P's.
- (e) What is Crank Nicolson Method? Why is it known as implicit method?
- (f) What is a divided difference table? How is it useful?
- (g) Define the terms Interpolation and Extrapolation.
- (h) What are the limitations of Taylor's series method for solving ordinary differential equations?

### SECTION - A

2. (a) If  $u = 4x^2y^3/z^4$  and errors in  $x, y, z$  be 0.001, Compute the relative maximum error in  $u$  when  $x = y = z = 1$ . 10

- (b) Given:  $a = 9.00 \pm 0.05$ ,  $b = 0.0356 \pm 0.0002$ ,  
 $c = 15300 \pm 100$ ,  $d = 62000 \pm 500$ . Find the  
maximum value of absolute error in (i)  $a+b+c+d$   
(ii)  $a+b+d$ . 10

3. (a) Determine  $f(x)$  as a polynomial in  $x$  for the  
following data: 10

$x$ :	-4	-1	0	2	5
$f(x)$ :	1245	33	5	9	1335

by using Divided Diff. Table. Hence evaluate  $f(1)$ .

- (b) Find the natural cubic spline to Fit the data 10

$x$ :	1	2	3	4
$y$ :	0	1	0	0

### SECTION - B

4. (a) Find  $f(10)$  from the following data: 10

$x$ :	3	5	11	27	34
$f(x)$ :	-13	23	899	17315	35606

(b) Evaluate :

10

$$\int_0^1 \frac{1}{1+x^2} dx \text{ using}$$

(i) Trapezoidal rule taking  $h = \frac{1}{4}$

(ii) Simpson's rule taking  $h = \frac{1}{6}$

5. (a) Find a real root of the equation  $x \log_{10} x = 1.2$  by Regula-Falsi Method correct of four decimal places.

10

(b) Using Newton-Raphson formula, find a root of the equation  $x \sin(x) + \cos(x) = 0$  up to three decimal places.

10

6. (a) Solve the system :

10

$$27x + 6y - z = 85$$

$$6x + 15y + 2z = 72$$

$$x + y + 54z = 100$$

by using iterative method.

(b) Solve the system :

10

$$2x + 4y + z = 3$$

$$3x + 2y - 2z = -2$$

$$x - y + z = 6$$

by using Gauss elimination method.

7. (a) Find the largest Eigen value of the matrix, using power method 10

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$$

- (b) Determine the eigen value and the corresponding eigen vector of the matrix by using Jacobi's Method 10

$$\begin{bmatrix} 2 & 3 & 1 \\ 3 & 2 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

### SECTION - D

8. Using Runge-Kutta Method of order 4, find  $y$  for  $x=0.1, 0.2, 0.3$ . Given that : 20

$$\frac{dy}{dx} = xy + y^2, \quad y(0) = 1$$

Continue the solution at  $x = 0.4$  using Milne's Method.

9. Solve the elliptic equation  $U_{xx} + U_{yy} = 0$  for the following square mesh with boundary values as shown:

20

