TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2076 Baishakh

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

***Subject*: -** Numerical Method (SH 603)

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

1. What do you mean by significant digits? Find the absolute, relative and percentage errors if the number x = 4.320106 is truncated to four significant digits.
2. Define a root of a non-linear equation f(x) =0. Give its geometrical meaning. Derive the formula of secant method.
3. Find a real root of the equation log(x)-cos(x) =0 using bisection method correct up to three decimal places.
4. Solve the following system of linear equations using Gauss Elimination with partial pivot technique.

$2x_1 + 5x_2 + x_3 + 5x_4 = 45$

$-8x_1 + 3x_2 + 5x_3 - 6x_4 = -10$

$4x_1 - 3x_2 + x_3 + 5x_4 = 26$

$2x_1 - 7x_2 - 2x_3 + 8x_4 = 6$

Or,

Write the program code in c/c++ to find the inverse of the given square matrix using Gauss Jordan Method.

5. Obtain the dominant Eigen value and its corresponding Eigen vector of following matrix using Power Method.

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

6. From the following table, evaluate y (2.4) and y (5.2) using appropriate interpolation formula.

X	2	3	4	5	6	7	8
Y	-0.62	2.72	22.00	81.83	223.38	508.52	1023.93

7. State normal equations for fitting a straight line y=ax+b to the given data (xi,yi), i=1,2,3,…n and hence use it to fit the curve $y=ab^x$ to the following data:

X:	20	25	30	35	40	45
Y:	354	332	391	260	231	204

8. A slider in a machine moves along a fixed straight rod. Its distance 'x' along the rod is given below for various values of time 't' seconds. Find the velocity of the slider and its acceleration when t=0.1 and t=0.6 sec.

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. Evaluate $\int_{0.2}^{1.5} \frac{e^{-x^2}}{1+x^2} dx$ using the 3 point Gaussian quadrature formula.
10. Given that: $y' = 2\cos x - e^x + 3$, find an appropriate value of y (0, 4) with an initial y (0) =1 using fourth order Runge-Kutta method, with a step size of 0.2.
11. Solve the following boundary value problem using shooting method by dividing the interval into our sub-intervals using Euler's formula.

$Y'' = 4e^x \sin x + 3y - xy'$, with y(0) =1 and y(1) =5

12. Solve the equation $u_{xx} + u_{yy} = 0$ over the square mesh of sides 3 units satisfying the following boundary conditions u(x,0) =0, $u(x,3)=10+3x^2$, $0 \le x \le 3$, $u(0,y) = y^3$ $0 \le x \le 3$ for $0 \le y \le 3$ $u(3,y) = \frac{1}{2}y^4$, find the value of u(i,j), i=1,2; j=1,2.

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INSTITUTE OF ENGINEERING

Examination Control Division

2075 Chaitra

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

***Subject*: -** Numerical Method (SH 603)

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

1. Discuss the advantages and limitations in solving mathematical problems by numerical techniques rather than analytically.
2. Find a negative real root of the following equation corrector three decimals using Bisection Method.

$$\frac{1-(x+1)^4}{x} - 1 = 0$$

3. What are limitations of Newton-Raphson method? Using Newton-Raphson method, find a root of the equation xsinx-cosx =0 correct to four decimal places.
4. Solve the following system of linear equation, using Gauss-Elimination method with partial pivoting technique.

$x_1 - 3x_2 + 8x_3 = 3$

$5x_1 + x_2 + 2x_3 = 9$

$x_1 + 7x_2 - x_3 = 14$

5. Obtain the dominant eigen value and its corresponding eigen vector of the following matrx using Power Method.

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

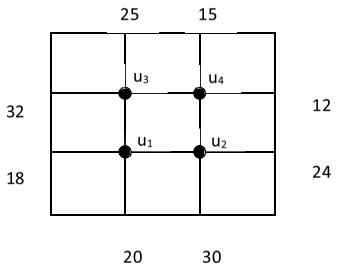
6. Using the method of Least Squares, fit the following set of data to a curve of the form $y = a\log_e x + b$.

