Mohamed Boudiaf University - M'sila **University Year : 2024/2025**
Faculty of Technology **01/06/2025 (11h00-12h30)**
Department of Civil Engineerin **Duration : 1h 30min**
Module : Numerical Methods

Resit Exam

Exercice n°1 : (7 marks)

Consider the function $f(x)$ defined by :$f(x) = x^3 - x - 1$ on the interval $[1; 2]$.

1. Show that $f(x) = 0$ has a unique solution α in the interval $[1; 2]$.
2. Verify that the function $g(x) = \sqrt[3]{x+1}$ satisfies the conditions of the fixed point theorem in the interval $[1; 2]$.
3. Calculate the root α with $x_0 = 1.5$ and the precision $\epsilon = 10^{-3}$ (take 4 digits after the decimal point).

Exercice n°2 (9 marks)

Consider the following linear system (S) :

$$\begin{cases} 5x_1 + 3x_2 + x_3 = 12 \\ 10x_1 + 8x_2 + x_3 = -13 \\ -6x_2 + 5x_3 = 161 \end{cases}$$

a) Write the system as $Ax = b$.

b) Show that the matrix A has a unique decomposition $A = LU$, where L is a lower triangular matrix with one diagonal and U is an upper triangular matrix.

c) Determine the matrices L and U, then solve this system.

d) Deduce the determinant of A.

Exercice n°3 (4 marks)

Consider the points given in the table below :

x_i	-1	0	1	2
$f(x_i)$	2	1	0	0

a) What is the degree of the polynomial represented by these points ?

b) Find this polynomial using Lagrange's method P.

c) Calculate $P(1, 5)$.

Module manager. Merini.A

Good luck