13 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Baisakh

Exam.	[illegible]		
Level	BE	Full Marks	80
Programme	BGE, BEL, BEX, BCT, BAG	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. What are the applications of Numerical Method in engineering and science? Discuss it. [4]
2. Write an algorithm of Secant method to calculate the roots of a nonlinear equations $f(x) = 0$. Write the differences between secant and the false position methods. [4+2]
3. Find a real root of the equation $x\log_{10}x = 1.2$ by N-R method correct up to 4 decimal places. [6]
4. Write the pseudo code of the Gauss Jordan method to solve the linear system $Ax = b$. [8]
5. Find the dominant eigenvalue and eigenvector of the matrix: [8]

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$

6. Estimate y(6.5) using Natural cubic spline interpolation technique from the following data. [8]

x	3	5	7	9	11
y	8	10	9	12	5

7. Fit the curve $y = ax^b$ to the following data: [8]

4	5	7	10	11	13
48	100	294	900	1210	2028

8. Evaluate $\int_0^{\pi/2} e^{\sin x} dx$ using Gaussian 3-point formula. [6]
9. Find $f'(3)$ from the following table: [5]

x:	2	4	8	12	16
f(x):	20	23	30	35	40

10. Solve $y' = \frac{y}{x^2 + y^2}$, $y(0) = 1$ using R - K2 method in the range 0, 0.5, 1. [6]
11. Solve the BVP: $y'' + 3y' = y + x^2, y(0) = 2, y(2) = 5$ at $x = 0.5, 1, 1.5$ using finite difference method. [5]
12. Solve the elliptic equation $\nabla^2 u = 0$ in the square plate of size 8cm × 8cm if the boundary values are given 50 on one side of the plate and 30 on its opposite side. On the other sides the values are given 10. Assume the square grids of size 2cm × 2cm. [10]

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05 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BME, BAME, BIE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Numerical Methods *(SH603)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Define error and write its different types with examples. If x = 1.350253 is rounded off to Four significant digits, find absolute and relative errors. [4]
2. Write an algorithm to find a real root of a non linear equation using secant method. [6]
3. What are limitations of Newton-Raphson method? Using Newton-Raphson method, find a root of equation
   $x\sin x + \cos x = 0$ which is near to $x = \pi$. [2+4]
4. Solve the following system of linear equation using Gauss-Seidal method, correct to 3 decimal places. [8]

$$2x_1 + 6x_3 - 3x_4 = 31$$
$$6x_1 + 2x_4 = 14$$
$$-3x_1 + 5x_2 = 9$$
$$2x_1 + x_2 - 5x_3 + 9x_4 = -9$$

5. Obtain the dominant eigen value and its corresponding eigen vector of following matrix using Power Method. [8]

$$\begin{bmatrix} 1 & 4 & 4 \\ 4 & 1 & 8 \\ 4 & 8 & 1 \end{bmatrix}$$

6. Fit the curve of the form $y = a\log_e x + b$ to the following data sets. [8]

x	2	3	4	5	6	7
y	5.45	6.26	6.84	7.29	7.66	7.96

7. Approximate y(2) and y(10) using appropriate interpolation formula from the following data: [8]

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

8. Derive Newton-Cotes general quadrature formula for integration and use it to obtain Simpson's $-\frac{1}{3}$ rule of integration. [6]
9. Evaluate $\int_0^1 \frac{\tan^{-1} x}{x}$ using Gaussian 3 point formula. [4]
10. Solve the following boundary value problem using shooting method [10]
    $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x$, with y(1) = 1 and y(2) = 5; Taking h = 0.25
11. Write a pseudo-code to solve an initial value problem of first order using Runge - Kutta 4 method. [4]
12. Derive recurrence formula for solving one dimensional heat equation $U_t = c^2 U_{xx}$. Using it solve the heat equation $U_t = 0.5\, U_{xx}$, $0 \le x \le 5$, $0 \le t \le 4$ with boundary conditions $U(x, 0) = xe^x(5 - x)$, $U(0, t) = 0$ and $U(5, t) = 0$; taking h = 1. [4+4]

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13 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2074 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BGE, BEL, BEX, BCT, BAG	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Discuss the significance of Numerical Methods in the field of science and engineering in modern day context. [4]
2. Write pseudo-code for finding a real of a non-linear equation using the False Position Method. [6]
3. Find a real root of the following equation, correct to six decimals, using the Fixed Point iteration method. [6]

$$\sin x + 3x - 2 = 0$$

4. Solve the following system of equations using LU factorization method. [8]

$$5x_1 + 2x_2 + 3x_3 = 31$$
$$3x_1 + 3x_2 + 2x_3 = 25$$
$$x_1 + 2x_2 + 4x_4 = 25$$

5. Write a pseudo-code to determine the largest Eigen value and the corresponding vector of a square matrix using Power Method. [8]
6. The following data are provided; use least-squares method to fit these data with the following model, $y = ax + b + \frac{c}{x}$ [8]
7. From the following data, compute: (a) y(3) using Newton's forward interpolation formula (b) y(6.4) using stirling's formula [8]

x	2	4	6	8	10	12
y	5.1	4.2	3.1	3.5	6.2	7.3

8. Evaluate the following integral using Romberg's method. (correct to two decimal planes) [8]

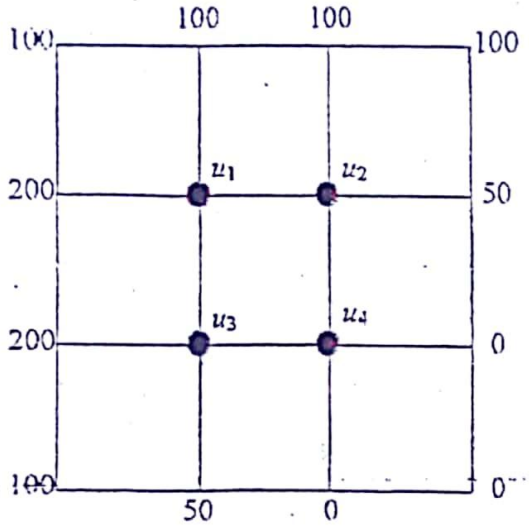
$$\int_0^2 \frac{e^x + \sin x}{1 + x^2}\, dx$$

9. Solve $y' = 4e^{0.8x} - 0.5y$; subject to initial condition y(0) = 2. for y(0.5) and y(1.0) using Runge-Kutta 2nd order method. [6]