X	0.5	1.0	1.5	2	2.5	3
Y	3.7	5.3	5.8	6.6	6.9	7.5

7. Using the cubic spline technique, estimate f(4) from the following data:

X	1	3	5	7	9
f(x)	1.5	-0.4	-6.9	6.1	6.4

8. Derive composite Simpson's 3/8 formula for integration.
9. Use Romberg's method to compute $\int_0^1 \frac{1}{1+x^2} dx$ correct to three decimal places.
10. Using Euler's method, solve $\frac{dy}{dx} = \frac{y+x}{y-x}$, with y=1 at x= 0, for x=0.1, h =0.02.
11. Solve the following boundary value problem using Finite Difference Method taking a step-size of 0.5. $y'' + 2y' + y = 3x^2$ subject to boundary conditions y(0) =5 and y(2) =4.
12. Solve the Laplace equation $u_{xx} + u_{yy} = 0$ for the square mesh with boundary conditions as shown in the figure attached.



TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2075 Bhadra

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

***Subject*: -** Numerical Method (SH 553)

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

1. Construct the divided difference table from the following data set: (x_0,y_0), (x_1,y_1), (x_2,y_2), (x_3,y_3) and (x_4,y_4).
2. Write a pseudo-code to find a real root of non-linear equation using Fixed Point Iteration method.
3. Find a real root of the equation $e^{2.80x} + \cos x = 3x^2$ correct to 3 decimals using bracketing method.
4. Solve the following system of equations using Gauss-seidel method. Correct to four decimal places.

   $x_1 + x_2 + 3x_3 + 2x_4 = 12$

   $2x_1 + x_2 + x_3 + 4x_4 = 11$

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

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

5. Find the largest Eigen value and the corresponding Eigen vector of the matrix using Power method.

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

6. State normal equations for fitting a parabola $y = ax^2 + bx + c$ to the given data; (x_i, y_i): i=1,2,…n and hence use it to fit $y = ax^2 + bx + c$ to the following data:

X	1.0	2.0	2.5	3.0	3.5	4.0
Y	1.1	1.3	2.0	2.7	3.4	4.1

7. Develop a pseudo code to interpolate the given sets of data using Lagrange's interpolation.
8. Derive an expression to evaluate first derivative from Newton's backward interpolation formula and evaluate $\frac{dy}{dx}$ at x =9 from the following table.

X	1	3	5	7	9
Y	-1.20	12.80	119.60	472.80	1302.80

9. Derive the general Newton-cotes quadrature formula and hence use it to obtain Simpson's -3/8 formula.
10. Using finite difference method solve the following BVP:

    $y'' - 3y' + 2y = 2$, $y(0) = 1$, $y(1) = 4$ in the interval [0,1]. Take h = 0.25

11. Write a program in any high level language (C/C++/FORTRAN) to solve the second order differential equations using classical RK-4 method.
12. Drive Bende-Schimidt recurrence formula for solving one-dimensional heat equation $u_t = c^2 u_{xx}$ and use it to solve the boundary value problem $u_t = u_{xx}$ under the condition u(0,t) = u(1,t) =0 and $u(x,0) = \sin(\pi x)$ upto t = 5 seconds.(take h = 0.2)

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INSTITUTE OF ENGINEERING

Examination Control Division

2075 Baishakh

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

***Subject*: -** Numerical Method (SH 603)

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

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

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

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

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

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

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.
9. Find *f '(3)* from the following table:

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.
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.
12. Solve the elliptic equation $\nabla^2 u = 0$ in the square plate of size 8cm x 8 cm if the boundary values are given 50 on one side of the plate and 30 cm on its opposite side. On the other side the values are given 10. Assume the square grids of size 2cm X 2cm

