	NIGTITUTE OF EXICINITED IN	T and	DE ·	Enll Monter	80
INSTITUTE OF ENGINEERING		Level	BCE BME	F un Warks	80
X	amination Control Division	Programme	BAME, BIE	Pass Marks	32
	2075 Ashwin	Year / Part	III / I	Time	3 hrs.
	C.L. N.	in 1 N Cathood	- (011(02)	ar í þeng þeganski fi Sauð Falla að Hella var Hella að Sau ar Sveitingar segna sen skilda find	
	Subject: - Numer	rical Method	S (SHOU3)		Han first Scorpania
1	Candidates are required to give their answ	wers in their or	wn words as fa	r as practicable.	
	Attempt <u>All questions</u> .	Kanka			
× ✓	Assume suitable data if necessary.	<u>auras</u> .			
	y				
۱.	Explain the importance of Numerical Me	thods in the fi	eld of Science	and Engineering	g.
2.	Write a pseudo-code to find a real roo	t of a non-lin	ear equation u	using False Pos	sition
	method.				
3.	Find a positive root of the equation x	$e^2 \sin x - e^x + 2$	2=0 correct t	o 3 decimals u	using
	Bisection method.				U
4.	Using L-U method solve, the following s	ystem of equa	tions		
	2x + 3y + z = 1				
	6x - 3y + 4z = 17				
	5x + 7y + 6z = 10				
5	Determine the dominant eigen value an	d correspondi	ng vector of t	he following m	atrix
	using the power method:	la concepcita		ne tonowing in	
	[2 6 3]				
	6 5 4				
	3 4 9				
_			by		
6.	Fit the following set of data to a curve of	t the form $y =$	ae".		
	x 2 3	4 5 6	7		
	y 15.1 10.2	7.8 5.5 3.8	3 1.7		
7.	Using the Cubic Spline interpolation t	echnique, esti	mate the valu	e of y(4) from	1 the
	tonowing data.		7		
	X 1 3 V 156 -04	43 -16.90 6	10		
2	Derive an expression to evaluate first d	erivative from	Newton's had	kward internol	ation
0.	dy		11	Kwara morpor	
	formula and evaluate $\frac{1}{dx}$ at x = 8 from t dx	he following t	able.		
	x 0 2	4 6	8		
	y 0 -0.7553 -11.	2151 34.286	7 -8.3226		

....

1

in the

9. Use Simpson's $\frac{1}{3}$ - rule to evaluate $\int_{0}^{6} \frac{2x^2 + 5}{1 + x} dx$, taking n = 6 and also find the absolute 2 error with exact value. [3+1] 10. Write a pseudo-code to solve an initial value problem of first order differential equation using Runge-Kutta 2 method. [4] 11. Using Fourth-order Runge Kutta method, solve the following differential equation for y at x = 0.2 and r = 0.4; y'

$$y' - xy'^{2} + y^{2} = 0, \quad y(0) = 1, \quad y'(0) = 0$$
[8]

12. Solve Poisson's equation $Uxx + Uyy = 243(x^3 + y^3)$ over the square domain $0 \le x \le 1$, $0 \le y \le 1$ with step size $h = \frac{1}{3}$ with u = 100 on the boundary. [10]

05 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division

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

2074 Chaitra

Subject: - Numerical Methods (SH603)

- \checkmark 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 Full Marks.
- ✓ Assume suitable data if necessary.
- 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.
- 3. What are limitations of Newton-Raphson method? Using Newton-Raphson method, find a root of equation

xsinx + cosx = 0 which is near to $x = \pi$.

Solve the following system of linear equation using Gauss-Seidal method, correct to 3 decimal places.
 [8]

$$2x_{1} + 6x_{3} - 3x_{4} = 31$$

$$6x_{1} + 2x_{4} = 14$$

$$-3x_{1} + 5x_{2} = 9$$

$$2x_{1} + x_{2} - 5x_{3} + 9x_{4} = -9$$

- 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.

X	2	3	4	5	6	7
у	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:

X	3	4	5	6	7	8	9
у	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

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x$$
, 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.
- 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

4 1 47

[4]

[10]

[6]

[2+4]

[8]

TRIBHUVAN UNIVERSITY 05 INSTITUTE OF ENGINEERING **Examination Control Division** 2074 Ashwin

Exam.		Back		
Level	BE	Full Marks	80	
Programme	BCE, BME, 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. V
- ~ Attempt All questions.
- The figures in the margin indicate Full Marks. V
- ✓ Assume suitable data if necessary.
- 1. Discuss the significance of Numerical Methods in the field of science and engineering. [4]
- 2. Find a real root of the equation $\cos x xe^x = 0$, correct to four decimal places, using Regula-falsi method.
- 3. Write pseudo-code for finding a real root of a non-linear equation using the Secant Method. [6]
- 4. Solve the following system of linear equations using the Gauss-Elimination Method.

 $3x_1 - 2x_2 + 3x_3 + 2x_4 = 16$ $2x_1 - 3x_2 + 2x_3 + 3x_4 = 9$ $5x_1 + 3x_2 - 5x_3 + 4x_4 = 7$ $4x_1 + 2x_2 + 2x_3 - 3x_4 = 16$

- 5. Find the dominant Eigen value and corresponding vector of the following matrix using the Power Method. [8]
 - $\begin{bmatrix} 5 & 2 & 3 \\ 2 & 4 & 2 \\ 3 & 2 & 5 \end{bmatrix}$
- 6. Write the pseudocode to fix a given set of data to a second degree polynomial $(y = a + bx + cx^2)$ using the Least Square Method. [8]
- 7. Fit the following data to the curve $y = ax^{b}$ using least square method.

x	350	400	500	600
у	61	26	7	2.6

- 8. Evaluate $\int_{0}^{2} (\sin x + \cos x) dx$ using Gaussian 3-point formula.
- 9. Derive the formula for computing first and second derivative using Newton's forward difference interpolation formula.
- 10. Solve the following boundary value problem using Shooting Method employing Euler's [10] formula taking a step-size of 0.25.

y''=x-y+y' subject to boundary conditions y(0) = 2 and y(1) = 3

11. Solve the elliptic equation (Laplace) $\mu_{xx} + \mu_{yy} = 0$ for the square mesh $0 \le x \le 1, 0 \le y \le 1$ where $h = \Delta x = 0.25$ and $k = \Delta y = 0.25$ with the following boundary conditions: [10]

u(0.25, 0) = 500 | u(0.5, 0) = 1000 | u(0.75, 0) = 500 | u(1, 0) = 0u(0,0) = 0u(1, 0.25) = 1000u(0, 0.25) = 1000u(1, 0.50) = 2000u(0, 0.50) = 2000

[8]

[6]

[6]

[6]

