[Total No. of Questions - 9] [Total No. of Pri Pages - 4]
(2066)

16033(J)

B. Tech 4th Semester Examination

Numerical Methods for Engineers (NS)

NS-207

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all selecting one question from each of sections A, B, C and D. Question 9 in Section E is compulsory. All questions carry equal marks.

SECTION - A

1. (a) Use the method of false position to find the fourth root of 32 correct to three decimal places. (10)

   (b) Show that Newton-Raphson method has a quadratic convergence. Also, find root of the equation $x^3 - 5x + 3 = 0$ by Newton-Raphson method correct to three decimal places. (10)

2. (a) Solve the system of equations $20x + y - 2z = 17$; $3x + 20y - z = -18$; $2x - 3y + 20z = 25$ by Jacobi's method. (10)

   (b) Using UL factorization method, find the inverse of the matrix

$$A = \begin{bmatrix} 2 & 3 & 1 \\ 1 & 2 & 3 \\ 3 & 1 & 2 \end{bmatrix}.$$ (10)

[P.T.O.]

SECTION - B

3. (a) Taking x = 3.141592 with an approximate value $\hat{x} = 3.14$ calculate absolute error, relative error, and number of significant digits. (10)

   (b) Find the polynomial which takes the following values:

x =	0	1	2	3
y =	1	2	1	10

   Also using the Newton's formula find f(4) (10)

4. (a) Use Newton's divided difference formula to find f(x) as a polynomial in x for the following data

x:	-4	-1	0	2	5
y:	1245	33	5	9	1335

   (10)

   (b) The values of $y = e^x$ for x are given below:

x=0.61	0.62	0.63	0.64	0.65
y=1.840431	1.658928	1.877610	1.896481	1.915541
x=0.66	0.67			
y=1.934792	1.954237			

   Find value of e^x at x=0.644 by Bessel's method. (10)

SECTION - C

5. (a) Find first and second derivatives of y for the given data

x=	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y=	7.989	8.403	8.781	9.129	9.451	9.750	10.031

   (10)

   (b) The values of the function y = f(x) are given below

x=	1.2	1.3	1.4	1.5	1.6
y=	0.9320	0.9636	0.9855	0.9975	0.9996

   for what value of x the function f(x) attains maximum value? Also find this maximum value. (10)

6. (a) Evaluate $\int_1^2 \frac{1}{x} dx$ by using (i) Trapezoidal rule, (ii) Simpson's 3/8 rule and find the percentage error from the exact value. (10)

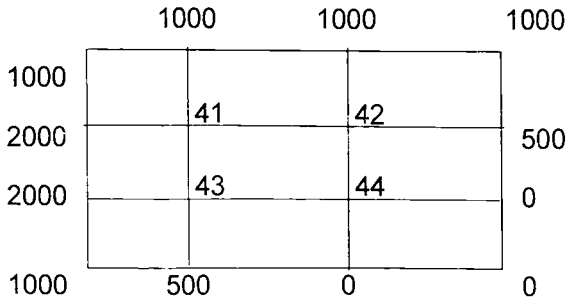
(b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ correct to four decimal places by using Romberg's method taking h=0.5, 0.25 and 0.125 . (10)

SECTION - D

7. (a) Use Euler's method to find solution of the differential equation $\frac{dy}{dx} = \frac{y-x}{x+y}$ at x=0.1 subject to y=1 when x=0. (10)

(b) Use Runge-Kutta fourth order method to find solution of the differential equation $\frac{dy}{dx} = x + y$ at x=0.2 when y(0)=1. (10)

8. (a) Find solution of the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ in the domain of figure



(10)

(b) Use Adams-Bashforth method to evaluate y(0.4) from the differential equation $\frac{dy}{dx} = \frac{1}{2}xy$, for the given data

x=0	0.1	0.2	0.3
y=1	1.0025	1.0101	1.0228

(10)

SECTION - E

9. (a) Write formulae of three methods used for the solution of algebraic and transcendental equations.

(b) Define Absolute, Relative and Percentage errors.

(c) Write name of three iterative methods used for the solution of simultaneous algebraic equations.

(d) Show that $E^n y_x = y_{x+nh}$ where E is the shift operator.

(e) Write Newton's forward interpolation formula and Lagrange' formula.

(f) Which of the following gives more accurate result

(i) Trapezoidal rule.

(ii) Simpson's 1/3rd and 3/8th rule.

(iii) Weddle's rule.

(g) Define total error and relative error.

(h) Write Milne's predictor-corrector formula.

(i) Write second order Runge-Kutta method.

(j) Write diagonal 5-point formula. (2×10=20)