10. Solve the following boundary value problem using the finite difference method by dividing the interval into four sub-intervals. [8]

$$y'' = e^x + 2y' - y; \quad y(0) = 1.5; \quad y(2) = 2.5$$

11. Find the values of u(x, y) satisfying the Laplace equation $\nabla^2 u = 0$, at the pivotal points of the square region with boundary conditions as shown below. [10]



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13 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2073 Magh

Exam.	[illegible]		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, B. Agri, BGE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Discuss the importance of Numerical Methods in Science and Engineering. [4]

2. Find a real root of $\cos x + e^x - 5 = 0$ accurate to 4 decimal places using the Secant Method. [6]

3. Write pseudo-code to find a real root of a non-linear equation using the Bisection Method. [6]

4. Compute the inverse of following matrix using the Gauss-Jordan Method. [8]

$$\begin{bmatrix} 3 & -1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 5 \end{bmatrix}$$

5. Write algorithm for computing the dominant Eigen value and corresponding vector of a square matrix using the Power method. [8]

6. Fit the following set of data to a curve of the form $y = ab^x$. [8]

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	8.2	5.2	3.1	2.5	1.7	1.6	1.4

7. Estimate $y(4.5)$ from the following data using Natural Cubic Spline Interpolation technique. [8]

x	1	3	5	7	9
y	10	12	11	13	9

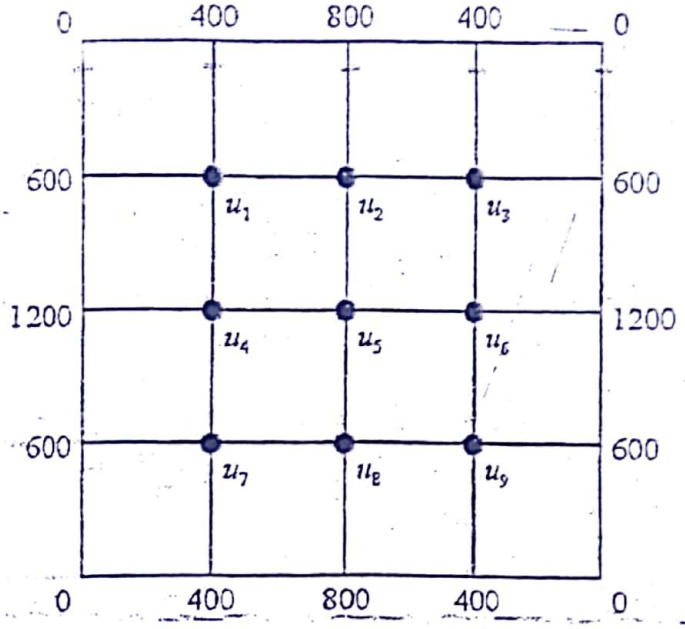
8. Derive the formula to evaluate $y'(x)$ and $y''(x)$ from Newton's Forward Interpolation formula. [4]

9. Evaluate $\int_0^{1.4} (\sin x^3 + \cos x^2)\, dx$ using Gaussian 3-point formula. [6]

10. Solve $y' = \sin x + \cos y$ subject to initial condition $y(0) = 2$ in the range $0(0.5)2$ using the Runge-Kutta second order method. [6]

11. Write a program in C/C++/FORTRAN to solve a second order ordinary differential equation (initial value problem) using the Runge-Kutta fourth order method. [6]

12. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the square mesh with boundary values as shown in the figure below. [10]



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13 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, B. Agri., BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Discuss the difference between absolute error and relative error with appropriate examples. [4]
2. Write an algorithm of Secant method for finding a real root of a non linear equation. [4]
3. Find a real root of the equation $\sin x = e^{-x}$ correct up to four decimal places using N-R method. What are the limitations of this method? [8]
4. Apply Gauss Seidal Iterative Method to solve the linear equations correct to 2 decimal places. [8]

$$10x + y - z = 11.19$$
$$x + 10y + z = 28.08$$
$$-x + y + 10z = 35.61$$

5. Find the dominant Eigen value and the corresponding Eigen vector of the given matrix using power method. [8]

$$\begin{bmatrix} 15 & -4 & -3 \\ -10 & 12 & -6 \\ -20 & 4 & -2 \end{bmatrix}$$

6. What is the practical significance of the least squares method of curve fitting? Derive the normal equations to fit a given set of data to a linear equation $(y = ax + b)$ [2+6]
7. Using stirling formula find u_{28}, given; [8]

$u_{20} = 49225, u_{25} = 48316, u_{30} = 47236, u_{35} = 45926, u_{40} = 44306$

8. Estimate the value of cost (1.74) from the following data: [4]

x	1.7	1.74	1.78	1.82	1.86
Sin(x)	0.9916	0.9857	0.9781	0.9691	0.9584

9. Evaluate $\int_{0.2}^{1.5} e^{-(x^2)} dx$ using the 3 point Gaussian quadrature formula. [6]
10. Solve the following simultaneous differential equations using Runge-Kutta second order method at x = 0.1 and 0.2. $dy/dx = xz + 1; dz/dx = -xy$ with initial conditions $y(0) = 0, z(0) = 1$ [6]
11. Write a program in any high level language (C/C++/FORTRAN) to solve a first order initial value problem using classical RK-4 Method. [6]
12. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ on the square mesh bounded by $0 \le x \le 3, 0 \le y \le 3$. The boundary values are $u(x,0) = 10, u(x,3) = 90, 0 \le x \le 3$ and $u(0,y) = 70, u(3,y) = 0, 0 < y < 3$. [10]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2072 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, B. Agri, BGE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Discuss the necessity of numerical methods in the field of Science and Engineering in this modern age of computers. [4]
2. Find a real root of the equation xtanu-1 = 0 using bisection method correct up to three (3) significant digits. [6]
3. Write Psudocode for solving a Non-Linear equation using the secant method. [6]
4. Find the inverse of the matrix $A = \begin{bmatrix} 2 & -2 & 4 \\ 2 & 3 & 2 \\ -1 & 1 & 1 \end{bmatrix}$ using Gauss Jordan method. [8]
5. Find the largest eigen value and the corresponding eigen vector of the following matrix. [8]

$$\begin{bmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{bmatrix}$$

6. Using the least square method, determine the exponential fit of the form $y = ae^{bx}$ for the following data:

x	0	1	2	3	4	5
y	1.5	2.5	3.5	5.0	7.5	11.25

7. Compute y(6) from the following data using Cubic Spline Interpolation. [8]

x	1	3	5	7	9
y	3	5	4	2	3

8. Derive an expression for evaluating first and second derivatives using Newton forward difference interpolation formula. [4]
9. Evaluate $\int_0^3 (\sin x + \cos x + 2)dx$ using Simpson's -3/8 rule taking h = 0.5. Determine the percentage error by comparing the result with exact solution. [4+2]
10. Using Finite difference method solve the BVP: $y'' = 4y' - 4y + e^{2x}, y(0) = 0, y(1) = 2$ for three internal points in (0,1). [8]
11. Write algorithm for solving an initial value problem of first order using RK-4 method. [4]
12. Solve the equation $\nabla^2 u = -10(x^2 + xy + 10)$ over the square with sides x = y = 0, x = y = 3 with u = 10 on the boundary and mesh length 1. [10]