05 TRIBHUVAN UNIVERSITY	Exam.	New Back (2)	066 & Later I	Batch)
INSTITUTE OF ENGINEERING	Level	BE	Full Marks	80
Examination Control Division	Programme	BCE, BME, BIE	Pass Marks	32
2073 Shrawan	Year / Part	III / I	Time	3 hrs.
Subject: - Num	erical Method	ls (SH603)	141 1 114 114 14 14 14 14 14 14 14 14 14	*
 ✓ Candidates are required to give their ans ✓ Attempt <u>All</u> questions. ✓ The figures in the margin indicate <u>Full</u> ✓ Assume suitable data if necessary. 	swers in their ov <u>Marks</u> .	wn words as far a:	s practicable.	
1. Construct Divided Difference table from	n the following	data:		[4
x 1 y 14	2 4 5 15 5 6	6 19		
Find an approximation of the root of method correct to three decimal places.	the equation :	$x^{3} - x - 11 = 0$ by	using Bisect	ion [6]
 Write an algorithm for finding a real ro method. 	oot of non-linea	r equation using	Newton Raphs	son [6
4. Solve the following system of linear equ	ations using Ga	uss-Seidal iteration	on method.	[8]
$6x_1 + x_2 - x_3 + 2x_4 = 4$				
$2x_1 + 5x_2 - 4x_3 + 6x_4 = -5$				
$x_1 + 4x_2 + 3x_3 - x_4 = 2$				
$x_1 + x_2 + 2x_3 + x_4 = 5$				
5. Find the largest Eigenvalue and corresp power method.	onding Eigenve	ector of the follow	ring matrix usi	ing [8]
$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$				
6. Evaluate y(10) by using Lagrange's inter	polation formul	a from the follow	ing data:	[8]
x 5 y 12	6 9 11 13 14 16].	0	[0]
7. Using least square method, fit a curve y	$= ae^{bx}$ to the following	lowing data:		[8]
x 4 5.5 y 18.47 39.11	7 8 82.79 136.5	10		[0]
8. Find the value of $\cos(1.74)$ from the foll	owing table			[4]
x 1.7 1.74	178 18	2 186		[7]
sinx 0.9916 0.9857	0.9781 0.9	691 0.9584		
9. Derive composite simpson's three-eight f	ormula for the i	ntegration.		[6]
10. Write Psudocode to solve a first order dif	fferential equation	on using R-K 4 m	ethod	[0]
11. Solve the boundary value problem $y''+x$	$xy'+y = 3x^2 + 2, y$	y(0) = 0, y(1) = 1		[6]
12. Solve the laplace equation $U_{\infty} + U_{\dots} = 0$	over the square	e grid with bound	ary condition	96 L-1
shown in figure.	100 00	o courte		[10]

80 100 80 50 60 50 U1 U4 U7 U3 U6 U9 U2 50 60 50 U5 U8

[10]

05 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division 2072 Chaitra

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

[4]

[8]

[8]

[4]

[4]

[10]

Subject: - Numerical Methods (SH603)

- \checkmark Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt <u>All</u> guestions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.
- 1. Write an algorithm to solve a non-linear equation using secant method. [6]
- Find the positive root of equation cosx -1.3x = 0, correct to six decimal places using Newton Raphson Method. [6]
- 3. Discuss the limitations of fixed point iteration methods graphically.
- 4. Using Factorisation method, solve the given system of linear equations.

$$2x-5y+z=12$$
$$-x+3y-z=-8$$
$$3x-4y+2z=16$$

- 5. Find the largest eigen value and corresponding eigen vector of the matrix: [8]
 - $\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$

6. using least square method, fit a curve $y = ax^2 + bx + c$ to the following data: [8]

X	20	40	60	80	100	120
У	5.5	9.1	14.9	22.8	33.3	46.0

7. Use cubic spline interpolation to estimate f(2.5) from given table.

X	1	2	3	4
f(x)	0.5	0.3333	0.25	0.20

- 8. Derive Newton-cotes quadrature formula for integration and use it to obtain the trapezoidal rule of integration. [6]
- 9. The following table gives distance (s) of a particle at time (t):

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

Calculate the velocity at time t = 0.3

- 10. Write Pseudocode to solve a first order differential equation using Euler's method.
- 11. Using Fourth order Runge-Kutta method, solve the following differential equation for y at x = 0.2 and x = 0.4: [8]

$$y''-xy'^2+y^2=0, y(0)=1, y'(0)=0$$

12. Solve Poisson's equation $u_{xx} + u_{yy} = 729x^2y^2$ over the square domain $0 \le x \le 1, 0 \le y \le 1$ with step size h = 1/3 with u = 0 on the boundary.

05 TRIBHUVAN UNIVERSITY	Exam.	New Back (20	New Back (2066 & Later Batch)		
INSTITUTE OF ENGINEERING	Level	BE	Full Marks	80	
Examination Control Division	Programme	BCE, BME, BIE	Pass Marks-	-32	
2072 Kartik	Year / Part	ΠΙ/Ι	Time	3 hrs.	
Subject: - Num	erical Method	ls (SH603)			

✓ 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 *Full Marks*.

✓ Assume suitable data if necessary.

. Show that the following data pairs satisfy a cubic polynomial by constructing a divided difference table.

ſ	'x 1	2		4	5	7	8
	y 8.	8 5.	5 3	.7 4	.0	4.0	2.5

2. Find a positive real root of the equation $xe^{x} + \sin x = 0.5$ with an accuracy of 6 decimal places using Newton-Raphson Method.

 Write pseudo-code to find a real root of a given non-linear equation using Secant Method. [6]
 Solve the following system of linear equations using Factorization Method. [8] 9x₁+5x₂-8x₃=19

 $5x_1 - 3x_2 + 8x_3 = 19$

 $7x_1 + 4x_2 - 5x_3 = 19$

OR

Write a high-level language (C/C++/FORTRAN) program to compute the inverse of a non-singular square matrix using Gauss Jordan Method.

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

[1.4	1.3	2.2	
1.3	3.5	1.5	
2.2	1.5	3.2	

6. Fit the following set of data to a curve of the form $y = a \log_{a} x + b$

x	2	4	6	8	10	12	14
y	4.7	7.2	8.3	9.6	10.4	10.7	10.9

Evaluate y (1.6), y (7.8) and y (4.2) from the following data using appropriate polynomial interpolation technique used for equally spaced intervals.
 [8]

x	1	2	3	4 ·	5	6	7	8
у	2.3	1.8	2.0	3.0	4.4	5.0	3.9	1.7

8. Derive formula for first derivative using Newton forward interpolation formula.

9. Evaluate $\int_{1}^{11} x \sin x dx$ using 3-point Gauss Legendre formula.

- 10. Solve $y' = \sin x + \cos y$, $y(0) = \pi$ in the range $0 \le x \le 2$ by dividing the interval into 5 subintervals using Euler's method.
- 11. Apply Runge-Kutta method of fourth order to find y(0.5) and y(1) from following equation $\frac{dy}{dx} = \frac{y^2 + x^2}{x + y}$ with y(0) = 1. [8]
- 12. Solve the Poisson's equation $\nabla^2 u = x^3 + y^3$ over the square region $0 \le x \le 3$ and $0 \le y \le 3$ subject to u(x,0) = 0, u(0,y) = 0, u(3,0) and u(0,2) = 0 taking $\Delta x = \Delta y = 1$.
 - [10]

[4]

[6]

[8]

[8]

[5]

[5]

[4]

