2005-PUNJAB TECHNICAL UNIVERSITY

B.TECH IV SEMESTER DEGREE EXAMINATION

NUMERICAL ANALYSIS

(MECHANICAL ENGINEERING)

TIME-3HOUR
MARK-60

Note: Section A Is Compulsory. Attempt Any Four Questions From Section B And Any Two From Section C.

SECTION A MARKS 2 EACH

1. (a) With a=0, b=1, the following function changes sign in (a, b), what point does the bisection method locate? Is this point a zero of f(x)?

(b) Find the function whose first difference is 9x2+11x+5.

(c) What are the major drawbacks of the Lagrange's form of interpolation?

(d) Prove that (please see the attachment)

(e) Show that the matrix (please see the attachment) is Invertible, but that A cannot be written as the product of a lower triangular matrix with an upper triangular matrix,

(f) Calculate the number of additions and number of multiplications necessary to multiply an n x n matrix with an n-vector.

(g) If third differences are constant, prove that:

(h) Prove that:

(i) Why higher order Newton-Cole's formula for numerical integration are not commonly used?

(j) Convert the following second order initial value problem into a system of first order initial value problem. ty"-y+4t3y=0.˜ Y(1) = 1, y' (1) = 2.

SECTION B MARKS 5 EACH

2. Show that bisection method always converges and its order of convergence is one.

3. Solve he equations:

x1+ x2+ x3=6

3x1+ (3+ e)x2+ 4x3=20

2x1+ x2+3 x3=13

using Gauss elimination method, where e is small such that 1+ e2 ˜ 1.

4 (a) Define the operators d and m and prove that

d(f(x)g(x)] = mf(x)dg(x) + mg(x)df(x). where d = delta and m is mu

(b) Use Newton's formula for interpolation to find the number of deaths at 40-50 and 50-55 if the following are the number of deaths on for successive ten year age groups:

Age group Deaths

25-35 13229
35-45 18139
45-55 24225
55-65 31496

5. Use stirling formula to find the first derivative of the function y 2ex x – 1 tabulated below at the point x = 0.6

X y

0.4 1.5836494
0.5 1.7974426
0.6 2.0442376
0.7 2.3275054
0.8 2.6510818

Compare with the true value which is 2.044238

6. Derive Simpson's 1/3 formula for numerical integration and show that its local truncation error is of the order h3.

.

SECTION C MARKS 10 EACH

7. (a) Use Picard's method to approximate y where x 0.1, x = 0.2, given that y = 0 when x = 0, dy/dx =x+y. Compare the results with exact value.

(b) Find the three term Taylor series solution for the third order initial value problem

W"' + WW" = 0.

W(0) = 0, W' = (0), W"(0) =1.

Find the bound on the error for t ? [0, 0.2]

8. By considering the limit of the three-point Lagrange interpolating polynomial relative to (please see the attachment)

9 (a) Factorize the following matrix into LU decomposition using direct factorization (Please see the attachment) with uii =1 for all i:

(b) The equation ex – 4x2 = 0 has a root between x = 4 and x = 5. Show that we cannot find this root using fixed point interaction with natural iteration function x = ½ ex/2