K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2024	
Exam Seat No.:	
Academic Year:2024-2025	Semester: I
Class: PG-I	Program: M.Tech
Branch Code: CIV	Pattern:2024
Name of Course: Numerical Methods	Course Code:2404501
Max. Marks:60	Duration: 2 Hrs. 30 Min.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 2 pages.
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. The last columns indicates the Course Outcome of the Question/sub-question.

		Marks	CO
Question No. 1			
1a)	Find the positive root of $x^3 - 2x - 5 = 0$ correct to three decimal places using Newton-Raphson method. Also write the Python code for the above problem.	(6)	1, 2, 3, 5
Question No. 2			
2a)	Given $\frac{dy}{dx} = x + y + xy$ with initial condition y = 1 at x = 0; find y for x = 0.1 by Euler's method. Take h = 0.025.	(6)	1, 2, 3
Question No. 3			
3a)	Evaluate $\int_0^1 \frac{dx}{x^3+x+1}$ by using Simpson's 1/3rd rule. Take h = 0.25. Also calculate error.	(8)	1, 2, 3, 4
	OR		
3b)	Evaluate $\int_0^6 \frac{dx}{x^2+1}$ by using Simpson's 3/8th Rule. Take h = 1.	(8)	1, 2, 3, 4
3c)	Use the Trapezoidal rule to estimate the integral $\int_0^2 e^{x^2} dx$ taking 10 intervals.	(8)	1, 2, 3
	OR		
3d)	Evaluate $\int_2^{2.6} \int_4^{4.4} \frac{dxdy}{xy}$ using double integration Simpson's rule. Take h = 0.2 and k = 0.3.	(8)	1, 2, 3
Question No. 4			
4a)	A simply supported beam carries a concentrated load P at its midpoint. Corresponding to various values of P, the maximum deflection Y is measured. The date is given below;	(8)	1, 2, 3

P	100	120	140	160	180	200
Y	0.45	0.55	0.6	0.7	0.8	0.85

Find the law of the form Y = a + bP.

OR

4b)	The velocity V of a liquid is known to vary with temperature according to a quadratic law V = a +bT + cT2. Find the best values of a, b and c for the following table;	(8)	1, 2, 3

T	1	2	3	4	5	6	7
V	2.31	2.01	3.8	1.66	1.55	1.47	1.41

4c) Using Lagrange's interpolation formula, find the value of y when x = 10, if the following values of x and y are; (8) 1, 2, 3

x	5	6	9	11
y	12	13	14	16

OR

4d) For the values of x and y below, find f(80) using Linear Spline interpolation formula. (8) 1, 2, 3

x	50	70	100	120
y	12	15	21	25

Question No. 5

5a) Using Stirling's formula, estimate the value of tan 16^0. (8) 1, 2, 3

θ	0	5	10	15	20	25	30
tan θ	0	0.0875	0.1763	0.2679	0.3640	0.4663	0.5774

OR

5b) Find f(22) from the Gauss forward formula: (8) 1, 2, 3

x	20	25	30	35	40	45
y	354	332	291	260	231	204

5c) In the table below, the values of y are consecutive terms of a series of which 23.6 is the 6^{th} term. Find the tenth term of the series using Newton's backward interpolation formula. (8) 1, 2, 3

x	3	4	5	6	7	8	9
y	4.8	8.4	14.5	23.6	36.2	52.8	73.9

OR

5d) The below table gives the distances in nautical miles of the visible horizon for the given heights in feet above the earth's surface: (8) 1, 2, 3

x(ht)	100	150	200	250	300	350	400
y(dist)	10.63	13.03	15.04	16.81	18.42	19.9	21.27

Find the values of y when x = 218ft using Newton's forward interpolation formula.

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