		Oł	106	
	T		Danin	
INSTITUTE OF ENGINEERING	Exam.	BE	Full Marks	80
Examination Control Division	Programme	BCE, BME, BIE	Pass Marks	32
2071 Chaitra	Year / Part	III /I	Time	3 hrs.
Subject: - Nur	merical Metho	ods <i>(SH603)</i>		
 ✓ Candidates are required to give their ans ✓ Attempt <u>All</u> questions. ✓ The figures in the margin indicate <u>Full</u> ✓ Assume suitable data if necessary. 	swers in their ov <u>Marks</u>	wn words as far a:	practicable.	
1. Calculate a real root of $x^7 + \sin x - \cos x$ Method.	$\mathbf{x} = 0$ accurate i	ip to 3 decimal p	aces using Bis	section
2. Write pseudo-code to find a real root Method.	of a given non	l linear equation	using False Po	osition [(
3. Discuss the limitations of Newton-Rap equation.	chson Method	in finding a real-	root of a non	-linear [4
4. Use Gauss Jordan method to find the in-	verse of followi	ng matrix A.		[
[1 1 3]				
$A = \begin{vmatrix} 1 & 3 & -3 \end{vmatrix}$				
-2 - 4 - 4			1. A.	
Compute the dominant Figen value of the	he following me	triv using Power	Method	. [5
			_	
[3 0 3]				
6. From the following table estimate $f(1.6)$	using Newton'	s forward interpol	ation method.	[
x 1	1.4 1.8	2.2		
$- \frac{\mathbf{f}(\mathbf{x}) + 3.49}{1}$	4.82 5.96	6.5		
7. Estimate y(5) from the following data us	sing Cubic Spli	ne Interpolation te	chnique.	[
X	2 4 6 8			
	4 5 7 6			
Write a high-level language (C/C+ interpolation.	<i>OR</i> +/FORTRAN)	program to co	mplete Largr	ange's
8 Find approximate values of y'(3) and y"	(3) from the fol	lowing function:		[4
	5 2 2	5 4		•
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	74 4.62 2.9	96 2.89		
9. Evaluate $\int_{0}^{1} \frac{\tan^{-1} x}{x} dx$ using Romberg m	nethod correct u	p to 3 decimal pla	ices.	[0
10. Solve $y''+3y'-y = 2x$ subject to the box $0 \le x \le 2$ by dividing the interval into for	undary conditio our sub-intervals	ns $y(0) = 3$ and y s using the finite d	f(2) = 4 in the difference methe	range
11. Write pseudo-code to solve an initi equation) using the Runge-Kutta fourth	al value probl order method.	em (first order	ordinary diffe	rential
12. Solve the equation $\nabla^2 u = -10(x^2 + y^2)$ with $u = 0$ on the boundary and mesh len	+10) over the s ngth = 1 ***	quare with sides	x = 0 = y, x =	3 = y [1(

P.101

n min ta tati Nati	2071	Shawan	
Examin	nation (Control	Division
INST	ITUTE OF	FENGINE	ERING
05	TRIBHUV	AN UNIVER	SITY

Exam.	New Back (2066 & Later Batch)				
Level	BE	Full Marks	80		
Programme	BCE, BME, 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. Find a real root of the following equation, correct to four decimals, using the False Position method.

$$x^3 - 5x - \sin(x) - 6 = 0$$

- 2. Derive analytically the iteration formula for Newton-Raphson method to find a real root of a non-linear equation.
- 3. Write an algorithm to find a real root of a non-linear equation using the Bisection Method.
- 4. Solve the following system of linear equations using the Gauss-Seidal Iteration Method.

$$9x_1 + 2x_2 - 3x_3 = 10$$

$$5x_1 + 11x_3 + 2x_4 = 30$$

$$x_2 + 3x_3 + 7x_4 = 25$$

$$2x_1 + 8x_2 - 2x_4 = 15$$

OR

Write pseudo-code for solving a system of linear equations using the Gauss Elimination Meythod.

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

[1	4	3]
42	2 6	7 5

6. Evaluate f(2.5) from the following data using Newton's Divided difference interpolation formula:

x	1	2	3	4	5	6
f(::)	8.9	9.2	16.3	35.5	72.5	132.4

7. Fit the following data to an exponential curve of the form $y = ab^{x}$.

x	2	4	6	8	10
y	2	6	25	115	300

8. Find y'(0.2) and y''(0.2) from the following data:

x	0.1	0.2	0.3	0.4	0.5
у	2.6	8.2	15.4	25.6	37.8

9. Evaluate the following using Gaussian three point formula:

$$\int_{0}^{2} x \sin(\cos x) + 2 \, dx$$

[5]

[5]

[6]

[4]

[6]

[8]

[8]

10. Solve the following initial value problem using the Modified Euler's method for $0 \le x \le 0.6$ with an interval of 0.2

$$\frac{dy}{dx} = \sin x + \cos y; \quad y(0) = 3$$

- 11. Explain the technique of solving a two-point boundary value problem using the shooting method.
- 12. Solve $u_{xx}+u_{yy}=0$ for the following square mesh with boundary conditions as shown in the figure.



; [6]

[6]

[10]

05	TRIBHUVAN UNIVERSITY		
INS	FITUTE OF ENGINEERING		
Examination Control Division			
	2070 Chaitra		

Exam.	Regular						
Level	BE	Full Marks	80				
Programme	BCE,BME,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 <u>All</u> questions.
- The figures in the margin indicate <u>Full Marks</u>.
- ✓ Assume suitable data if necessary.
- 1. How do we obtain a real root of a non-linear equation using Secant method? Explain graphically and hence deduce the iteration formula.
- 2. Write an algorithm to find a real root of a non-linear equation using Bisection method. [4]
- Find a positive real root of sin(x) + cos(x) + e^x- 8 = 0 correct up to 4 decimal places using Newton-Raphson method.
- 4. Solve the following system of equations using the LU Factorization method.

4x + 3y + z = 332x + 5y + 3z = 412x + y + 5z = 47

- 5. Obtain the numerically dominant Eight value and corresponding eigen vector of the following matrix, using power method.
 - $\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$
- 6. From the following data, find the cubic polynomial between x = 3 and x = 4 using the natural cubic Spline interpolation technique.

x	2	3	4	5	6			
у	5	6	4	3	2			
OR								

Write a program in C to numerically interpolate a value from a given data set using Lagrange's interpolation formula.

7. Fit the following set of data to a curve of the form $y = a e^{bx}$

x	1	2	3	4	5	6	7	8
у	2	3	4	5	7	10	15	30

8. A slider in a machine moves along a fixed straight rod. Its displacement x cm. along the rod is given below at different instant of time t seconds. Find the velocity of the slider and its acceleration when t = 0.2 seconds.

t	0.0	0.1	0.2	0.3	0.4
x	30.13	31.62	32.87	33.64	33.95

[4]

[8]

[4]

[8]

9. Evaluate the following integral correct to three decimals using Romberg's method.

$$\int_{2}^{4} \left(4 + \frac{\cos(X)}{e^{\sin x}}\right) dx$$

10. Using the finite difference approximation, solve the following boundary value problem for three interior points. [8]

y''+4y'-3y = sin(x); with boundary conditions y(2) = 3 and y(4) = 4

- 11. Write pseudo-code to solve an initial value problem (first order ordinary differential equation) using the Runge-Kutta fourth order method.
- 12. Solve the Poisson's partial differential equation $u_{xx} + y_{yy} = -10(x^2 + y^2 + 10)$ over the region $0 \le x \le 3$ and $0 \le y \le 3$ with boundary conditions: u(0, y) = 0, u(3, y) = 0, u(x, 0) = 0 and u(x, 3) = 0 Assume mess length = 1
 [10]

[6]

[6]

06	TRIBHUVAN UNIVERSITY
INS	FITUTE OF ENGINEERING
Exami	nation Control Division
	2070 Chaitra

Exam.	Old Back (2065 & Earlier Batch)								
Level	BE	Full Marks	80						
Programme	All (except B. Arch)	Pass Marks	32						
Year / Part	III / I	Time	3 hrs.						

