

	P.R.Government College (Autonomous) KAKINADA	Program&Semester II B.Sc Major (III Sem) w.e.f 2023-24 admitted batch			
CourseCode MAT-302 T	TITLEOFTHECOURSE Numerical Methods &Problem Solving Sessions				
Teaching	HoursAllocated:60(Theory)	L	T	P	C
Pre-requisites:	Advanced Calculus, Linear Algebra and Differential Equations	3	1	-	3

Course Objectives:

This course will cover the classical fundamental topics in numerical methods such as, approximation, finite differences, Interpolation with equal and unequal intervals, solution of Algebraic and Transcendental equations and Curve fitting.

Course Outcomes:

On Completion of the course, the students will be able o-	
CO1	Difference between the operators, Δ , ∇ , E and the relation between them.
CO2	Know about the Newton – Gregory Forward and backward interpolation, Central Difference operators, δ , μ , σ and relation between them
CO3	Solve Algebraic and Transcendental equations.
CO4	Understand the concept of Curve fitting.

Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
-------------------	--	---------------	--	------------------	--

Unit – 1:

The calculus of finite differences

The operators, Δ , ∇ , E - Fundamental theorem of difference calculus- properties of, Δ , ∇ , E and problems on them to express any value of the function in terms of the leading terms and the leading differences - relations between E and D - relation between D and Δ - problems on one or more missing terms- Factorial notation- problems on separation of symbols- problems on Factorial notation.

Unit – 2: Interpolation with Equal and Unequal intervals

Derivations of Newton – Gregory Forward and backward interpolation and problems on them.

Divided differences - Newton divided difference formula - Lagrange's and problems on them.

Unit – 3: Central Difference Interpolation formulae

Central Difference operators, δ , μ , σ and relation between them - Gauss forward formula for equal intervals

- Gauss Backward formula - Stirlings formula - Bessel's formula and problems on the above formulae.

Unit – 4: Solution of Algebraic and Transcendental equation

Method for finding initial approximate value of the root - Bisection method - to find the solution of given equations by using (i) Regula Falsi method (ii) Iteration method (iii) Newton – Raphson's method and problems on them.

Unit – 5: Curve Fitting

Least-squares curve fitting procedures - fitting a straight line-nonlinear curve fitting-curve fitting by a sum of exponentials.

Text Book

Numerical Analysis by G. Shanker Rao, New Age International Publications

References:

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson, (2003) 7th Edition.
2. Introductory Methods of Numerical Analysis by S.S. Sastry, (6th Edition) PHI New Delhi 2012
3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S .R. K. Iyengar and R. K. Jain, New Age International Publishers (2012), 6th edition.

Co-Curricular Activities:

Seminar/ Quiz/ Assignments/ Applications of Numerical methods to Real life Problem /Problem Solving Sessions.

CO-PO Mapping:

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3	1	2	2	3	2	3	2
CO2	3	2	3	3	2	3	3	1	3	3	3	2	1
CO3	2	3	2	3	2	3	2	2	2	3	2	2	3
CO4	3	2	3	2	3	2	3	3	2	1	3	1	2

BLUE PRINT FOR QUESTION PAPER PATTERN
SEMESTER-III : PAPER-VI

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	The calculus of finite differences	2	1	20
II	Interpolation with Equal and Unequal intervals	2	2	30
III	Central Difference Interpolation formulae	1	1	15
IV	Solution of Algebraic and Transcendental equation	1	1	15
V	Curve fitting	1	1	15
Total		7	6	95

S.A.Q. = Short answer questions (5 marks)

E.Q = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20

Essay questions : 3X10 = 30

.....

Total Marks = 50

.....

Pithapur Rajah's Government College (Autonomous), Kakinada

II year B.Sc., Degree Examinations - III Semester

Mathematics Course VI: NUMERICAL METHODS

Model Paper (w.e.f. 2024-25)

.....
Time: 2Hrs

Max. Marks: 50

SECTION-A

Answer Any Three Questions, Selecting At Least One Question from Each Part.

