

B.Tech 4th Semester Exam., 2015

NUMERICAL METHODS AND
COMPUTATIONAL TECHNIQUE

Time : 3 hours

Full Marks : 70

Instructions :

- (i) All questions carry equal marks.
 (ii) There are **NINE** questions in this paper.
 (iii) Attempt **FIVE** questions in all.
 (iv) Question No. 1 is compulsory.

1. Choose the correct option (any seven) :

(a) The number of significant digits in 1.5034 is

- (i) 4
 (ii) 5
 (iii) 6
 (iv) 3

(b) If the approximate value of $\pi/4$ is 0.7854, then the absolute error is

- (i) 0.0031
 (ii) 0.00031
 (iii) 0.000031
 (iv) 0.031

(c) $(\Delta - \nabla)x^2$ is equal to

- (i) h^2
 (ii) $2h^2$
 (iii) $3h^2$
 (iv) $4h^2$

where h is the step length.(d) If $f(x) = e^{ax}$, then $\Delta f(x)$ is (h is step length)

- (i) $e^{ah} e^{ax}$
 (ii) $(e^{ah} - 1)e^{ax}$
 (iii) e^{ax}

(iv) None of these

(e) The Gauss' interpolation formula is used

- (i) near beginning of tabulated values
 (ii) near middle of tabulated values
 (iii) near end of tabulated values
 (iv) All of these

(f) The Lagrange interpolation formula is used for

- (i) equal interval
 (ii) unequal interval
 (iii) both equal and unequal intervals
 (iv) None of these

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- (g) Newton's forward and backward interpolation formula is used for
- equal interval
 - unequal interval
 - both equal and unequal intervals
 - None of these
- (h) In the Simpson's $\frac{1}{3}$ rule, the number of equal subintervals of the interval is
- even
 - odd
 - both odd and even
 - None of these
- (i) In the trapezoidal rule, the error is zero when $f(x)$ is a polynomial of degree
- 1
 - 2
 - 3
 - None of these
- (j) The iterative method is always convergence.
- True
 - False

2. (a) Find a root of the equation $x^2 - 3x - 5 = 0$ by bisection method.
- (b) Solve
- $$x \log_{10} x = 1.2$$
- by regula falsi method.
3. (a) Solve the following equations by Gauss-Seidel method :
- $$\begin{aligned} 20x + y - 2z &= 17 \\ 3x + 20y - z &= -18 \\ 2x - 3y + 20z &= 25 \end{aligned}$$
- (b) Solve the following equations by Jacobi's method :
- $$\begin{aligned} 5x + 2y + z &= 12 \\ x + 4y + 2z &= 15 \\ x + 2y + 5z &= 20 \end{aligned}$$
4. (a) The function $y = f(x)$ is given in the points (7, 3), (8, 1), (9, 1) and (10, 9). Find the value of y for $x = 9.5$ using Lagrange interpolation formula.
- (b) Using Newton's forward interpolation formula, find the value of $f(x)$ at $x = 1.3$ from the following data :
- | | | | | | | |
|--------|---|---|-----|-----|-----|-----|
| x | : | 0 | 1 | 2 | 3 | 4 |
| $f(x)$ | : | 1 | 1.5 | 2.2 | 3.1 | 4.3 |

5. (a) Evaluate

$$\int_0^{\pi/2} \sqrt{\sin x} dx$$

taking $n=6$, correct up to 4 significant figures by (i) Simpson's $\frac{1}{3}$ rule and (ii) trapezoidal rule.

(b) Fit a parabola $y = a + bx + x^2$ to the following data :

x :	2	4	6	8	10
y :	3.07	12.85	31.47	57.38	91.29

6. Given

$$\frac{dy}{dx} = \frac{y-x}{y+x}$$

with boundary conditions $y=1$ when $x=0$, find approximately y for $x=0.1$ by—

- (a) Euler's method;
 (b) modified Euler's method.

7. (a) Explain machine level language, assembly level language and high level language.

(b) Write a flowchart of Lagrange interpolation method.

8. Write a program to demonstrate Gauss elimination method for four unknowns.

9. What are tokens? Name them and describe constants and variables.