[8]

[8]

[8]

[8]

[8]

Subject: - Numerical Metho	Oas (EGOUISH)
----------------------------	---------------

- \checkmark 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 <u>Full Marks</u>.
- ✓ Assume suitable data if necessary.
- Use the Bisection method to find a real root having accuracy within 10⁻² for x³-7x²+14x-6=0 on the interval [0,1].
 - b) Let $f(x) = -x^3 \cos x$, find a real root using secant method with accuracy 0.01.
- 2. a) Construct the interpolating polynomial of degree four for the unequally spaced points given in the following table:

x	0.0	0.1	0.3	0.6	1.0
f(x)	6.000000	-5.89483	-5.65014	-5.17788	-4.28172

Find the value for x = 2.5 using polynomial.

b) Estimate coefficient of Y = ax+b for following data using least square method.

x	4	5	6	7	8	9
у	14	12	11	9	6	4

3. a) A car laps a race track in 84 s. The speed of the car at each 6-s interval is determined using a radar gun and is given from the beginning of the lap, in feet/second, by the entries in the following table.

Time	0	6	12	18	24	30	36	42	48	54	60	66	72	78	84
Speed	124	134	148	156	147	133	121	109	99	85	78	89	104	116	123

Calculate the acceleration at t = 12S and t = 54S.

- b) Approximate the following integrals using Gaussian quadrature with n=2 and compare your results to the values of the integrals $\int_{0}^{1} x^2 e^{-x} dx$. [8]
- 4. a) Solve the following linear algebraic equation using Gauss-Jordan method:

 $X_1 + 3X_3 + 2X_4 = 17$

 $3X_2 + 3X_3 + 2X_4 = 18$

 $-2X_1 + 2X_2 + X_3 = 20$

- b) Solve the following equations using Jacobi' Iteration method. [8] 3x + 4y + 15z = 54.8; x + 12y + 3z = 39.66; 10x + y - 2z = 7.74
- 5. a) What is initial value problem and boundary value problem? Explain with example. [4]
 - b) Using Runge Kutta method of order 4^{th} , solve y'' = y + xy', given that y(0) = 1, y'(0) = 0, find y(0.2) and y'(0.2) with step size h = 0.1
- 6. Write an algorithm, flow chart and Pseudo code to solve system of equation by Gauss-Jordan method. Program should capable to solve 2 to 10 system of equations. [16]

05 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division

2068	Chaitra	
	Unama	•

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

[4]

[8]

[8]

[8]

[4]

[6]

[10]

Subject: - Numerical Methods (SH 603)

 \checkmark Candidates are required to give their answers in their own words as far as practicable.

✓ Attempt <u>All</u> questions.

1. G

✓ The figures in the margin indicate *Full Marks*.

✓ Assume suitable data if necessary.

enerate the forwa	ard differ	ence	table fro	m the fo	llowing	data:			[4]
	х	0	1	2	3	4	5	6	
	f(x)	0	2.2	4.7	8.5	14.3	20.7	30.1	

2. Derive iterative formula for Newton-Raphson method using Taylor-series.

3. Find a root of the equation x^3 -4x-9=0, using bisection method, correct upto three decimal places.

4. Solve the following system of linear equations using the factorization method.

2x+2y+3z = 173x+2y+z = 125x+2y+2z = 18

OR

Write the Pseudo-code for solving a system of linear equations using the Gauss Jordan Method.

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

$$\begin{bmatrix} 1 & -2 & 3 \\ -2 & 4 & 2 \\ 3 & 2 & 9 \end{bmatrix}$$

6. Using Lagrange interpolation formula, find the value of f(1.3) from following data [8] $\begin{array}{c}
X & 1 & 3 & 4 \\
\hline
Y & 4.28 & 2.18 & 4.13
\end{array}$

7.	Estimate the co-efficients of $y = ax+b$ for the following data using least square method.	[8]

Х	-2.0	-1.0	0.5	2.0	3.0	5.5
Y	-0.4	1.2	3.5	6.0	7.4	11.0

8. Derive the expression for evaluating derivative by forward difference method:

9. Evaluate $\int_{0}^{6} \frac{dx}{1+x^2}$ using Simpson's 1/3 rule taking unit interval size.

10. Solve $\frac{dy}{dx} = y - \frac{3x}{y}$, y(0) = 1.5 in the range $0 \le x \le 0.4$ taking h = 0.2 using Modified Euler's method,

performing iteration for an accuracy of four decimal places in each step.

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



05 TRIBHUVAN UNIVERSITY	Exam.	DE	Regular	00
INSTITUTE OF ENGINEERING	Level	BCE BME	Full Marks	80
Examination Control Division	Programme	BIE	Pass Marks	32
2069 Chaitra	Year / Part	III / I	Time	3 hrs
Subject: - Nume	rical Method	e (SH603)		
Bubjeci Hune				
 Candidates are required to give their ans Attempt All questions 	swers in their o	wn words as fa	r as practicable) .
\checkmark The figures in the margin indicate <u>Full</u> .	Marks.			
✓ Assume suitable data if necessary.	· · ·			
1. Using the divided different table, sl	how that the	following dat	a satisfies a	cubic
		7 0		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	6 41.5 16	6.7 418.1	,	
2 Write an algorithm to find a real root of	a non-linear eo	uation using R	isection Metho	d.
Find a real root of the following environment	ation correct to	three decime	ls using the S	ecant
method. $e^{\cos x} = \sin x$			an anne mo n	Juli
4. Solve the following system of linear emi	nations using G	auss-Seidel's m	ethod	
$-x_1 - x_2 - 2x_2 + 10x_4 = -9$				
$10x_1 - 2x_2 - x_3 - x_4 = 3$	- <i>7</i> ,	-74= 9	>	
$-2x_1 + 10x_2 - x_3 - x_4 = 15$	9	5 7 7		
$-x_1 - x_2 + 10x_3 - 2x_4 = 27$ Your answer must be correct to three de	cimal places.			
	OR .			
Write pseudo-code to solve a system of	linear equation	s of 'N' unknov	vns using the G	auss-
elimination method.				
5. Obtain the numerically dominant Eig	en value and	corresponding	eigenvector o	of the
	15 -4 -	3]		
following matrix using Power Method.	10 12 -	6		
	-20 4 -2	2		
5. Using the Cubic Spline interpolation	technique, esti	imate the valu	e of y(9) from	n the
following data:		_		
x 4	6 8 10	4		
		hx		
7. Fit the following set of data to a curve o	f the form $y = a$	a e ^r .		
$\mathbf{x} 2 \cdot 3$	4 5	$\frac{6}{28}$ 17		•
	1.0 3.3	<u></u>		1 • •
 A rod is rotating in a plane. The following the rod is turned for various values of the 	ng table gives t e time t second	ne angle θ (rad	lians) through v	which
		10 12		
		3 20 4 6	7	

Calculate the	angular	velocity	and t	the	angular	acceleration	of the	rod,	when t =	= 0.2 ai	nd
1.0 second.											