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14 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2072 Ashwin

Exam.			
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, B. Agri, BGE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Discuss the difference between Absolute error and Relative error with examples. [4]
2. Derive Newton Raphson interative formula for solving nonlinear equation, using Taylor series. [4]
3. Using the Bisection method, find a real root of the equation $f(x) = 3x - \sqrt{1+\sin x}$ correct up to three decimal points. [8]
4. Develop pseudocode to solve a system of linear equations using Gauss Jordan method. [8]
5. Find the largest Eigen value and the corresponding Eigen vector of the following matrix using the power method with an accuracy of 2 decimal points. [8]

$$\begin{pmatrix} 1 & 2 & 1 \\ 2 & 1 & 2 \\ 1 & 2 & -1 \end{pmatrix}$$

6. Using appropriate Newton's Interpolation Techniques, estimate y(15) and y(85) from the following data: [8]

x	10	30	50	70	90
y	34	56	45	23	36

7. Fit the following data in to $y = a + b\sqrt{x}$ [8]

X	500	1000	2000	4000	6000
Y	0.20	0.33	0.38	0.45	0.51

8. Write an algorithm to calculate the definite integral $\int_a^b f(x)dx$ using composite simpson's 1/3 rule. [4]
9. The distance travelled by a vehicle at intervals of 2 minutes are given as follows: [6]

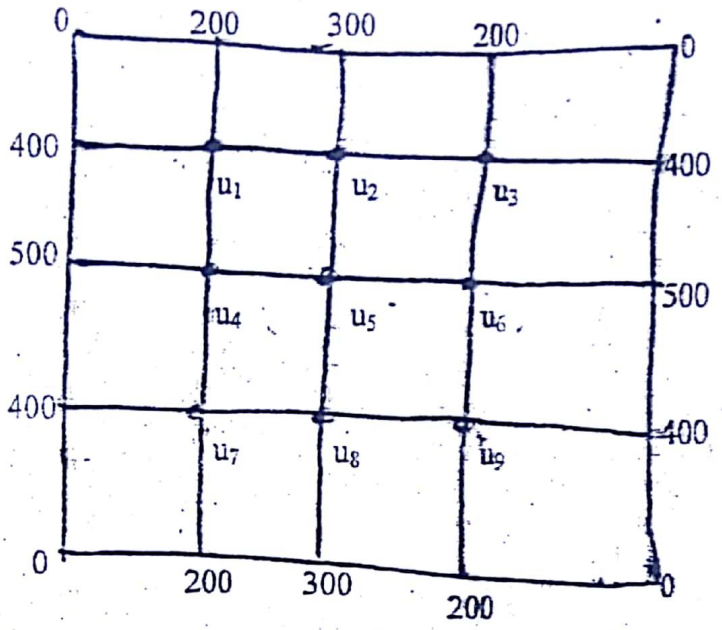
Time (min):	2	4	6	8	10	12
Distance (km):	0.25	1	2.2	4	6.5	8.5

Evaluate the velocity and acceleration of the vehicle at t = 3 minutes. [8]

10. Solve the following by RK-2 method for x = 0 (0.1) 0.2

$$\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0 \; ; \; y(0) = 1, y'(0) = 0$$

11. Solve the Laplace equation $u_{xx} + u_{yy} = 0$ for the square mesh with boundary values as shown in the figure. [10]



12. Derive Euler's formula for solving initial value problem. [4]

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11 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2071 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BGE, B.Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Find a root of the equation $\cos x = xe^x$ using the regula-falsi method correct upto four decimal places. [8]
2. Derive Newton-Raphson iterative formula for solving non-linear equation. [4]
3. Define error. Discuss different types of errors in numerical computation. [4]
4. Solve the following set of linear equations using LU factorization method. [8]

$$x - 3y + 10z = 3$$
$$-x + 4y + 2z = 20$$
$$5x + 2y + z = -12$$

5. Use Gauss Seidel method to solve the following equations: [8]

$$20x + y - 2z = 17$$
$$3x + 20y - z = -18$$
$$2x - 3y + 20z = 25$$

6. The following data are taken from the steam table. [8]

Temp. °C	140	150	160	170	180
Pressure kgf/cm^2	3.685	4.854	6.302	8.076	10.225

Find the pressure at the temperature T = 142°C and T = 175°C using Newton's interpolation.

7. Derive expression for least square method of fitting a linear curve. [8]

OR

Develop pseudocode to interpolate the given set of data using Langrange interpolation.

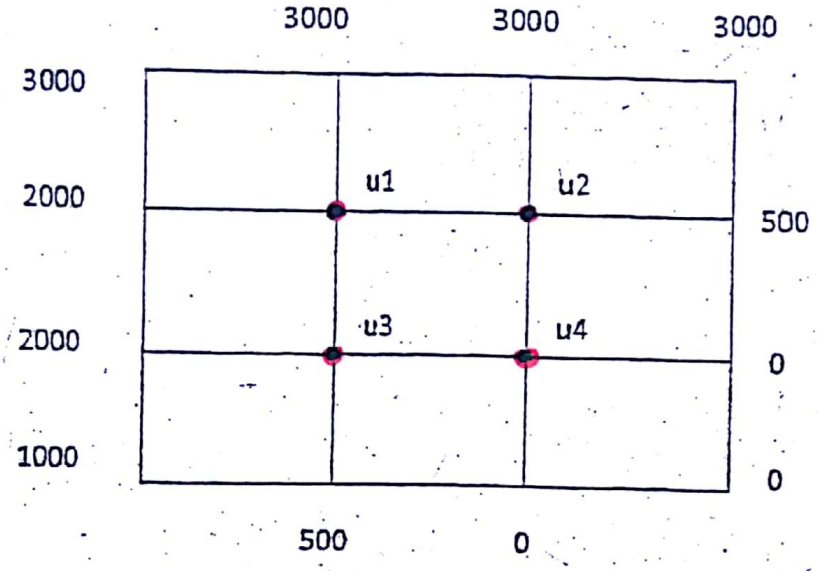
8. If 'x' is in cm and 't' is in time then find velocity and acceleration when t = 0.1 second. [4]

t	0	0.1	0.2	0.3	0.4	0.5	0.6
x	30.13	31.62	32.87	33.64	33.95	33.81	33.24

9. Compute integration of the following function using Romberg integration $\int_{-1}^{1} \frac{dx}{1+x^2}$. [6]
10. Using Euler's method find y(0.2) from following equation $y' = x + y$, $y(0) = 0$, take $h = 0.1$. [4]

