

8. (a) Using modified Euler's method, obtain a solution of the equation  $\frac{dy}{dx} = x + \sqrt{y}$ , with initial conditions  $y = 1$  at  $x = 0$ , for the range  $0 \leq x \leq 0.6$  in steps of 0.2.

- (b) Using Runge-Kutta Method of order 4, find  $y$  for  $x = 0.1$  and 0.2 Given that

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

9. (a) Solve the elliptic equation  $u_{xx} + u_{yy} = 0$  for the following square mesh with boundary values as shown

	1	1	
0			0
0			0
	0	0	

- (b) Find the largest Eigen value of the matrix, using power method

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & -4 & 2 \\ 0 & 0 & 7 \end{bmatrix}$$

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B. Tech. 5th Semester (M.E.) Examination,  
December-2015

**APPLIED NUMERICAL TECHNIQUES AND  
COMPUTING**

Paper-ME-311-F

Time allowed : 3 hours] [Maximum marks : 100

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

- (a) Round of the following numbers correct to four significant figures :  
3.26245, 35.46735, 0.70035, 18.265101, 0.859378

(b) Discuss the rate of convergence of Newton Raphson Method.

(c) What are direct methods and iterative method to solve the system of linear equations ?

(d) What is spline interpolation ?

(e) Find by Taylor's series method, the value of  $y$  at  $x = 0.1$  and  $x = 0.2$  from

$$\frac{dy}{dx} = x^2y - 1, y(0) = 1$$

- Discuss initial problems and B. V. P's.
- Write down the Newton Cotes Quadrature formula
- Write the finite difference approximations to partial derivatives in  $x$  and  $y$  directions.



## Section-A

2. (a) If  $x = 3.4327$  find the value of the absolute error and relative error if:
- $x$  is truncated to three decimal places.
  - $x$  is rounded off to three decimal places.
- (b) If  $u = 4x^2y^3/z^4$  and errors in  $x, y, z$  be  $0.001$ , compute the relative maximum error in  $u$  when  $x = 1, y = 2, z = 3$ .

3. (a) Given the values :

$x$	5	7	11	13	17
$f(x)$	150	392	1452	2366	5209

Evaluate  $f(9)$  by using

- Lagrange's formula
  - Newton's divided difference formula
- (b) Fit a straight line, by the method of least squares, to the following data :

$x$	1	2	3	4	5
$y$	14	27	40	55	68

## Section-B

4. (a) Given that :

$x$	1.96	1.98	2.00	2.02	2.04
$f(x)$	0.7825	0.7739	0.7651	0.7563	0.7473

find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  at  $x = 2.04$

- (b) Use Romberg's method to evaluate  $\int_{4.0}^{5.2} \log x \, dx$ .  
Given that :

$x$	4.0	4.2	4.4	4.6	4.8	5.0	5.2
$\log x$	1.3863	1.4351	1.4816	1.5261	1.5686	1.6094	1.6487

5. (a) Find a real root of the equation  $x^3 + x^2 - 1 = 0$  by Secant Method.
- (b) Using Newton-Raphson formula, find a root of the equation  $x \sin(x) + \cos(x) = 0$  up to three decimal places.

## Section-C

6. (a) Solve the system :

$$54x + y + z = 110$$

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

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

by using iterative method.

- (b) Solve the equations :

$$10x - 2y - 3z = 205;$$

$$-2x + 10y - 2z = 154;$$

$$-2x - y + 10z = 120$$

by UV Factorization method.

7. Transform the matrix to tri-diagonal form by using Householder's method

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

Also find the Eigen values and corresponding eigen vectors.