

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

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

[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

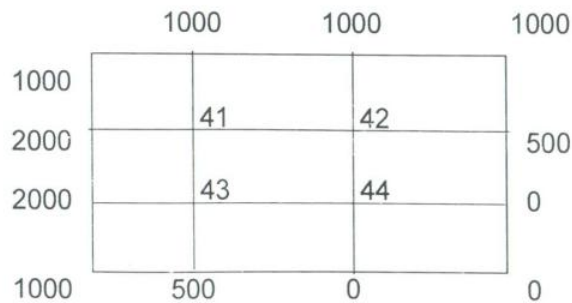
for what value of x the function $f(x)$ attains maximum value? Also find this maximum value. (10)

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)

[P.T.O.]

- (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
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|-------|----------|----------|----------|------|
| $x=0$ | 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's 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)