11. Using the Runge-Kutta method of second order, obtain a solution of the equation $y'' = y + xy'$ with the initial condition $y(0) = 1$, $y'(0) = 0$ to find $y(0.2)$ and $y'(0.2)$. (Take $h = 0.1$) [8]

12. Calculate the value of $u(x, y)$ satisfying the Laplace equation $\nabla^2 u = 0$ at the interior points of the square region with boundary conditions shown in figure below. [10]



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13 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2071 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BGE, B.Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Methods *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Create difference table from following data. [4]

X	3.0	3.2	3.4	3.6	3.8
Y	0.4771	0.5051	0.5315	0.5563	0.5798

2. Use bisection method to find a real positive root of $\sin x = \frac{1}{x}$ correct upto three decimal places. [8]

3. Write a pseudo-code to find a real root of a non-linear equation using Secant Method. [4]

4. Solve the following linear equations using Gauss Elimination or Gauss Jordan method using partial pivoting. [8]

$$\begin{aligned} 2x+3y+2z &= 2 \\ 10x+3y+4z &= 16 \\ 3x+6y+z &= 6 \end{aligned}$$

5. Find the largest eigen-value and the corresponding eigen-vector of the following matrix. [8]

$$\begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$$

6. Find the best fit curve in the form of $y = a + bx + cx^2$ using least square approximation from the following discrete data. [8]

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

7. Use Lagrange's Interpolation formula to find the value of y when x = 3.0, from the following table. [8]

x	3.2	2.7	1.0	4.8	5.6
y	22.0	17.8	14.2	38.3	51.7

8. Evaluate $\int_0^2 f(x)dx$, for the function $f(x) = e^x + \sin 2x$ using composite Simpson's 3/8 formula taking step size $h = 0.4$. [5]

9. Evaluate $\int_0^2 \frac{dx}{x^2+2x+1}$ using Gaussian 3 point formula. [5]

10. Solve $\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$ using RK – 4 method, for y(0.4). (Given, y(0) = 1, h = 0.2) [6]

11. Using the finite difference method, find y(0.25), y(0.5) and y(0.75) satisfying the differential equation $xy'' + y = 0$, subject to the boundary conditions y(0) = 1, y(1) = 2. [6]

12. Solve the Poisson equation $u_{xx} + u_{yy} = -81xy$, $0 < x < 1$, $0 < y < 1$ given that $u(0, y) = 0$, $u(x, 0) = 0$, $u(1, y) = 100$, $u(x, 1) = 100$ and $h = 1/3$. [10]

24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2070 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, B.Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Discuss the importance of Numerical Methods in the field of Science and Engineering. [4]
2. Write pseudo-code for finding a real root of a non-linear equation using False Position Method. [6]
3. Find a real root of the following equation, correct to three decimals, using the Fixed Point iteration method. [6]

$$\sin x + 3x - 2 = 0$$

4. Solve the following systems of linear equations using the Gauss-Seidal iteration method. [8]

$$x_1 + 3x_2 - x_3 + 7x_4 = 19$$
$$2x_1 + 8x_2 + x_3 - x_4 = 17$$
$$3x_1 + x_2 + 9x_3 - x_4 = 15$$
$$9x_1 - x_2 - x_3 + 2x_4 = 13$$

5. Find the largest Eigen value and corresponding vector of the following matrix using power method. [8]

$$\begin{bmatrix} 2 & 5 & 1 \\ 5 & -2 & 3 \\ 1 & 3 & 10 \end{bmatrix}$$

6. Compute the value of y(3) and y(7) from the following data using Newton's interpolation formula. [8]

x	2	4	6	8	10	12
y	5.1	4.2	3.1	3.5	6.2	7.3

7. Fit the following data to the curve $y = \log_e (ax+b)$. [8]

x	0	1	2	3	4	5	6
y	0.9	1.0	1.5	1.9	2.1	2.4	2.5

8. Evaluate the following, using simpson's 1/3 rule. (take h = 0.2) $\int_0^2 \frac{4e^x}{1+x^3} dx$ [5]

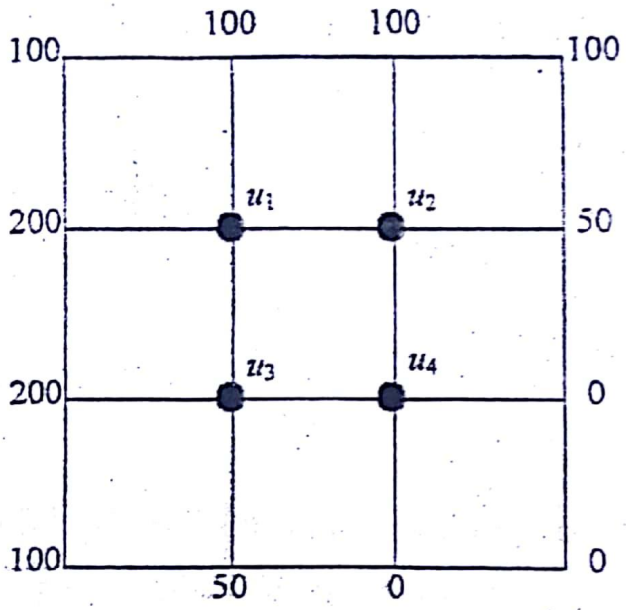
9. Evaluate $\int_2^3 \frac{\cos 2x}{1+\sin x} dx$ using Gauss quadrature three-point formula. [5]

10. Solve the following boundary value problem using finite difference method. [8]

$$y'' = e^x + 2y' - y; \quad y(0) = 1.5; \quad y(2) = 2.5$$

11. Explain the technique of solving an initial value problem using Euler's method. [4]

12. Find the value of u (x,y) satisfying the Laplace equation $\nabla^2 u = 0$, at the pivotal points of the square region with boundary conditions as shown below. [10]



