14 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

Exam.	Regular		
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]

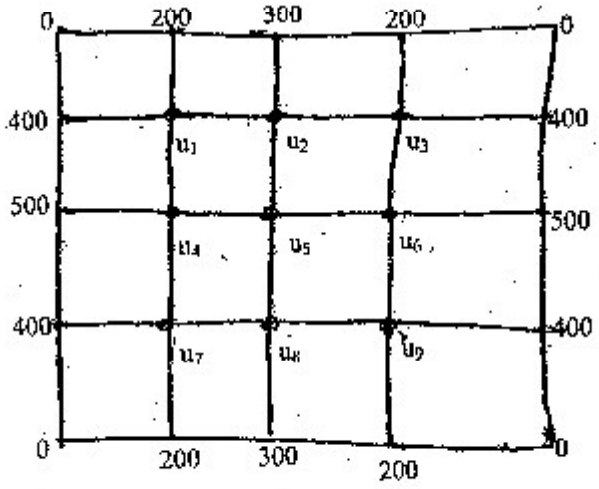
Time (min):	2	4	6	8	10	12
Distance (km):	0.25	1	2.2	4	6.5	8.5

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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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 <u>All</u> questions.*
- ✓ *The figures in the margin indicate <u>Full Marks</u>.*
- ✓ *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]

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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.

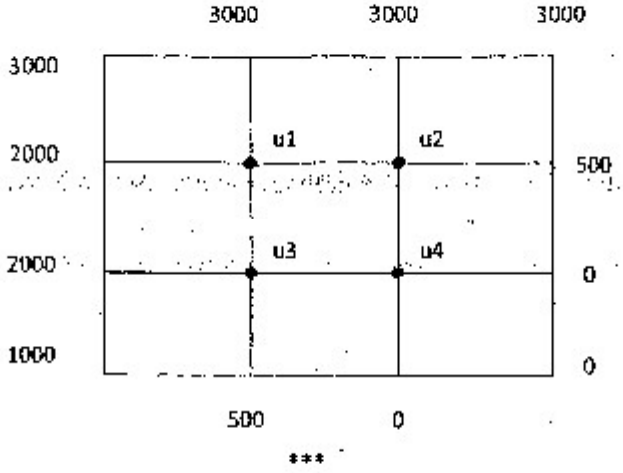
8. If 'x' is in cm and 't' is in time then find velocity and acceleration when t = 0.1 second. [4]

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 $\int_0^1 \frac{dx}{1+x^2}$. [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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Shankar Poudel

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]

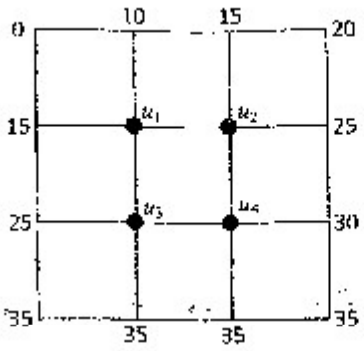
x	0.5	1.0	1.5	2.0	2.5
y	6	3	2	1.2	0.8

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 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]

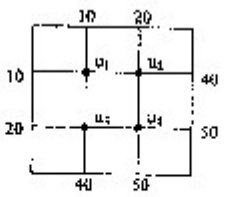
x	1	2	3	4	5	6
y	5.5	6.5	9.4	15.2	30.6	49.8

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]



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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2068 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEI., 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

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.

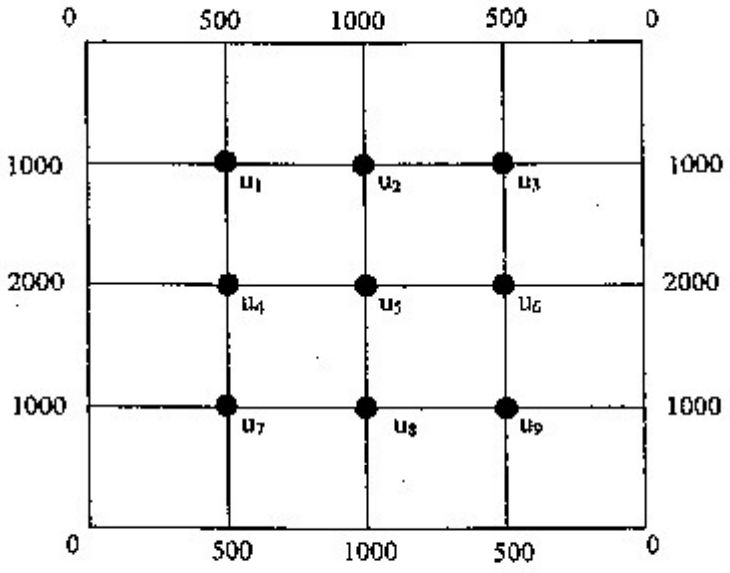
10. Solve the differential equation, $\frac{dy}{dx} = (1+x^2)y$, within $x \le 0(0.2)0.4$ and $y(0) = 1$ using RK 4th order method. [6]

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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