

Code : 211404

B.Tech 4th Semester Exam., 2018

**NUMERICAL METHODS AND
COMPUTATIONAL TECHNIQUE**

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.*
- (ii) There are **NINE** questions in this paper.*
- (iii) Attempt **FIVE** questions in all.*
- (iv) Question No. 1 is compulsory.*

1. Choose the correct answer (any seven) :

2×7=14

(a) The _____ provides pictorial representation of a given problem.

- (i) algorithm
- (ii) flowchart
- (iii) pseudocode
- (iv) All of the above

(2)
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(b) Which of the following is not a High-level computer programming language?

(i) FORTRAN

(ii) MODEM

(iii) COBOL

(iv) ALGOL

(c) The type cast operator is

(i) (type)

(ii) cast()

(iii) //

(iv) ""

(d) The order of convergence in Newton-Raphson method is

(i) 2

(ii) 3

(iii) 0

(iv) 1

(e) If x_n is the n th iterate, then Newton-Raphson formula is

(i) $x_n = x_{n-1} + \frac{f(x_n)}{f'(x_n)}$

(ii) $x_n = x_{n-1} - \frac{f(x_{n-1})}{f'(x_{n-1})}$

(iii) $x_n = x_{n-1} - \frac{f(x_{n+1})}{f'(x_{n+1})}$

(iv) $x_n = x_{n-1} - \frac{f(x_n)}{f'(x_n)}$

(f) A unique polynomial of degree _____ passes through $(n+1)$ data points.

(i) $n+1$

(ii) n

(iii) n or less

(iv) $n+1$ or less

(g) The n th divided differences of a polynomial of the n th degree are

(i) constant

(ii) variable

(iii) equal

(iv) unequal

(h)

In Newton's forward difference formula what is u ?

(i) $u = \frac{x - x_n}{h}$

(ii) $u = x - x_n$

(iii) $u = \frac{(x - x_n)^2}{h}$

(iv) $u = \frac{x - x_0}{h}$

(i)

In application of Simpson's $\frac{1}{3}$ rd rule, the interval h for closer approximation should be

(i) even

(ii) small

(iii) odd

(iv) even and small

(j) In the geometrical meaning of Euler's algorithm, the curve is approximated as a/an

(i) straight line

(ii) circle

(iii) parabola

(iv) ellipse

2. (a) Write an algorithm and draw a flow-chart to convert the length in feet to centimeter.

(b) What is high-level language? What are the different types of high-level languages? 7

3. What is a flowchart? How is it different from an algorithm? 14

4. (a) Write a C/C++ program to print all numbers between 1 to n divisible by 7. 7

(b) Define array. Explain different types of array in detail. 7

5. (a) Evaluate : 7

$$\Delta \left(\frac{2^x}{(x+1)!} \right); h = 1$$

(b) Apply Gauss-Seidel iteration method to solve the following equations : 7

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

6. The equation $x^2 + ax + b = 0$ has two real roots α and β . Show that the method

(a) $x_{k+1} = -\frac{1}{x_k}(ax_k + b)$ converges to α if

$$|\alpha| > |\beta|.$$

7

(b) $x_{k+1} = -\frac{b}{x_k + a}$ converges to a if $|\alpha| < |\beta|$. 7

7. (a) Derive Newton's forward difference interpolation formula. 8

(b) A third degree polynomial passes through the points $(0, -1)$, $(1, 1)$, $(2, 1)$ and $(3, -2)$. Find the polynomial. 6

8. (a) Evaluate $\int_{30^\circ}^{90^\circ} \log_{10}(\sin x) dx$ by Simpson's one-third rule by dividing the interval into 6 parts. 7

(b) A river is 80 m wide. The depth 'y' of the river at a distance x from one bank is given by following table : 7

x	0	10	20	30	40	50	60	70	80
y	0	4	7	9	12	15	14	8	3

Find approximately the area of cross-section of the river using Simpson's one-third rule.

9. (a) Find the solution of following initial value problem by using Euler's method : 7

$$\frac{dy}{dx} + 2y = 0, y(0) = 1$$

(b) Solve the boundary value problem

~~by~~ $y'' - 64y + 10 = 0; y(0) = y(1) = 0$

by the finite-difference method. Compute the value of $y(0.5)$ and compare it with the true value.

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$y = f(x) = 0$ $b = 0$ $f = \frac{y}{x}$

$f(x) = \frac{dy}{dx} = (y_0 + \epsilon x) = f(x) = y_0 + \epsilon x$

$y_p = y + \epsilon x^p = y_p = \Delta x^p$

$\therefore \Delta = 1 + \epsilon$

$y_p = y_0 + \Delta x^p$

$\therefore y_p = y_0 + p \Delta x + \frac{p(p-1)}{2!} \Delta^2 x + \dots +$

$\frac{p(p-1)(p-n+1) \Delta^n x}{n!}$