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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT. B.Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Define error. Explain different types of errors in numerical computation. [6]
2. Find a real root of the following equation correct to four decimals using False Position method. [6]

$$e^{\cos x} - \sin x - 1 = 0$$

3. Discuss the limitations of Newton-Raphson method while finding a real root of a non-linear equation. [4]
4. Solve the following system of equations using LU factorization method. [8]

$$5x_1 + 2x_2 + 3x_3 = 31$$
$$3x_1 + 3x_2 + 2x_3 = 25$$
$$x_1 + 2x_2 + 4x_3 = 25$$

5. Write an algorithm for solving a system of linear equations of 'N' unknowns using Gauss-Jordan Method. [8]
6. Find y at x = 8 from the following data using Natural Cubic Spline interpolation. [8]

x	3	5	7	9
y	3	2	3	1

7. Fit the following set of data to a curve of them form $y = a\,b^x$. Also evaluate y(7). [8]

x	2	4	6	8	10	12
y	16.0	11.1	8.7	6.4	4.7	2.6

8. Evaluate the following integral using Romberg method. [6]

$$\int_0^2 \frac{e^x + \sin x}{1 + x^2}\,dx$$

9. Determine y'(1) and y''(1) from the following data. [4]

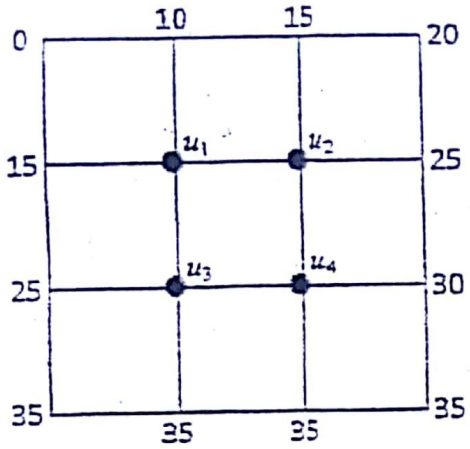
x	0.5	1.0	1.5	2.0	2.5
y	6	3	2	1.2	0.8

10. Solve the following initial value problem for y(1.2) using the Runge-Kutta fourth order method. [6]

$y'' - 3y' + y = \sin x;\quad y(1) = 1.2;\quad y'(1) = 0.5$

11. Write an algorithm to solve two point boundary value problem using shooting method. [6]

12. Solve $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary conditions as shown in figure below. [10]



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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2069 Poush

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, B. Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Methods *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Write an algorithm to find a real root of a non-linear equation using the bisection method. [4]
2. How can you obtain a real of a noon-linear equation using the Secant method? Explain graphically and hence obtain the iteration formula. [4]
3. Find the root of the equation $xe^x - \cos x = 0$ using the secant method correct to four decimal places. [8]
4. Solve the following system of linear equations using the Gauss Elimination method with partial pivoting. [8]

$$x + 2y - 12z + 8v = 27$$
$$5x + 4y + 7z - 2v = 4$$
$$-3x + 7y + 9z + 5v = 11$$
$$6x - 12y - 8z + 3v = 49$$

5. Find the dominant Eigen value and the corresponding vector of the following matrix using power method. [8]

$$\begin{bmatrix} 1 & 4 & -1 \\ 4 & 2 & 5 \\ -1 & 5 & 10 \end{bmatrix}$$

6. Using Lagrange's interpolation formula evaluate f(27.5) from the table : [6]

x:	26	27	28	29	30
f(x):	3.846	3.704	3.571	3.448	3.333

7. Using the Natural Cubic Spline interpolation technique, estimate the value of y(0.5) from the following data: [10]

x	0	1	2	3
y	2.0	2.2	1.0	0.5

8. The distance y(t) traversed in time t by an object moving in a straight line is given below; approximate the velocity and acceleration at 0.2 seconds. [6]

t(in seconds)	0.0	0.1	0.2	0.3	0.4	0.5	0.6
y(in times)	0.0	1.5	7.1	14.3	24.5	36.7	50.0

2069 Poush

9. Evaluate the integral $I = \int_{0.2}^{1.2} (\log(x+1) + \sin 2x)dx$, using Gaussian 2 point and 3 point formula. [6]

OR

Write a Pseudo-code to integrate a given function within given limits using Simpson's 3/8 rule.

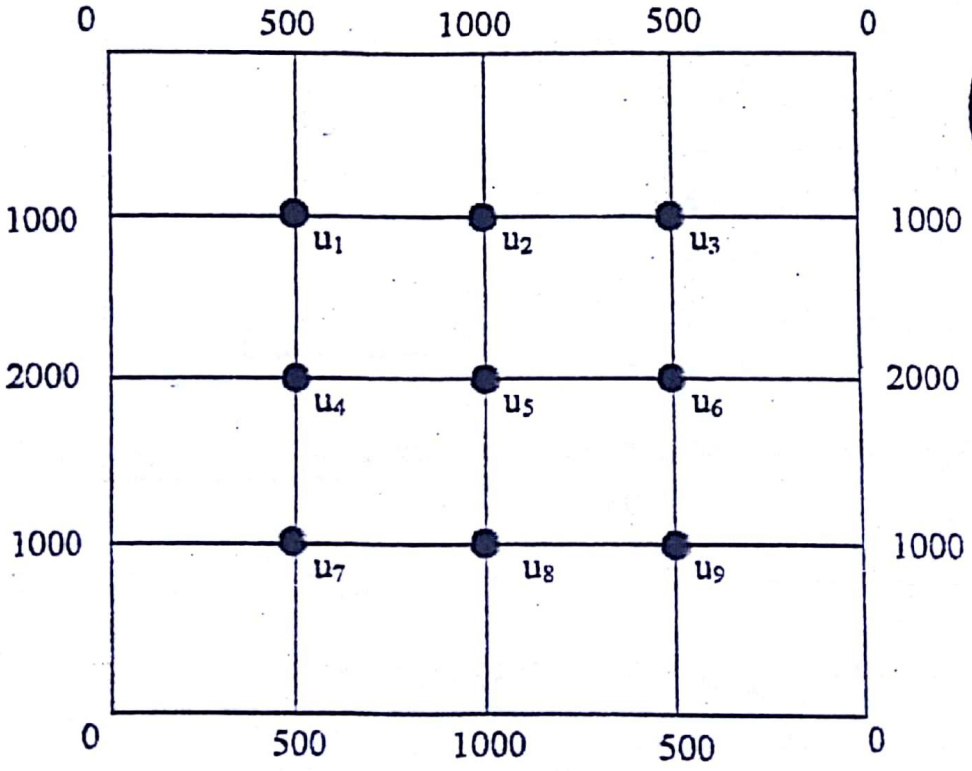
10. Solve the differential equation, $\frac{dy}{dx} = (1+x^2)y$, within $x \le 0(0.2)0.4$ and $y(0) = 1$ using RK 4th order method. [6]