Part – A

3 X 10 = 30 M

1. Essay question from unit - I.
2. Essay question from unit – II.
3. Essay question from unit – II.

Part – B

4. Essay question from unit - III.
5. Essay question from unit - IV.
6. Essay question from unit - V.

SECTION-B

Answer any four questions

4 X 5 M = 20 M

7. Short answer question from unit – I.
8. Short answer question from unit – I.
9. Short answer question from unit – II.
10. Short answer question from unit – II.
11. Short answer question from unit - III.
12. Short answer question from unit - IV.
13. Short answer question from unit – V.

P.R. GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
DEPARTMENT OF MATHEMATICS
Question Bank for
PAPER--: NUMERICAL METHODS

Short Answer Questions

Unit-I

1. Prove that i) $\Delta = E - 1$ ii) $\nabla = 1 - E^{-1}$
2. Prove that i) $(1 + \Delta)(1 - \nabla) = 1$ ii) $E\nabla = \Delta$ iii) $\Delta - \nabla = \Delta\nabla$
3. Prove that (i) $\mu^2 = 1 + \frac{\delta^2}{4}$, (ii) $\Delta = \frac{\delta^2}{2} + \delta \sqrt{1 + \frac{\delta^2}{4}}$
4. Prove that i) $u_3 = u_2 + \Delta u_1 + \Delta^2 u_0 + \Delta^3 u_0$ ii) $u_4 = u_3 + \Delta u_2 + \Delta^2 u_1 + \Delta^3 u_1$
5. Given $y_0 = 3$, $y_1 = 12$, $y_2 = 81$, $y_3 = 200$, $y_4 = 100$. Find $\Delta^4 y_0$ without forming difference table.
6. Find the missing term in the following data.

x	0	1	2	3	4
y	1	3	9	?	81

UNIT - II

7. Compute $f(1.1)$ from the following data.

x	1	2	3	4	5
f(x)	7	12	29	64	123

8. From the following table find y value at $x = 0.26$

x	0.10	0.15	0.20	0.25	0.30
y = Tanx	0.1003	0.1511	0.2027	0.2553	0.3093

9. Show that $f(x_0, x_1, x_2, \dots, x_n) = \frac{\Delta^n f(x_0)}{n!h^n}$.
10. Find the third divided difference with arguments 2, 4, 9, 10 of the function $f(x) = x^3 - 2x$.
11. By Lagrange's interpolation formula, find the value of y at $x = 5$, given that

x	1	3	4	8	10
f(x)	8	15	19	32	40

12. Using Lagrange's interpolation formula, prove that

$$y_0 = \frac{1}{2}(y_1 + y_{-1}) - \frac{1}{8} \left[\frac{1}{2}(y_3 - y_1) - \frac{1}{2}(y_{-1} - y_{-3}) \right]$$

UNIT – III

13. Using Gauss forward formula find u_{30} from the given data $u_{21} = 18.4708$, $u_{25} = 17.8144$, $u_{29} = 17.1070$, $u_{33} = 16.3432$, $u_{37} = 15.5154$.
14. Given that $\sqrt{12500} = 111.803399$, $\sqrt{12510} = 111.848111$, $\sqrt{12520} = 111.892806$, $\sqrt{12530} = 111.937483$, show $\sqrt{12516} = 111.8749301$ by using Gauss backward interpolation formula.
15. State and prove Stirling's formula
16. Apply Stirling's formula to find y_{28} given that $y_{20} = 49225$, $y_{25} = 48316$, $y_{30} = 47236$, $y_{35} = 45926$, $y_{40} = 44300$.
17. Given $y_{20} = 24$, $y_{24} = 32$, $y_{28} = 35$, $y_{32} = 40$, find y_{25} by Bessel's formula.

Unit - IV

18. Find a real root of the equation $x^3 - 6x - 4 = 0$ by bisection method.
19. Find a real root of the equation $x^3 - x - 1 = 0$ by bisection method.
20. Find the root of the equation $x^3 + x^2 - 1 = 0$ by iteration method.
21. Find the square root of 2.
22. Find a real root of the equation $x = e^{-x}$, using the Newton – Raphson method.

