Seat No:______________ Enrollment No:______________

PARUL UNIVERSITY

FACULTY OF APPLIED SCIENCE

M .Sc., Winter 2017-18 Examination

Semester:1 **Date: 22/12/2017**

Subject Code: 11206103 **Time: 02:00 pm to 04:30 pm**

Subject Name: Advanced Numerical Analysis **Total Marks: 60**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1. A) Use householder's method to reduce matrix $A=\begin{pmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{pmatrix}$ in tri-diagonal matrix . **(08)**

Q.1. B) **Answer the following questions (Any two)**

(a) Do as directed (Each of 02 marks) **(04)**

1. Find the derivative of the function f(x) at x=8.5 using the following data

x:	1.8	1.9	2.0	2.1	2.2
f(x)	10.8894	12.7032	14.7781	17.14898	19.8550

2. Evaluate $\int_0^{\frac{\pi}{4}} x \sin x \, dx$ using Trapezoidal method.

(b) Using Runge Kutta 4th order method, determine $y(0.5)$ for differential equation $\frac{dy}{dx}=x-y;$ $y(0)=1;$ by taking step size h=0.5. **(04)**

(c) Using Euler's method, solve the differential equation $\frac{dy}{dx}=\frac{y-x}{y+x};$ $y(0)=1$ where $0<x\le 0.5$, by taking h=0.25. **(04)**

Q.2. A) **Answer the following questions.**

(a) Do as directed: (Each of 2 marks) **(04)**

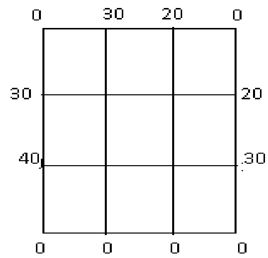
1. Write advantages and disadvantages of Secant Method for minimization function.
2. Use central difference method to find $f''(1)$ if $f(x)=1-e^x$, by taking step size h=0.25.

(b) Write Algorithm of Nelder Mead method. **(04)**

Q.2. B) **Answer the following questions (Any one)**

(a) Using Power method Find largest eigenvalue of $A=\begin{pmatrix} 4 & -1 & 1 \\ -1 & 3 & -2 \\ 1 & -2 & 3 \end{pmatrix}$ **(06)**

(b) Use Five point formula for Laplace equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ to find the temperature at given nodes. Take h=k=0.5. **(06)**



Q.3. A) Do as directed: (Each of 4 marks) **(08)**

(a) Find the minimum value of the function $f(x) = x^2 - \sin x$ in $[0.3, 0.5]$ using Golden section method . Perform 5 iterations.

(b) Solve the boundary value problem $y'' - y = x;\ \ y(0) = y(1) = 0$ with h=0.25. Using Finite difference method.

Q.3. B) **Answer the following questions (Any two)**

(a) Evaluate $\int_1^{1.5} x^2 \ln(x)\, dx$ using Romberg method. **(04)**

(b) Use Steepest descent method to find minimum of function $f(x, y) = x^2 + y^2 - 4x - y - xy$ initial guess is $X_0 = (1,0)$. **(04)**

(c) Solve the differential equation $\frac{dy}{dx} = 1 + y;\ y(0) = 1$ using Taylor's method at x=0.1. **(04)**

Q.4. A) Using Shooting method solve the boundary value problem $u'' = 6u^2 - x,\ u(0) = 1, u(1) = 5$. Take step size h=$\frac{1}{3}$. **(08)**

Q.4. B) **Answer the following questions (Any one)** **(06)**

(a) Using Finite difference method, Solve,

$u_{tt} = 4u_{xx}$ for $0 \le t \le 0.02,\ 0 \le x \le 1$

$u(0,t) = u(1,t) = 0\ \ 0 \le t \le 0.02$

$u(x,0) = \sin \pi x + \sin 2\pi x\, ; 0 \le x \le 1$

$u_t(x,0) = 0,\ 0 \le x \le 1$

(b) Use Crank Nicholsen method to solve the heat equation $u_t = u_{xx},\ 0 \le t \le 0.1$ with initial condition $u(0,t) = u(1,t) = 0;\ u(x,0) = \sin \pi x,\ 0 \le x \le 1$ taking h=0.2, k=0.1.