11. Solve the following boundary value problem using the finite difference method, by dividing the interval into four sub-intervals. $\frac{d^2y}{dx^2} = x + y, y(0) = y(1) = 0.$ [6]

12. Solve the equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over a square mesh with sides $x = 0$, $y = 0$, $x = 3$, $y = 3$ with $u = 0$ on the boundary and mesh length = 1. [10]

OR

Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with the boundary values as shown.



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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2069 Bhadra

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, B. Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method *(SH553)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Generate forward difference table from the following data. [4]

x	1	2	3	4	5	6
f(x)	2	9	28	65	126	217

2. Explain the mechanism of finding a real root of a non-liner equation using secant method. [4]
3. Find a root of $e^x = 3x$ using bisection method and Newtons Raphson method correct upto 3 decimal places. [4+4]
4. Solve following system of linear equation using Gauss elimination method. [8]

$$x + 2y + 3z = 6$$
$$2x + 3y + 5z = 10$$
$$2x - y + 3z = 4$$

5. Write Pseudo- code to solve a system of linear equations of 'N' unknowns using Gauss-Jordan method. [8]
6. Use Lagrange method to find f(2.5) from the following data : [8]

x	1	2	4	5	7
f(x)	1	1.414	1.732	2.00	2.6

7. Fit the following set of data to a curve of the form $y = a\, e^{bx}$ from the following observation by least square method. [8]

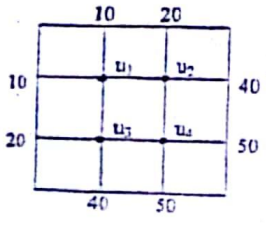
x	1	2	3	4	5	6
y	5.5	6.5	9.4	15.2	30.6	49.8

8. Derive the expression of Simpson's 1/3 rule for integration. [4]
9. Evaluate: $\int_2^4 e^{-x^2} dx$ using 2-point Gauss Legendre method. [6]

OR

Evaluate $\int_1^2 e^{-x^2} dx$ using Romberg method correct up to 3 decimal places.

10. Solve: $y'' + xy' + y = 0$; $y(0) = 1$; $y'(0) = 0$ for $x = 0(0.1)0.2$ using the RK2 method. [10]
11. Solve the elliptic equation $u_{xx} + y_{xx} = 0$ for the following square mesh with boundary conditions as shown in figure below. [12]



24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Magh

Exam.			
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, B.Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Evaluate the real root of $f(x) = 4 \sin x - e^x$, using Newton Raphson method. The absolute error of root in consecutive iteration should be less than 0.01%. [8]
2. Write an algorithm to find a real root of a non-linear equation using the Newton-Raphson method. [4]
3. Round off the numbers 865250 and 37.46235 to four significant figures and compute relative, absolute and percentage errors. [4]
4. Solve the following system of linear algebraic equations using the Gauss Elimination Method. [8]

$$2x_1 + 3x_2 + 2x_3 + 5x_4 = 11$$
$$4x_1 + 2x_2 + 2x_3 + 4x_4 = 11$$
$$4x_1 + x_2 + 4x_3 + 5x_4 = 11$$
$$5x_1 - 5x_2 + 3x_3 + x_4 = 11$$

5. Find the inverse of the matrix $A = \begin{bmatrix} 4 & 3 & -1 \\ 1 & 1 & 1 \\ 3 & 5 & 3 \end{bmatrix}$ using Gauss elimination. [8]
6. Develop a Pseudocode to interpolate the given set of data using Lagrange method. [8]

OR

What is Cubic Spline Interpolation? What is the advantage of this method over polynomial interpolation?

7. Use Stirling's formula to compute y(35) from the following table: [8]

X	20	30	40	50
Y	512	439	346	243

OR

Fit the following set of data into a curve $y = \frac{ax}{b+x}$

X	1	2	3	4	5
Y	0.500	0.667	0.750	0.2	0.833

8. A rod is rotating in a plain. The following table gives the angle in radians (θ) through which the rod has turned for various values of time in seconds (t). Find the angular velocity and angular acceleration t = 0.2. [4]

t	0	0.2	0.4	0.6	0.8
θ	0	0.122	0.493	0.123	2.022

2068 Magh

9. Evaluate the following using Gaussian three point formula: $\int_0^2 e^{-x/3} dx$. [4]

10. Solve the ordinary differential equation, $y'' = xy'^2 - y^2$ for $x = 0.6$ with initial conditions $y(0) = 1$, $y'(0) = 0$ by using R-K second order method. (Take $h = 0.3$) [6]

11. Write Psedocode to solve an initial value problem (first order differential equation) using the Runge-Kutta fourth order method. [6]

12. Solve the Possion equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 2x^2y^2$ over the square domain $0 \le y \le 3$ with $h = k = 1$ and boundary conditions are $u(0,0) = 0$, $u(3,0) = 0$, $u(0,3) = 0$ and $u(3, 3) = 0$. [10]

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2068 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, B.Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Methods

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Find a real root of $x^5 - 3x^3 - 1 = 0$ correct up to four decimal places using the Secant Method. [8]
2. Write a Pseudo-code to find a real root of a non- linear equation using Bisection Method. [4]
3. Obtain the iteration formula of Secant method and explain its working procedure in finding a root of a non linear equation. [4]

OR

Explain the working principle of the bisection method to find a real root of a non-linear equation.