UNIT - V

23. Obtain the normal equations to the least square line $y = a + bx$.
24. Find the least square line $y = a + bx$ and $y(5)$ for the data.

x	0	2	5	7
y	-1	5	12	20

25. Find the least square line For the data points $(-1, 10)$, $(0, 9)$, $(1, 7)$, $(2, 5)$, $(3, 4)$, $(4, 3)$, $(5, 0)$ and $(6, -1)$.
26. Fit a polynomial of the second degree to the data points

x	0	1	2
y	1	6	17

27. Fit the exponential curve $y = ae^{bx}$ to the following data.

x	2	4	6	8
y	25	38	56	84

Unit - I

1. State and prove fundamental theorem of Difference calculus.
2. Show that $\Delta^n \cos(ax + b) = (2\sin \frac{ah}{2})^n \cos[a + bx + n(\frac{ah+\pi}{2})]$
3. Obtain the estimate of the missing terms in the following data.

x	1	2	3	4	5	6	7	8
f(x)	1	8	?	64	?	216	343	512

4. Prove that $\Delta^n x^{(n)} = n! h^n$ and $\Delta^{n+1} x^{(n)} = 0$

UNIT - II

5. State and prove Newton's – Gregory formula for forward interpolation with equal intervals .
6. The area of a circle of diameter d is given for the following values , find the approximate value for the area of a circle of diameter 82 .

d(Diameter)	80	85	90	95	100
A(Area)	5026	5674	6362	7088	7854

7. From the following table , find the number of students who obtain less than 56 marks .

Marks	30-40	40-50	50-60	60-70	70-80
No.of students	31	42	51	35	31

8. Given

x	1	2	3	4	5	6	7	8
f(x)	1	8	27	64	125	216	343	512

Find f(7.5)

9. The population of a country in the decennial census were as under . Estimate the population for the year 1925 .

Year(x)	1891	1901	1911	1921	1931
Population(y) (in thousands)	46	66	81	93	101

10. State and prove Netown's divided difference formula .

11. By means of Newton's divided difference formula, find the values of $f(8), f(15)$ from the following table.

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

UNIT - III

12. Using Gauss forward formula find u_{32} from the given data $u_{20} = 14.035$, $u_{25} = 13.674$, $u_{30} = 13.257$, $u_{35} = 12.734$, $u_{40} = 12.089$, $u_{45} = 11.309$.
13. Apply Gauss forward formula to find the value of u_9 if $u_0 = 14$, $u_4 = 24$, $u_8 = 32$, $u_{16} = 40$.
14. Interpolate by means of Gauss backward interpolation formula the sales for the concern for the year 1936, given that

<i>year</i>	1901	1911	1921	1931	1941	1951
<i>sales(in thousands)</i>	12	15	20	27	39	52

15. Apply Stirling's formula to find a polynomial of degree four which takes

x	1	2	3	4	5
y	1	-1	1	-1	1

16. Apply Bessel's formula to obtain find y_{25} given that $y_{20} = 2854$, $y_{24} = 3162$, $y_{28} = 3544$, $y_{32} = 3992$.

UNIT - V

17. Find a real root of the equation $f(x) = x^3 - 2x - 5 = 0$ by the method of false position up to three places of decimals.
18. Find a real root of the equation $x^3 - x - 4 = 0$ correct to three decimal places by the method of Regula - False position.
19. Find a real root of the equation $\cos x = 3x - 1$, correct to three decimal places, using iteration method.
20. Solve $x = 0.21 \sin(0.5 + x)$ by iteration method starting with $x = 0.12$.
21. Find the real root of the equation $x^2 - 5x + 2 = 0$ by Newton- Raphson's method.

22. Using Newton -Raphson method, establish the iterative formula $x_{n+1} = \frac{1}{3}(2x_n + \frac{N}{x_n^2})$ to calculate the cube root of N and hence find the cube root of 12.