1

9. Derive simpson's 1/3 rule for integration. Evaluate the following integral using Simpson's

1/3 rule, taking h = 0.25 $\int_{0}^{1} \frac{e^{x}}{x+1} dx$

10. Solve the following boundary value problem using the finite difference method by dividing the interval into four sub-intervals. $\frac{d^2y}{dx^2} = \sin x + y$; y(0) = 3; y(1) = 4

- 11. Write pseudo-code to solve an initial value problem (first order ordinary differential equation) using Euler's method.
- 12. Solve the Poisson's equation $u_{xx} + u_{yy} = -81xy$, 0 < x < 1, 0 < y < 1 with boundary condition: u(0,y) = u(x,0) = 0 and u(1,y) = u(x,1) = 100; taking h = 1/3. [10]

[4+2]

[8]

[4]

05 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING

Examination Control Division

2068 Chaitra

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

[4]

[8]

[4]

[6]

. [10]

Subject: - Numerical Methods (SH 603)

 \checkmark Candidates are required to give their answers in their own words as far as practicable.

✓ Attempt <u>All</u> questions.

1.

✓ The figures in the margin indicate <u>Full Marks</u>.

✓ Assume suitable data if necessary.

Generate the forwa	ard differ	ence	table fro	m the fo	ollowing	data:			[4]
	х	0	1	2	3	4	5	6	
	f(x)	0	2.2	4.7	8.5	14.3	20.7	30.1	

2. Derive iterative formula for Newton-Raphson method using Taylor-series.

3. Find a root of the equation $x^3-4x-9=0$, using bisection method, correct up to three decimal places. [8]

4. Solve the following system of linear equations using the factorization method.

2x+2y+3z = 173x+2y+z = 125x+2y+2z = 18

OR.

Write the Pseudo-code for solving a system of linear equations using the Gauss Jordan Method.

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



6. Using Lagrange interpolation formula, find the value of f(1.3) from following data [8]

X	1	3	4
Y	4.28	2.18	4.13

7.	Estimate the co-efficients of	y = ax+b for the following	data using least square met	hod. [8]
----	-------------------------------	----------------------------	-----------------------------	---------	---

Х	-2.0	-1.0	0.5	2.0	3.0	5.5
Y	-0.4	1.2	3.5	6.0	7.4	11.0

8. Derive the expression for evaluating derivative by forward difference method.

- 9. Evaluate $\int_{0}^{6} \frac{dx}{1+x^2}$ using Simpson's 1/3 rule taking unit interval size.
- 10. Solve $\frac{dy}{dx} = y \frac{3x}{y}$, y(0) = 1.5 in the range $0 \le x \le 0.4$ taking h = 0.2 using Modified Euler's method,

performing iteration for an accuracy of four decimal places in each step.

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



ે	3	TRIBHUVAN UNIVERSITY	Exam.	R	egular / Back	
	INS	TITUTE OF ENGINEERING	Level	BE	Full Marks	80
Ex	am	ination Control Division	Programme	All (Except B.Arch.)	Pass Marks	32
		2068 Baishakh	Year / Part		Time	3 hrs.
······		Subject: - N	umerical Me	thods	สสมรณฑร - มระการจะนิเอา เราร่างอาการจำนุกรายางสรรม	
✓ ✓ ✓ ✓	Can Atte The Ass	ndidates are required to give their and empt any <u>Five</u> questions. Question N e figures in the margin indicate <u>Full</u> sume suitable data if necessary.	swers in their o No. 6 is compuls Marks.	wn words as fa sory	r as practicable	>.
1		Find the most of the counting ax	2		·	
1.	a)	bisection method.	3x = 0 correct	t upto three d	lecimal places	using
	b)	Find the reciprocal of 3 using Newto	on Raphson me	thod.		
2.	a)	Apply Newton's forward difference	formula to find	1 y(3.5) from the	ne following da	ita.
				6 7	8	
	•	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	64 125	216 343	512	
	b)	Obtain x relation of the form $y = c$	a ^{bx} for the fall	owing data by	the method o	fleast
	0)	souares. $y = z$		Owing data by	the method o	1.10451
		x: 0.0 0.5 1	1.0 1.5	2.0 2.5		
		y: 0.10 0.45 2	.15 9.15	40.35 180.7	5	
				² dy		
3.	a)	Use Romberg integration method to	o evaluate the in	ntegral $\int \frac{dx}{x} c dx$	orrect upto 3 de	ecimal
				i X		
		places taking the initial sub interval	size as $h = (b -$	- a)/2.	- -	
	b)	The velocity V of a particle at a d	istance S from	a point on its	path is given	in the
		table below:	· · · · ·		· .	
		$\begin{array}{c c} S(ft) & 0 & 10 \\ \hline \\ V(0) & & 77 & 70 \\ \hline \end{array}$	20 30	40 50 0	50	
•	• • •	V (ft/sec) 47 58	64 65	61 52 .	<u>38 </u>	
		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 signifi	cant digits and	l corresponding	g eigen
		vector of the following matrix using	g power method	1.		
			1 2 3			
		A =	2 -1 4			
			3 4 5			
	·b)	Use Gauss Jordan method to find th	ne inverse of the	e following ma	trix.	
		· • • •	[2 2 1]	-		
		Δ -	- 1 3 1			
		. .			· · · · ·	
					•	
						· · ·
				•	an a	
				-		

- 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.
 - 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.



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.

[8]

[16]