4. Solve the following set of linear equations using a suitable iterative method. [8]

$$2x + y + z - 2w = -10$$
$$4x + 2z + w = 8$$
$$3x + 2y + 2z = 7$$
$$x + 3y + 2z - w = -5$$

5. Find the largest eigen value and corresponding eigen vector of the following matrix, using power method [8]

$$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$

6. Find the values of y at x = 1.6 and x = 4.8 from the following points using Newton's interpolation technique. [8]

x	1	2	3	4	5
y	4	7.5	4	8.5	9.6

7. Find a curve of the form $y = ab^x$ that fits the following set of observations using least square method. [8]

x	1	2	3	4	5
y	1.2	2.5	6.25	15.75	28.65

8. The following table gives the angle in radians (θ) through which a rotating rod has turned for various values of time in seconds (t). Find the angular velocity and angular acceleration at t = 0.2. [4]

t	0	0.2	0.4	0.6	0.8
θ	0	0.122	0.493	0.123	2.022

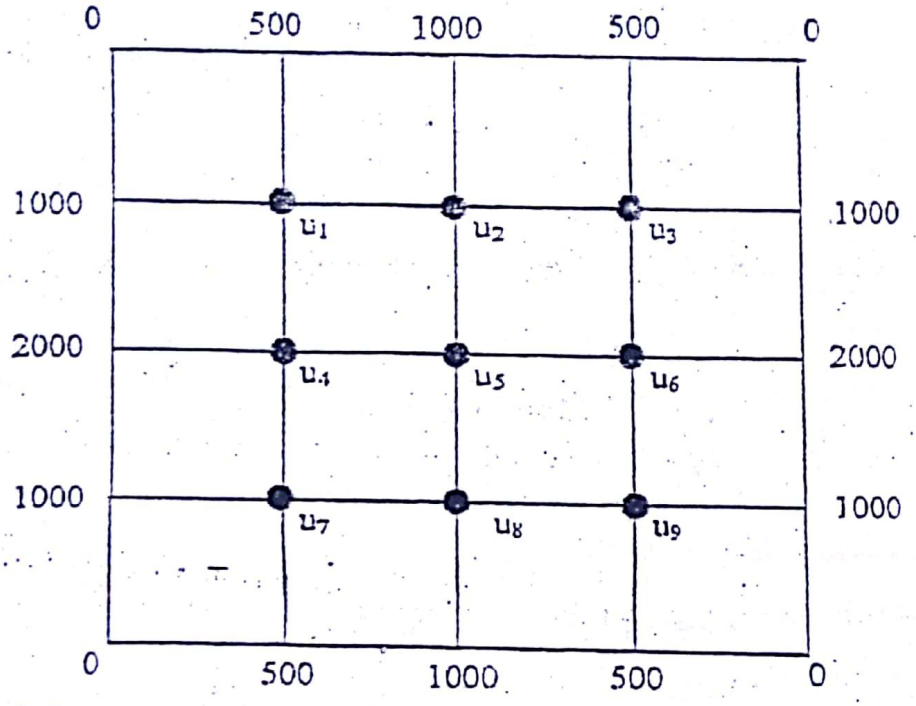
2068 Bhadra

9. Use Romberg's method to compute $\int_1^2 \frac{2}{1+x^2}dx$. [6]

10. Using the Runge-Kutta method of second order, obtain a solution of the equation $y' = xy + y^2$, with the initial condition $y(0) = 1$ for the range $0 \le x \le 0.6$, with increments of 0.2. [6]

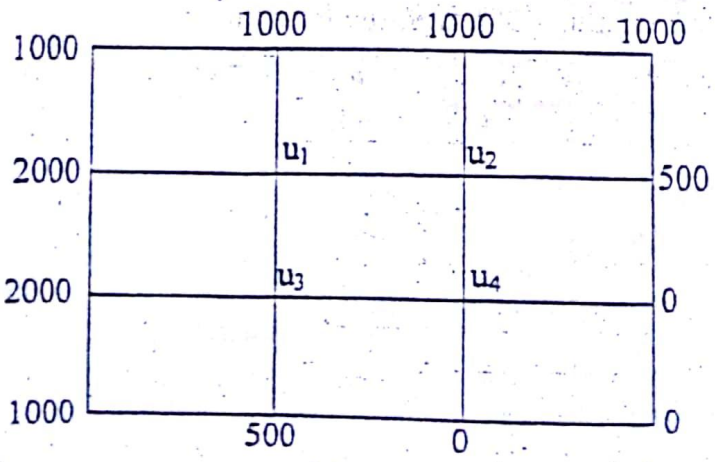
11. Solve the following boundary value problem using the finite difference method, by dividing the interval into four sub-intervals. $\frac{d^2y}{dx^2} = x + y, y(0) = y(1) = 0$. [6]

12. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with the boundary values as shown. [10]



OR

Given the values of u(x, y) on the boundary of the square as shown in the figure below, evaluate the function u(x, y) satisfying the Laplace $\nabla^2 u = 0$ at the pivotal points, using standard five point formula iterative method.



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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Baishakh

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	All (Except B.Arch.)	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Numerical Methods

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any Five questions. Question No. 6 is compulsory.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. a) Find the root of the equation $e^x - 3x = 0$ correct upto three decimal places using bisection method. [8]

   b) Find the reciprocal of 3 using Newton Raphson method. [8]

2. a) Apply Newton's forward difference formula to find y(3.5) from the following data. [8]

x	1	2	3	4	5	6	7	8
y	1	8	27	64	125	216	343	512

   b) Obtain a relation of the form $y = ae^{bx}$ for the following data by the method of least squares. [8]

x:	0.0	0.5	1.0	1.5	2.0	2.5
y:	0.10	0.45	2.15	9.15	40.35	180.75

3. a) Use Romberg integration method to evaluate the integral $\int_1^2 \frac{dx}{x}$ correct upto 3 decimal places taking the initial sub interval size as $h = (b - a)/2$. [10]

   b) The velocity V of a particle at a distance S from a point on its path is given in the table below: [6]

S (ft)	0	10	20	30	40	50	60
V (ft/sec)	47	58	64	65	61	52	38

   Estimate the time taken to travel a distance of 60ft by using Simpson's 1/3 rule. Compare the result with Simpson's 3/8 rule.

