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(2125)

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**B. Tech 4th Semester Examination**  
**Numerical Methods & Computer Programming (OS)**

AS(ID)-4001

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. Select one question from each section A, B, C and D. Section E is compulsory.

**SECTION - A**

1. (a) Use Newton's Forward Interpolation Formula to evaluate  $\sin 52^\circ$ , given that

$\theta:$	45°	50°	55°	60°	
$\sin\theta:$	0.7071	0.7660	0.8192	0.8660	(10)

- (b) Using Gauss's Forward Interpolation Formula, find a polynomial of degree 4 which takes the following function  $f(x)$ :

$x:$	1	2	3	4	5	
$f(x):$	1	-1	1	-1	1	(10)

2. (a) Use Newton's divided difference interpolating polynomial and hence find  $f(15)$ :

$x:$	4	5	7	10	11	13	
$f(x):$	48	100	294	900	1210	2028	(10)

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- (b) Find the missing term in the following table using interpolation:

$x:$	1	2	4	5	6	
$y:$	14	15	5	—	9	(10)

**SECTION - B**

3. (a) Find the root of equation  $\cos x - xe^x = 0$  using Bisection method correct to four decimal places up to eight iterations. (10)

- (b) Using Newton Raphson method to find the smallest root of the equation.

$$f(x) = x^3 - 5x + 1 \quad (10)$$

4. (a) Using Jacobi's method, solve the equations:  
 $15x + y - z = 14, x + 20y + z = 23, 2x - 3y + 18z = 37.$

- (b) Solve the equations by Relaxation method:  
 $10x - 2y - 3z = 205, -2x + 10y - 2z = 154, -2x - y + 10z = 120$  (10)

**SECTION - C**

5. (a) Find  $y'$  and  $y''$  at  $x = 1.1, 1.5, 1.9$  from the following data:  
 $x:$  1.0 1.2 1.4 1.6 1.8 2.0  
 $y:$  0 0.128 0.544 1.2696 2.432 4.000 (10)

- (b) Evaluate the integral  $\int_0^1 \frac{x}{1+x^2} dx$ , using Boole's rule. Compare the error with exact value. (10)

6. Apply Romberg's method to evaluate  $\int_4^{5.2} \log x dx$  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 1.526 1.5686 1.6094 1.6486 (20)

## SECTION - D

7. Solve the Poisson's equation  $u_{xx} + u_{yy} = -81xy$ ;  $0 < x < 1$ ,  $0 < y < 1$ ; given that  $u(0, y) = 0$ ,  $u(x, 0) = 0$ ;  $u(1, y) = 100$ ,  $u(x, 1) = 100$  and  $h = 1/3$ . (20)
8. Solve the boundary value problem  $u_t = u_{xx}$ , under the conditions  $u(0, t) = u(1, t) = 0$  and  $u(x, 0) = \sin \pi x$ ;  $0 \leq x \leq 1$ ; using Schmidt method (take  $h = 0.2$  and  $\alpha = 0.5$ ). (20)

## SECTION - E

9. (a) What is the difference between Transcendental equation and polynomial equation?
- (b) The interval in which the real root of the equation  $x^3 - 2x - 5 = 0$  lies is.....
- (c) When a linear system is said to be ill conditioned and well conditioned?
- (d) By Gauss-Elimination method solve the equations  $x+y=2$  and  $2x+3y=5$ .
- (e) Prove that  $E = \Delta + 1$  and  $E = e^{hD}$ .
- (f) Evaluate  $\Delta^2 \cos 3x$ .
- (g) Write down Newton's Backward interpolation formula and Lagrange's interpolation formula.
- (h) Define the terms: Interpolation and Extrapolation with examples.
- (i) The number of sub intervals required for Boole's rule is .....
- (j) The equation  $u_{xx} + 3u_{xy} + u_{yy} = 0$  is classified as..... (10×2=20)