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INSTITUTE OF ENGINEERING

Examination Control Division

2074 Chaitra

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

***Subject*: -** Numerical Method (SH 603)

- ✓ Candidates are required to give their answer in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicates **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 nonlinear equation using secant method. **[6]**
3. What are limitations of Newton-Raphson method? Using Newton-Raphson method, find a root of equation xsinx – cosx = 0 which is near to x = π. **[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. $\begin{bmatrix} 1 & 4 & 4 \\ 4 & 1 & 8 \\ 4 & 8 & 1 \end{bmatrix}$ **[8]**

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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INSTITUTE OF ENGINEERING

Examination Control Division

2074 Bhadra

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

***Subject*: -** Numerical Method (SH 553)

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

1. Discuss the significance of Numerical Methods in the field off 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 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 places) [8]

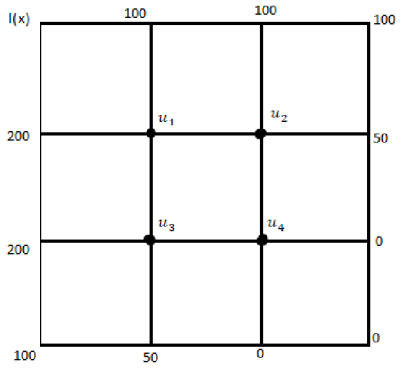
$$\int_0^2 \frac{e^x + \sin x}{1 + x^2}\, dx$$

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 2^{nd} 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]



TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2073 Magh

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

***Subject*: -** Numerical Method (SH 553)

- ✓ Candidates are required to give their answer in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicates **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

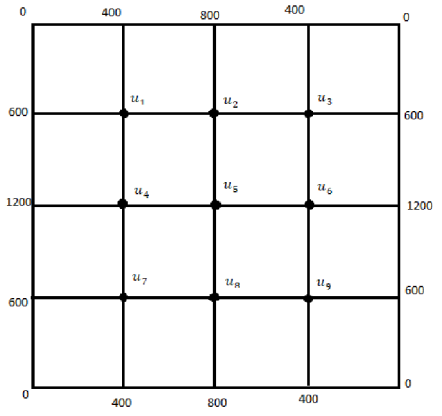
8. Derive the formula to evaluate $y'(x)$ and $y''(x)$ from Newton's Forward Interpolation formula. [4]

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 $O(0.5)2$ using the Runge-Kutta second order. [6]

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

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



TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2073 Bhadra

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

***Subject*: -** Numerical Method (SH 553)

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

1. Discuss the difference between **absolute** 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 $sinx = e^{-x}$ correct up to **four decimal places** using **N-R method**. What are the **limitations** of this method? [4]
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]
   $u_{20} = 49225, u_{25} = 48346, u_{30} = 47236, u_{35} = 45926, u_{40} = 44306$
8. Estimate the value of $cos(2.74)$ 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. Estimate $\int_{0.2}^{1.5} e^{-(x^2)} dx$ 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. $\frac{dy}{dx} = xz + 1$; $\frac{dz}{dx} = -xy$ 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 $u_{xx} + u_{yy} = 0$ 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]

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INSTITUTE OF ENGINEERING

Examination Control Division

2072 Magh

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

***Subject*: -** Numerical Method (SH 553)

- ✓ Candidates are required to give their answer in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicates **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 of the equation xtanu-1=0 using bisection method correct 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	0	1	2	3	4
y	1.5	2.5	3.5	5.0	7.5

8. Derive an expression for evaluating first and second derivatives using Newton forward difference interpolation formula. [4]

9. Evaluate $\int_0^3 (\sin x + cosx + 2)dx$ using Simpson's -3/8 rule taking h=0.5. Determine the percentage error by comparing the result with exact solutin. [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 ∇^2u=-10(x^3+xy+10) over the square with sides x=y=0, x=y=3 with u=10 on the boundary and mesh length l. [10]