.4

	03	TRIBHUVAN UNIVERSITY	Exam.	Re	gular/Back	·····
	INS	STITUTE OF ENGINEERING	Level	BE	Full Marks	80
	Exan	nination Control Division	Programme	B.Arch.)	Pass Marks	32
,	•	2067 Ashadh	Year / Part	III / I	Time	3 hrs.
.		Subject: -	Numerical Me	thods 26	IBCE	
, t	$ \begin{array}{c} \checkmark \text{Ca} \\ \checkmark Att \\ \checkmark Th \\ \checkmark As \end{array} $	ndidates are required to give the fit the second se	No. 6 is computed in the second secon	wn words as far s <i>ory</i> .	as practicable	•
	1. a)	Find at least one root of x - x - method.	-3 = 0 with the a	accuracy of 0.08	%, using Bise	ction three
	,	decimal places of accuracy.	810 31 1.2	o using boomit	mounou apro.	unoo
	2. a)	Use a suitable method to fit an exp X 1 Y 1.65	ponential curve y 2 3 2.7 4.5 7	$= ae^{bx} \text{ for the for}$ $4 \qquad 5$ $7.35 \qquad 12.2$	ollowing data:	
	b)	The followings are the measurer oscillograph representing a chang t (time) 1.2 I 1.36	ment of t (time)e in the condition 2.0 2.3 0.58 0.3	made on a curls of an electric 5 3.0 4 0.20	rve recorded fourrent (I).	by an
	3. a)	Find the value of 1 when $t = 1$, method. Evaluate $I = \int_0^2 \frac{(x^2 + 2x + 1)}{1 + (x + 1)^4} dx$	using Gauss tv	vo point and th	hree point for	mula.
		Also, compare results obtained fre	om both the meth	ods. -24	a anna an t-seach. An anna an t-seacha	nant i t
	b)	Find the largest Eigen value of th	e matrix $A = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$	$\begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}$ usin	g power metho	od.
	4. a)	Solve the system of equations give pivoting. $2x_1 + x_2 + x_3 - 2x_4 = -10$ $4x_1 + 2x_3 + x_4 = 8$ $3x_1 + 2x_2 + 2x_3 = 7$ $x_1 + 3x_2 + 2x_3 - x_4 = -5$	ven using the Ga	uss elimination	method with	partial
•	b)	Solve the following differential method. $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = 6x$, v	equation within with $y(0) = 0$ and	$0 \le x \le 0.4$ y'(0) = 1. (take	using RK 4^{th} h = 0.2)	order
	5. a)	A rod is rotating in a plane. The which the rod has turned for varies $\begin{array}{c c} t & 0 & 0.2 \\ \hline \theta & 0 & 0.12 \\ \hline \end{array}$ Calculate the angular velocity an	the following table ous values of the 0.4 0.6 0.49 1.12 d angular acceler	e gives the ang time t seconds. 0.8 1.0 2.02 3.20 ation of the rod,	le θ (radian) the hyperbolic state is the hyperbolic state is a second state in the hyperbolic state is a second state in the hyperbolic state is a second	hrough second.
	b)	Solve the Poisson equation $\nabla^2 f$ with $h = k = 1$. Consider $f = 0$ at	$= 2x^2y^2$, over the all its boundaries	the square domain, $x = 0, y = 0, x$	n of $0 \le x \le 3$ at = 3 and y = 3.	nd 0≤y≤
				(

03 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division

2066 Jestha

Exam.	Back				
Level	BE	Full Marks	80 ·		
Programme	All (Except B.Arch.)	Pass Marks	32		
Year / Part	Ш/І	Time	3 hrs.		

[8]

[8]

[8]

[8]

[8]

Subject: - Numerical Methods

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- Attempt any <u>Five</u> questions. Question No. 6 is compulsory.
- The figures in the margin indicate <u>Full Marks</u>.
- ✓ Assume suitable data if necessary.
- 1. a) Find a real root of the following equation using Harner's rule, correct upto three decimal places. $x^3 6x^2 + 11x 6 = 0$
 - b) Estimate a root of $x^2 + lnx = 3$, using Bisection method, correct up to three decimal places.
- a) Using Newton's forward difference formula or Lagrange interpolation estimate the square of 3.25, if.
 [8]

X	1	2	3	4	5
X^2	1	4	9	16	25

b) Fit the following data to the function y = ln (ax + b) using least square method.

Х	-2.0	-1.0	0.5	2.0	3.0	5.5
Y	0.4	1.2	3.5	6.0	7.4	11.0

3. a) Using trapezoidal, Simpon's 1/3 (Composite) formulate with number of strips, n = g, evaluate $\int_{0}^{\pi} \sqrt{1.3 \cos x} \, dx$.

b) Use Romberg Integration method to evaluate $I = \int_0^2 \frac{e^x + e^{-x}}{2}$ correct up to three decimal places. [8]

4. a) Find out the largest Eigen value and corresponding Eigen vector from the following square matrix:
 [8]

 $\mathbf{A} = \begin{bmatrix} 1 & 2 & 3 \\ -2 & 4 & 6 \\ -1 & -2 & 3 \end{bmatrix}$

- b) Solve the following linear algebraic equations using Cholesky's factorization method. [8] 2a + 3b + 4c = 20
 - 3a + 4b + 5c = 264a + 5b + 6c = 32
- 5. a) Determine y at x = 1, using RK second order (RK-2) method. (take h = 0.5) $\frac{dy}{dx} = \frac{1}{x + y}, \quad y(0) = 2$
 - b) Solve the following differential equation within 0 ≤ x ≤ 1, h = 0.5 using Euler's method.
 [8]

 $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + y = 2x \text{ with } y(0) = 0 \text{ and } y'(0) = 2.$

6. Write an algorithm, flowchart, and computer program in any of the language C or FORTRAN to solve a system of linear equations using Gauss elimination method with partial pivoting.
[6+4+6]

03 TRIBHUVAN UNIVERSITY	Exam.	Re	egular / Back				
INSTITUTE OF ENGINEERING	Level	BE	Full Marks	80			
Examination Control Division	Programme	All (Except B.Arch.)	Pass Marks	32			
2066 Bhadra	Year / Part	III / I	Time	3 hrs.			
·/		-					
Subject: - N	lumerical Me	thods					
 ✓ Candidates are required to give their an ✓ Attempt any <u>Five</u> questions. Question I ✓ The figures in the margin indicate <u>Full</u> ✓ Assume suitable data if necessary. ↓ a Find a real root of the equation x³ 	swers in their o <i>No. 6 is compul:</i> <u>Marks.</u> $+ x^2 - 1 = 0$ b	wn words as fa sory. y the fixed po	r as practicable int iteration me	ethod,			
correct to six decimal places.				[8]			
by Calculate a real root of non-linear e Method. The absolute error of func- than 10 ⁻⁴ .	quation x sin x ctional value at	$+\cos x = 0$ usion our calculated	ng Newton Ra I root should b	phson e less [8]			
2. ray Use appropriate method of interpola	a) Use appropriate method of interpolation to get $f(0.675)$ from the given table.						
1 - 125 - 125	0 375	0.5	0.625 0	75			
f(x) 0.7916 0.7733	0.7437	0.7041	0.6532 0.6	5022			
• b) Use the suitable method to fit a oua	dratic curve v =	$ax^2 + bx + C$	for the followir	un data [8]			
v 4.63 2.11	0.67 0.09	0.63	2.15	4.56			
			LL				
3. a) Evaluate the integral $I = \int e^{-x^2} dx$	and compare	the result in	both condition	ns for			
o Simpson's 1/3 rule and 3 point Gau	iss Legendre me	thod.		[10]			
b) The following data gives correspo	nding values o	f pressure (P)	and specific v	olume			
(V) of superheated steam:		1	1	[6			
V 2	4 6	8 10					
P 105 42	2.7 25.3 1	6.7 13					
Find the rate of change of pressure	with respect to	volume when `	V = 2 and $V = 1$	8.			
4 a) Using the power method, find the l	argest eigen val	ue of the follow	ving matrix.	[6			
	° .		-				
$A = \begin{bmatrix} 1 & 2 & 0 \end{bmatrix}$			•				
		~ .	· · · · · · · ·				
by Solve the following system of lines	ar equations by	Jauss-Elimina	uon method.	t t			

