(2064)

14657

B. Tech 4th Semester Examination

Computer Based Numerical Analysis (O.S.)

AS/ME-4004

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 selecting one from each section. Section E is compulsory.

SECTION - A

1. (a) From the following table estimate the number of students who obtained marks between 75 and 80.   (10)

Marks	30-40	40-50	50-60	60-70	70-80
No of students	31	42	51	35	31

   (b) Using Stirling formula find y(12.2)   (10)

$x°$	10	11	12	13	14
$10^5 y(x)$	23967	28060	31788	35209	38368

2. (a) Find the expression for velocity in terms of time from following data:

time 't'	0	1	3	4
velocity 'v'	21	15	12	10

   Hence find acceleration at t = 4 and distance moved in 4 seconds.   (10)

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(b)   Define (i) forward (ii) backward difference operator. Hence prove that

$$hD = \log(1 + \Delta) = -\log(1 - \nabla) = \sinh^{-1}(\mu\delta)$$

where symbols have usual meaning.   (10)

SECTION - B

3. (a)   Prove that Bisection method is always convergent. (10)

    (b)   Solve the system of equations $10x - 2y - 3z = 205$, $-2x -y + 10z = 120$ and $-2x + 10y - 2z = 15$ using relaxation method.   (10)

4. (a)   Derive iteration formula of Newton Raphson method & hence show that it has quadratic rate of convergence.   (10)

    (b)   Solve $\cos x = 3x - 1$ correct to three decimal places using iteration method.   (10)

SECTION - C

5. (a)   Find the value of $f'(x)$ at $x = 3.5$ from data given below:

x	1.5	2.0	2.5	3.0	3.5	4.0
f(x)	3.375	7.0	13.625	24.0	38.875	58.0

    (10)

    (b)   Find value of $\int_0^1 \dfrac{dx}{1+x^2}$ with 12 strips using Simpson's $\dfrac{3}{8}$ rule.   (10)
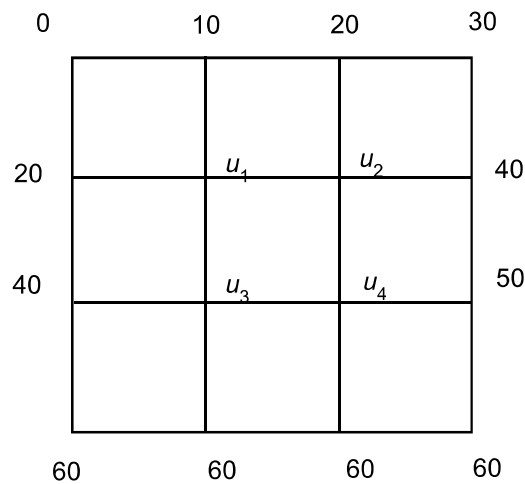
6. (a)   Find the value of $\int_0^1 \dfrac{dx}{1+x}$ using trapezoidal Rule with $h = \dfrac{1}{2}, \dfrac{1}{4}, \dfrac{1}{8}, \dfrac{1}{16}$ then by Romberg method.   (10)

(b) Using Newton interpolation formula prove that

$$D = \frac{1}{h}\log(1+\Delta) = -\frac{1}{h}\log(1-\nabla)$$ (10)

SECTION - D

7. (a) Find the solution of $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ correct to 2 decimal places over grid below: (10)
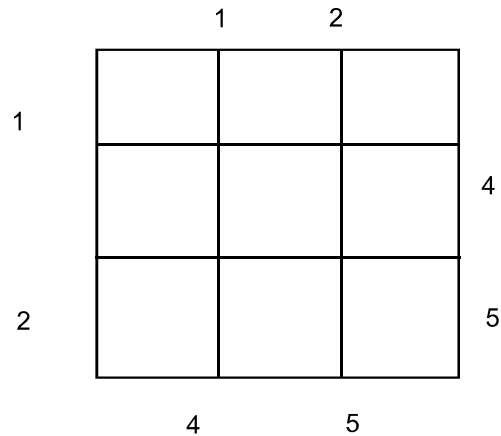

(b) Find the finite difference equation corresponding to parabolic equation by Schmidt method.   (10)

8. (a) Use Crank Nicolson's method to solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ for two step in time

u(x, 0) = 0   u(0, t) = 0   and   u(l, t) = 200t   (10)

(b) Find the solution of $u_{xx} + u_{yy} = 0$ over square mesh with boundary values as shown　　　　(10)

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        1       2
    ┌───────┬───────┬───────┐
  1 │       │       │       │
    ├───────┼───────┼───────┤ 4
    │       │       │       │
    ├───────┼───────┼───────┤
  2 │       │       │       │ 5
    └───────┴───────┴───────┘
        4       5
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SECTION - E

9. Each part carries 2 marks:

(a) State convergence condition of iteration method to solve non-linear equations.

(b) State the convergence condition of Gauss Seidal method.

(c) Prove that $e^{hD} = E = 1 - \Delta$

(d) State Stirling interpolation formula and its applications.

(e) Find the expression for $\dfrac{dy}{dx}$ using Newton's forward difference interpolation formula.

(f) Find the value of $\displaystyle\int_0^1 \dfrac{d}{1+x^2}$ using Trapezoidal rule using 5 strips.

(g) Find the finite difference equation corresponding to Laplace equation.

(h) Explain complete pivoting

(i) Find the root of $x \log_{10} x = 1.2$ between 2 and 3 if exists.

(j) Prove that Divided Differences are symmetric.