UNIT - V

23. Obtain the normal equations to the parabola $y = a + bx + cx^2$ by using least square method.
24. Fit a second-degree parabola to the following data.

x	0	1	2	3	4
y	1	5	10	22	38

25. Determine the constants a and b by the least squares method such that $y = ae^{bx}$, fits the following data.

x	1.0	1.2	1.4	1.6
y	40.170	73.196	133.372	243.02

26. Fit a curve of the form $y = ax^b$ to the following data.

x	2	4	6	8	10
y	0.973	3.839	8.641	15.987	23.794

27. Fit a curve of the form $y = ab^x$ to the following data.

x	1	2	3	4
y	4	11	35	100

	P.R.Government College (Autonomous) KAKINADA	Program&Semester II B.Sc Major (III Sem) w.e.f 2023-24 admitted batch			
Course Code MAT-302 P	TITLE OF THE COURSE Numerical Methods & Problem Solving Sessions Practical Course				
Teaching	Hours Allocated: 30 (Practicals)	L	T	P	C
Pre-requisites:	Advanced Calculus, Linear Algebra and Differential Equations	-	-	2	1

Unit – 1:

The calculus of finite differences

The operators, Δ , ∇ , E - Fundamental theorem of difference calculus- properties of, Δ , ∇ , E and problems on them to express any value of the function in terms of the leading terms and the leading differences - relations between E and D - relation between D and Δ - problems on one or more missing terms- Factorial notation- problems on separation of symbols- problems on Factorial notation

Unit – 2: Interpolation with Equal and Unequal intervals

Derivations of Newton – Gregory Forward and backward interpolation and problems on them. Divided differences - Newton divided difference formula - Lagrange's and problems on them.

Unit – 3: Central Difference Interpolation formulae

Central Difference operators, δ , μ , σ and relation between them - Gauss forward formula for equal intervals - Gauss Backward formula - Stirlings formula - Bessel's formula and problems on the above formulae

Unit – 4: Solution of Algebraic and Transcendental equation

Method for finding initial approximate value of the root - Bisection method - to find the solution of given equations by using (i) Regula Falsi method (ii) Iteration method (iii) Newton – Raphson's method and problems on them.

Unit – 5: Curve Fitting

Least-squares curve fitting procedures - fitting a straight line-nonlinear curve fitting-curve fitting by a sum of exponentials.

Text Book

References:

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson, (2003) 7th Edition.
2. Introductory Methods of Numerical Analysis by S.S. Sastry, (6th Edition) PHI New Delhi 2012
3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S .R. K. Iyengar and R. K. Jain, New Age International Publishers (2012), 6th edition.

Semester – III End Practical Examinations

Scheme of Valuation for Practical's

Time : 2 Hours

Max.Marks : 50

- **Record** - 10 Marks
- **Viva voce** - 10 Marks
- **Test** - 30 Marks
- **Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.**

BLUE PRINT FOR PRACTICAL PAPER PATTERN

COURSE-VI - NUMERICAL METHODS

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	The calculus of finite differences	2	06
II	Interpolation with Equal and Unequal intervals	2	12
III	Central Difference Interpolation formulae	1	12
IV	Solution of Algebraic and Transcendental equation	2	06
V	Curve Fitting	1	12
	Total	08	48

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II year B.Sc., Degree Examinations - III Semester
Mathematics Course-VI: NUMERICAL METHODS
(w.e.f. 2023-24 Admitted Batch)
Practical Model Paper (w.e.f. 2024-2025)

.....

Time: 2Hrs

Max. Marks: 50M

Answer any 5 questions. At least 2 questions from each section.

5 x 6 = 30 Marks

SECTION - A

1. Unit - I.
2. Unit – I.
3. Unit - II.
4. Unit – II.

SECTION – B

5. Unit - III.
6. Unit - IV.
7. Unit - IV.
8. Unit - V.

- **Record** - 10 Marks
- **Viva voce** - 10 Marks