4. a) Find the largest eigen value correct to three significant digits and corresponding eigen vector of the following matrix using power method. [8]

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 4 & 5 \end{bmatrix}$$

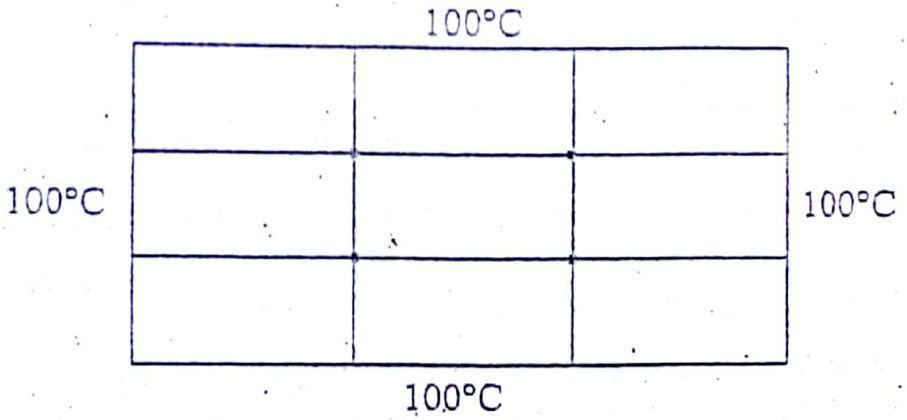
   b) Use Gauss Jordan method to find the inverse of the following matrix. [8]

$$A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$$

2068 Baishakh

5. a) Solve $y' = xy + y^2$, $y(0) = 1$ for $y(0.1)$ and $y(0.2)$ using Runge-Kutta method of fourth order. [8]

   b) Consider a metal plate of size 30cm × 30cm, the boundaries of which are held at 100°C. Calculate the temperature at interior points of the plate. Assume the grid size of 10cm ×10cm. [8]



6. Write algorithm, flowchart and program code in any one of the high level languages (FORTRAN or C) to fit the parabola $y = a + bx + cx^2$ where a, b and c are constants, Hence find the value of y when x is an user defined value. [16]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2067 Ashadh

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	All (Except B.Arch.)	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Numerical Methods

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any Five questions. Question No. 6 is compulsory.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. a) Find at least one root of $x^3 - 2x - 5 = 0$ with the accuracy of 0.08%, using Bisection method. [8]

   b) Find an approximate root of $x \log_{10} x - 1.2 = 0$ using secant method upto three decimal places of accuracy. [8]

2. a) Use a suitable method to fit an exponential curve $y = ae^{bx}$ for the following data: [8]

X	1	2	3	4	5
Y	1.65	2.7	4.5	7.35	12.2

   b) The followings are the measurement of t (time) made on a curve recorded by an oscillograph representing a change in the conditions of an electric current (I). [8]

t (time)	1.2	2.0	2.5	3.0
I	1.36	0.58	0.34	0.20

   Find the value of I when t = 1.6 with appropriate Newton's Gregory Interpolation method.

3. a) Evaluate $I = \int_0^2 \frac{(x^2 + 2x + 1)}{1 + (x+1)^4} dx$ using Gauss two point and three point formula. Also, compare results obtained from both the methods. [8]

   b) Find the largest Eigen value of the matrix $A = \begin{bmatrix} 2 & -2 & 4 \\ 2 & 3 & 2 \\ -1 & 1 & 1 \end{bmatrix}$ using power method. [8]

4. a) Solve the system of equations given using the Gauss elimination method with partial pivoting. [8]

$$2x_1 + x_2 + x_3 - 2x_4 = -10$$
$$4x_1 + 2x_3 + x_4 = 8$$
$$3x_1 + 2x_2 + 2x_3 = 7$$
$$x_1 + 3x_2 + 2x_3 - x_4 = -5$$

   b) Solve the following differential equation within $0 \le x \le 0.4$ using RK 4th order method. $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = 6x$, with $y(0) = 0$ and $y'(0) = 1$. (take $h = 0.2$) [8]

5. a) A rod is rotating in a plane. The following table gives the angle θ(radian) through which the rod has turned for various values of the time t seconds. [8]

t	0	0.2	0.4	0.6	0.8	1.0	1.2
θ	0	0.12	0.49	1.12	2.02	3.20	4.67

   Calculate the angular velocity and angular acceleration of the rod, when t = 0.1 second.

   b) Solve the Poisson equation $\nabla^2 f = 2x^2y^2$, over the square domain of $0 \le x \le 3$ and $0 \le y \le 3$ with $h = k = 1$. Consider $f = 0$ at all its boundaries, $x = 0$, $y = 0$, $x = 3$ and $y = 3$. [8]

6. Develop algorithm, flowchart and program coding to interpolate at any points within a given set of data using Lagrange's interpolation method. [16]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2065 Shrawan

Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	All (Except B.Arch.)	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Numerical Methods

Candidates are required to give their answers in their own words as far as practicable.
Attempt any Five questions. Question No. 6 is compulsory.
The figures in the margin indicate Full Marks.
Assume suitable data if necessary.

1. a) Find the point with accuracy 0.001, where the line $y = x - 3$ and $y = \ln x$ is intersecting, using bisection method. [8]

   b) Calculate the root of non-linear equation $f(x) = \sin x - 2x + 1$ using secant method. The absolute error of functional value at our calculated root should be less than 10^{-3}. [8]

2. a) Find the missing values of collected water level using Lagrange' interpolation. [8]

Time duration of rainfall (t) min	1	3	6.5	10
Collected Water level (h) mm	23	61	?	203

   b) Use the suitable method and determine the exponential fit of $y = Ce^{Ax}$ for the following data: [8]

X	0	1	2	3	4
Y	1.5	2.5	3.5	5.0	7.5

3. a) Evaluate the integral $I = \int_0^{1.5} \sin x\,dx$, compare the absolute error in both conditions for Simpson 1/3 rule and Simpson's 3/8 rule. [8]

   b) Use Romberg Integration find the integral of $e^x \sin x$ between the limits -1 and 1. [8]

4. a) Find the inverse of the matrix $A = \begin{bmatrix} 2 & -2 & 4 \\ 2 & 3 & 2 \\ -1 & 1 & 1 \end{bmatrix}$ using Gauss-Jordan method. [8]

   b) Solve the following by Gauss Elimination method with complete pivoting. [8]

   $2x + 3y + 2z = 2$
   $10x + 3y + 4z = 16$
   $3x + 6y + z = 6$

5. a) Solve the following differential equation within $0 \le x \le 1.0$ using RK 4th order method. [8]

   $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 4y = 3x$, with $y(0) = 0$ and $y'(0) = 1$. (take $h = 0.5$)

   b) Consider a sheet metal of size 30cm by 30cm. The two adjacent sides are maintained at temperature of 50°C and other two sides are held at 500°C. Calculate the steady state temperature at interior points assuming a grid size of 10cm by 10cm. [8]

6. Write algorithm flow chart and program code of any high level language to solve polynomial of n^{th} degree using Hamer's rule. Your program should read the coefficients of polynomial and display all roots of that polynomial correct up to five decimal places. [5+5+6]

50