 $5x_1 + x_2 + x_3 + x_4 = 4$ $x_1 + 7x_2 + x_3 + 4x_4 = 6$ $x_1 + x_2 + 6x_3 + x_4 = -5$ $x_1 + x_2 + x_3 + x_4 = 0$

5. •a) Use second order Runge-Kutta method to solve $\frac{dy}{dx} + xz = 0$; $\frac{dy}{dx} - y^2 = 0$ at x = 0.2and 0.4 given that y = 1, z = 1 at x = 0. [8]

by Apply Runge Kutta fourth order method to approximate the value of y when x = 0.2. and 0.4 given that y' = x + y, y(0) = 1. [8]

Write an algorithm, flowchart and program code in any high level language to solve a system of linear equations in 'n' unknowns using the Gauss Jordan Method. The program should display the augmented co-efficient matrix at each step of elimination. [5+5+6]

9

	02	TRIBHUVAN UNIVERSITY	Exam.	F	legular/Back	
	INS	TITUTE OF ENGINEERING	Level	BE ·	Full Marks	80
E	xam	ination Control Division	Programme	All (Except B.Arch.)	Pass Marks	32
	<u>.</u> .	2065 Shrawan	Year / Part	III / I	Time	3 jars.
	/	1		1 1	/	
	•	Subject: - N	lumerical Me	thods		
	Car Atte The Ass	didates are required to give their an empt any <u>Five</u> questions. Question I figures in the margin indicate <u>Full</u> ume suitable data if necessary.	swers in their c Vo. 6 is comput <u>Marks</u> .	own words as fa Isory.	ar as practicable	
1.	a)	Find the point with accuracy 0.0 intersecting, using bisection method	01, where the 1.	line $y = x -$	3 and $y = In$	a x is
· · · ·	b)	Calculate the root of non-linear eq The absolute error of functional val	uation $f(x) = s$ ue at our calcu	in $x - 2x + 1$ lated root shou	using secant me ld be less than 1	ethod. 0 ⁻³ .
2	. a)	Find the missing values of collected	i water level us	ing Lagrange'	interpolation.	
		Time duration of rainfall (t) min	1	3	6.5	10
	_	Collected Water level (h) mm	23	61	? 2	203
	b)	Use the suitable method and det following data:	ermine the ex	ponential fit o	of $y = Ce^{Ax}$ for	or the
•		X 0 -	1	2	3 4	4
· .		Y 1.5	2.5 - 3	3.5 . 5	5.0 7.	.5
		- 1.5				
3	. a)	Evaluate the integral $I = \int \sin x dx$,	, compare the a	absolute error i	in both conditic	ons for
		0 0	10 1			
	-	Simpson 1/3 rule and Simpson's 3/	8 rule.			
	b)	Use Romberg Integration find the i	ntegral of e [*] sin	n x between the	e limits –1 and 1	
			$\begin{bmatrix} 2 & -2 & 4 \end{bmatrix}$			
4	. a)	Find the inverse of the matrix $A =$	2 3 2	using Gauss-Jo	ordan method.	
			-1 1 1			
	b)	Solve the following by Course Eli-		1 1 1		
	0)	Solve the following by Gauss Ellin		i with complete	e pivoung.	
		2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6				
••••	5 a)	Solve the following differential	equation withi	n () < v < 1 () using RK Δ^{t}	order
	. ц)	method.		<u> </u>		01401
	•	$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 4y = 3x$, with $y(0) = 0$) and y'(0) = 1.	(take h = 0.5)		
	b)	Consider a sheet metal of size 300 at temperature of 50°C and other state temperature at interior points	cm by 30cm. T two sides are assuming a gri	he two adjacer held at 500°C id size of 10cm	nt sides are main 2. Calculate the 1 by 10cm.	ntained steady
• •	6. W po of	rite algorithm flow chart and pro olynomial of n th degree using Harne f polynomial and display all roots of	ogram code o: er's rule. Your `that polynomia	f any high lev program shoul al correct up to	vel language to d read the coef five decimal pl	o solve ficients aces. [5
·			***			•
i						
				•.		

!

3	TRIBHUVAN UNIVERSITY	Exam.	R	egular / Back	
NS	STITUTE OF ENGINEERING	Level	BE	Full Marks	80
xa1.	nination Control Division	Programme	All (Except B.Arch.)	Pass Marks	32
	2066 Bhadra .	Year / Part	III / I	Time	3 hrs.
	Subject: - N	umerical Me	thods		
Ca Att The Ass	ndidates are required to give their an empt any <u>Five</u> questions. Question N e figures in the margin indicate <u>Full</u> sume suitable data if necessary.	swers in their o No. 6 is compul <u>Marks</u> .	wn words as fa <i>sory</i> .	ar as practicable	~
. a)	Find a real root of the equation x^3 correct to six decimal places.	$+x^{2}-1=0$ b	by the fixed po	int iteration me	ethod,
b)	Calculate a real root of non-linear e Method. The absolute error of function than 10^{-4} .	quation x sin x prional value at	$+\cos x = 0$ us our calculated	ing Newton Ra 1 root should b	phson e less
. a)	Use appropriate method of interpola	ation to get $f(0)$.	675) from the g	given table.	
	x 0.125 0.25	0.375	0.5	0.625 0.	.75
	f(x) 0.7916 0.7733	0.7437	0.7041	0.6532 0.6	022
b)	Use the suitable method to fit a qua	dratic curve y =	$ax^2 + bx + C$	for the followin	g data.
	x -3 -2	-1 0	1	2	3
	y 4.63 2.11	0.67 0.09	9 0.63	2.15 2	1.50
. a)	Evaluate the integral $I = \int_{0}^{1} e^{-x^{2}} dx$	and compare	the result in	both condition	ns for
	Simpson's 1/3 rule and 3 point Gau	ss Legendre me	ethod.	•	
b)	The following data gives correspo (V) of superheated steam:	nding values o	f pressure (P)	and specific ve	olume
	V 2 2 P 105 42	4 6 .7 25.3 1	8 10 6.7 13		
	Find the rate of change of pressure	with respect to	volume when	V = 2 and $V = 8$	3.
. a)	Using the power method, find the la	argest eigen val	ue of the follow	wing matrix.	
•	$\mathbf{A} = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$				•
b)	Solve the following system of lines	r equations by	Gauss-Elimina	tion method.	• • •
	$5x_1 + x_2 + x_3 + x_4 = 4$	· · · ·			
· .	$x_1 + 7x_2 + x_3 + 4x_4 = 6$				

6

l

[8]

 $x_1 + x_2 + 6x_3 + x_4 = -5$ $x_1 + x_2 + x_3 + x_4 = 0$

- 5. a) Use second order Runge-Kutta method to solve $\frac{dy}{dx} + xz = 0$; $\frac{dy}{dx} y^2 = 0$ at x = 0.2
 - and 0.4 given that y = 1, z = 1 at x = 0.
 - b) Apply Runge Kutta fourth order method to approximate the value of y when x = 0.2[8] and 0.4 given that y' = x + y, y(0) = 1.
- ×., 6. Write an algorithm, flowchart and program code in any high level language to solve a system of linear equations in 'n' unknowns using the Gauss Jordan Method. The program should display the augmented co-efficient matrix at each step of elimination. [5+5+6]

