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S. No. of Question Paper : 338

Roll No.....

Name of Department : Physics and Astrophysics

Name of the Course : B.Sc. Hons.-(Physics)/Prog._CBCS-LOCF

IT-Skill Enhancement Course

Name of the Paper : Numerical Analysis Theory (SEC)

Semester : IV/VI

Unique Paper Code : 32223912

Question Paper Set Number : 2

Duration: 3 Hours

Maximum Marks: 50

Instructions

1. Attempt any five questions in all.
2. Question 1 is compulsory.
3. All questions carry equal marks.
4. Non programmable scientific calculator is allowed.
5. Write your roll no on top of this question paper immediately after receiving it..

Ques (1). Attempt any four parts

- (a). Differentiate between absolute and relative errors. Evaluate the sum as $S = \sqrt{5} + \sqrt{7} + \sqrt{11}$ to 4 Significant digits. Find its relative and absolute errors.
- (b). How Secant method is different from Newton-Raphson method?
- (c). Define the central difference operator δ and the averaging operator μ . Prove that:

$$\mu\delta \equiv \frac{\Delta + \nabla}{2}$$

- (d). Using the generalized quadrature formula, obtain the expression for Simpson's 3/8 rule. Also discuss the geometrical interpretation of trapezoidal rule.
- (e). Using the Simpson's 1/3 rule, compute the value of integral $I = \int_0^1 \frac{dx}{1+x^2}$ with $h=0.25$.
(2.5x4=10 Marks)

Ques (2). Describe the fixed point iteration method. Explain the necessary and sufficient conditions for the convergence of iteration method. Find root of the equation $x^3 - 3x + 4 = 0$ using Newton-Raphson's method, starting with $x_0 = 1.5$, correct to three decimal places.
(10 Marks)

- Ques (3). Derive Newton backward Formula for Interpolation. The following table gives pressure of a steam plant at a given temperature. Using Newton's formulae, compute the pressure for a temperature of 142 °C and 176 °C. (10 Marks)

Temperature (°C)	140	150	160	170	180
Pressure (N/m ²)	3.685	4.854	6.302	8.076	10.225

- Ques (4). Fit a curve of the types $y = ax^b$ to the following points.

x	2	3	4	5	6
y	4.5	9.2	20.4	34	42.2

Also estimate the total error.

(10 Marks)

- Ques (5). From the following table, find the value of $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at the point $x = 1.5$.

x	1.5	2.0	2.5	3.0	3.5	4.0
y	3.375	7.253	15.736	25	36.847	60.387

(10 Marks)

- Ques (6). Solve the following initial value problem for $x=0.1$ and 0.2 using modified Euler's method,

$$\frac{dy}{dx} = x^2 - y, \quad y(0) = 1$$

How Modified Euler Method is better than simple Euler Method? (7+3=10 Marks)

- Ques (7). Using the Newton's forward interpolation formula, obtain the General Quadrature formula. Evaluate $I = \int_0^2 \frac{1}{1+x} dx$ correct to three decimal places, using Trapezoidal and Simpson's 3/8 rules for $h=0.5, 0.25$. (10 Marks)