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INSTITUTE OF ENGINEERING

Examination Control Division

2072 Ashwin

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

***Subject*: -** Numerical Method (SH 553)

- ✓ Candidates are required to give their answer in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicates **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 non linear equation, using Taylor series. [4]
3. Using the Bisection method, find a real root of the equation f(x)=3x-$\sqrt{1+sinx}$ correct up to three decimal points. [8]
4. Develop pseudocoede 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 matrixusing the power method with an accuracy of 2 decimal points. [8]

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

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]

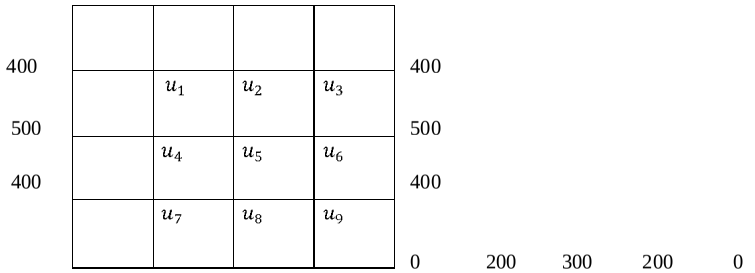
   Time (min): 2 4 6 8 10 12

   Distance (Km): 0.25 1 2.2 4 6.5 8.5

   Evaluate the velocity and acceleration of the vehicle at t=3 minutes.
10. Solve the following by RK-2 method for x=0(0.1)0.2 [8]

    $\frac{d^2y}{dx^2}+x\frac{dy}{dx}+y=0$; 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 Eular's formula for solving initial problem. [4]

TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2071 Magh

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

***Subject*: -** Numerical Method (SH 553)

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

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

   $x - 3y + 10z = 3$

   $-x + 4y + 2z = 20$

   $5x + 2y + z = -12$
5. Use Gauss Seidel method to solve the following equations:

   $20x + y - 2z = 17$

   $3x + 20y - z = -18$

   $2x - 3y + 20z = 25$
6. The following data are taken from the steam table.

Temp °C	140	150	160	170	180
Pressure kgf/cm²	3.685	4.854	6.302	8.076	10.225

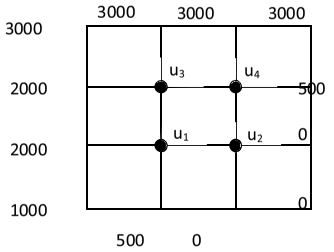
   Find the pressure at the temperature T = 142 °C and T = 175 °C using Newton's interpolation.
7. Derive expression for least square method of fitting a linear curve.

   OR

   Develop pseudocode to interpolate the given set of data using Lagrange interpolation.
8. If 'x' is in cm and 't' is in time, then find velocity and acceleration when t = 0.1 second.

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 $\int_{-1}^{1} \frac{dx}{1+x^2}$.
10. Using Euler's method find y(0.2) from the following equation y' = x + y, y(0) = 0, take h = 0.1.
11. Using the Runge-Kutta method of second order, obtain a solution of the equation y'' = y + xy' with the initial condition y(0) = 0 to find y(0.2) and y'(0.2). (Take h = 0.1)
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.



TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2071 Bhadra

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

***Subject*: -** Numerical Method (SH 553)

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

1. Create difference table from following data.

X	3.0	3.2	3.4	3.6	3.8
Y	0.4771	0.5051	0.5415	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.
3. Write a pseudo-code to find a real root of a non-linear equation using Secant Method.
4. Solve the following linear equations using Gauss Elimination or Gauss Jordan method using partial pivoting.

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

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

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

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

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 Langrange's Interpolation formula to find the value of y when x = 3.0, from the following table.

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.
9. Evaluate $\int_0^2 \frac{dx}{x^2+2x+1}$ using Gaussian 3 point formula.
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)
11. Using 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.
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.