Mohamed Boudiaf University - M'sila
Faculty of Technology
Department of Civil Engineerin
Module : Numerical Methods

University Year : 2024/2025
13/05/2025 (13h30-15h00)
Duration : 1h 30min

Final Exam

Exercice n°1 : (7 marks)

Consider the function $f(x)$ defined by :$f(x) = exp\,(x) - x - 5$

1. Show that $f(x) = 0$ has a unique solution α in the interval $[1; 2]$.
2. Verify that the function $g(x) = ln(x + 5)$ satisfies the conditions of the fixed point theorem in the interval $[1; 2]$.
3. Calculate the root α with $x_0 = 2$ and the precision $\epsilon = 5 \times 10^{-3}$ (take 4 digits after the decimal point).

Exercice n°2 (9 marks)

Consider the following linear system (S) :

$$(S)\begin{cases} x_1 - 3x_2 = 28 \\ -3x_1 + 13x_2 - 8x_3 = 96 \\ -8x_2 + 41x_3 = -985 \end{cases}$$

i) Write the system (S) as $AX = b$.

ii) Verify that the matrix A is symmetric positive definite.

iii) Calculate the Cholesky factorisation of $A = MM^t$.

iv) Solve system (S) using Cholesky's factorisation.

v) Deduce the determinant of A.

Exercice n°3 (4 marks)

Consider the points given in the table below :

x_i	0	2	3	5
$f(x_i)$	-7	-13	5	143

a) Construct the divided differences table.

b) Find the equation of Newton's polynomial passing the first three points.

c) Deduce the equation of Newton's polynomial of degree three passing through all the points.

Module manager. Merini.A

Good luck