INS	TRIBHUVAN UNIVERSITY	Exam.		Regular/Back	1
	TITUTE OF ENGINEERING	Level	BE	Full Marks	80
xam	ination Control Division	Programme	All (Except B.Arch.)	Pass Marks	32
	2065 Shrawan	Year / Part	III / I	Time	3 hrs
	Subject: - N	lumerical Me	thods		
′ Car	didates are required to give their an	swers in their o	wn words as	far as practicable	
Atte	empt any Five questions. Question I	Vo. 6 is compul	sory.	•	
´ The	figures in the margin indicate Full	<u>Marks</u> .			
' Ass	ume suitable data if necessary.				-
	Find the naint with accuracy 0.00	01 where the	1:	2 and the la	
. a)	intersecting using hisection method	or, where the	inte y $-x$	-5 and $y - 1n$	X 15
1->	Coloring, using encedent memory	···	0 1 1		- 41I
b)	Calculate the root of non-linear eq	uation $I(x) = si$	n x - 2x + 1	using secant me	o^{-3}
					· ·
. a)	Find the missing values of collected	l water level us	ing Lagrange	' interpolation.	
	Time duration of rainfall (t) min	1	3	6.5	10
	Collected Water level (h) mm	23	61	? 2	.03
b)	Use the suitable method and det	ermine the exp	ponential fit	of $y = Ce^{Ax}$ for	or the
	following data:				
	X 0	1	2	3 4	 ,
	Y 1.5	2.5 3	.5	5.0 7.	5
. a)	Simpson 1/3 rule and Simpson's $3/3$	compare the a 8 rule.	bsolute error	in both conditio	ns ior
b)	Use Romberg Integration find the in	ntegral of e ^x sin	x between th	the limits -1 and 1	•
		$\begin{bmatrix} 2 & -2 & 4 \end{bmatrix}$			
	Find the inverse of the matrix A	2 - 2 + 1	ising Gauss I	orden method	
·. a)	Find the inverse of the matrix A° =	2 5 2 1	Ising Gauss-J	oldan memou.	
		1 1 1			
		-1 1 1			
b)	Solve the following by Gauss Elim	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method	with complet	e pivoting.	
b)	Solve the following by Gauss Elim 2x + 3y + 2z = 2	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method	with complet	e pivoting.	
b)	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method	with complet	e pivoting.	
b)	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method	with complet	e pivoting.	
b) j. a)	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6 Solve the following differential of	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method	with complet $0 \le x \le 1$.	e pivoting. 0 using RK 4 th	order
b) ;. a)	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6 Solve the following differential emethod.	[-1 1 1] ination method	with complet $0 \le x \le 1$.	e pivoting. 0 using RK 4 th	order
b) 5. a)	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6 Solve the following differential emethod.	[−1 1 1] ination method	with complet $0 \le x \le 1$.	e pivoting. 0 using RK 4 th	order
b) 5. a)	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6 Solve the following differential emethod. $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 4y = 3x$, with $y(0) = 0$	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method equation within and $y'(0) = 1$.	with complet $0 \le x \le 1$. (take h = 0.5)	e pivoting. 0 using RK 4 th	order
b) 5. a)	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6 Solve the following differential emethod. $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 4y = 3x$, with $y(0) = 0$	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method equation within and y'(0) = 1. (with complet $0 \le x \le 1$. (take h = 0.5)	e pivoting. 0 using RK 4 th	order
b) 5. a) b)	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6 Solve the following differential emethod. $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 4y = 3x$, with $y(0) = 0$ Consider a sheet metal of size 30c	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method equation within and y'(0) = 1. (m by 30cm. Th	with complet $0 \le x \le 1$. (take h = 0.5) the two adjace	e pivoting. 0 using RK 4 th nt sides are main	order
b) 5. a) b)	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6 Solve the following differential emethod. $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 4y = 3x$, with $y(0) = 0$ Consider a sheet metal of size 30c at temperature of 50°C and other	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method equation within and y'(0) = 1. (m by 30cm. Th two sides are b	with complet $0 \le x \le 1$. (take h = 0.5) the two adjaces held at 500°C	e pivoting. 0 using RK 4 th nt sides are main C. Calculate the s	order tained steady
b) 5. a) b)	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6 Solve the following differential emethod. $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 4y = 3x$, with $y(0) = 0$ Consider a sheet metal of size 30c at temperature of 50°C and other state temperature at interior points	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method equation within and y'(0) = 1. (m by 30cm. Th two sides are 1 assuming a gric	with complet $0 \le x \le 1$. (take h = 0.5) the two adjaces held at 500°C 1 size of 10cm	e pivoting. 0 using RK 4 th nt sides are main C. Calculate the n by 10cm.	order tained steady
b) 5. a) 5. W	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6 Solve the following differential emethod. $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 4y = 3x$, with $y(0) = 0$ Consider a sheet metal of size 30c at temperature of 50°C and other state temperature at interior points rite algorithm flow chart and pro-	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method equation within and y'(0) = 1. (m by 30cm. Th two sides are 1 assuming a grid gram code of	with complet $0 \le x \le 1$. (take h = 0.5) the two adjaces held at 500°C any high le	te pivoting. 0 using RK 4 th nt sides are main C. Calculate the n by 10cm. vel language to	order tained steady solve
b) 5. a) 5. W	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6 Solve the following differential emethod. $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 4y = 3x$, with $y(0) = 0$ Consider a sheet metal of size 30c at temperature of 50°C and other state temperature at interior points rite algorithm flow chart and pro- lynomial of n th degree using Harner polynomial and dimensional points	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method equation within and y'(0) = 1. (m by 30cm. Th two sides are 1 assuming a grid gram code of r's rule. Your p	with complet $0 \le x \le 1$. (take h = 0.5) the two adjaces held at 500°C 1 size of 10cm any high le program shou	e pivoting. 0 using RK 4 th nt sides are main C. Calculate the n by 10cm. vel language to ld read the coefficient pla	order tained steady solve icients
b) 5. a) 5. W po of	Solve the following by Gauss Elim 2x + 3y + 2z = 2 10x + 3y + 4z = 16 3x + 6y + z = 6 Solve the following differential emethod. $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 4y = 3x$, with $y(0) = 0$ Consider a sheet metal of size 30c at temperature of 50°C and other state temperature at interior points rite algorithm flow chart and pro- lynomial of n th degree using Harner polynomial and display all roots of the state of the st	$\begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$ ination method equation within and y'(0) = 1. (m by 30cm. Th two sides are 1 assuming a grid gram code of r's rule. Your p that polynomial	with complet $0 \le x \le 1$. (take h = 0.5) the two adjaces held at 500°C 1 size of 10cm any high leorogram should correct up to	te pivoting. 0 using RK 4 th nt sides are main C. Calculate the n by 10cm. vel language to ld read the coeff o five decimal pla	order tained steady solve icients ces. [

•

7

1. C. L. Martin M. M. Martin M. Martin M. Martin M. M. Martin M. Ma Martin M. Martin Martin M. Martin M Martin M. M Martin M. Marti

٢

and the set of

!