NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF GEOLOGICAL, MINING AND METALLURGICAL ENGINEERING

GEOLOGICAL ENGINEERING PROGRAM

FI565 – FLUID MECHANICS

I. GENERAL INFORMATION

CODE	**:**	FI565 Fluid Mechanics
SEMESTER	**:**	6
CREDITS	**:**	3
HOURS PER WEEK	**:**	4 (Theory – Practice – Labs)
PREREQUISITES	**:**	FI456 Strength of Materials
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

The course prepares students for understanding and applying the principles governing the behavior of fluids in static and dynamic conditions. Students analyze the effect of force and pressure on fluid motion and the relationship with fluid velocity, acceleration and flow. The characteristics of laminar and turbulent flows are analyzed, as well as the motion of fluid in open and closed ducts. Students analyze energy concepts, Bernoulli equation, energy losses, dimensional analysis and similarity, viscous flow, pipe friction ad head loss among other topics for the modeling and analysis of fluid in engineering applications, especially in underground flows.

III. COURSE OUTCOMES

At the end of the course, students:

1. Identify the scientific experimental nature of the fluid mechanics and appreciate the rigor and objectivity of the discipline.
2. Understand and differentiate the behavior and characteristics of laminar and turbulent flows.
3. Formulate the equations for modeling the behavior of fluids in static and dynamic conditions.
4. Understand and apply the Bernoulli equation for analyzing the behavior of fluids in open and closed ducts.
5. Analyze fluid behavior from an energy-conservation view point, and estimate energy losses in pipes and accessories.

IV. LEARNING UNITS

1. FLUID PROPERTIES AND FLUID STATICS / 16 HOURS

Preliminary concepts / Concept of fluid / Dimensions and unities / Physical and thermodynamic properties of fluids / Surface tension / Capillarity / Viscosity / Euler equation / Forces acting on a fluid / Manometrics / Hydrostatic forces acting on plane and curve surfaces / Examples of application / Points about laboratories.

2. FLUID KINEMATICS / 20 HOURS

Stability and flotation / Motion equilibrium / Fluid kinematics / Flow fields / Acceleration curl and velocity vector fields.

3. FLUID DYNAMICS / 30 HOURS

Classification of flows and methods to describe them / Conservation of momentum / Energy equation / Energy loss / Interpretation of Bernoulli's equation / Holes and gates / General equations and loss coefficients / Pitot tube, venture tube and current meter / Dimensional analysis and similarity / Viscous flow in ducts / Flow and duct types / Pipe friction head loss / Flow in ducts / Pressure and under-pressure criteria / general aspects of channel flow.

V. LABORATORY EXPERIENCES

Lab 1: Fluid properties: surface tension, viscosity
Lab 2: Manometrics.
Lab 3: Reynolds experience.
Lab 4: Energy losses in pipes.

VI. METHODOLOGY

The course is carried out in computing lab, theory and practice sessions. In theory sessions, the instructor introduces concepts, analysis, descriptions and applications. In practice sessions, several problems are solved, and their solutions are analyzed. In lab sessions, debate group research and analysis of solutions are carried out. The handing over of the lab reports will be held before the following session start. In all sessions student's active participation is encouraged.

VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

PF = (EP+EF+((P1+P2+P3+P4)/3+(L1+L2+L3+L4+L5+L6+L7+L8)/8)/2)/3

EP: Mid-Term Exam EF: Final Exam
P : Quizzes L: Labs

VIII. BIBLIOGRAPHY

1. **FOX, ROBERT**
   Introduction to Fluid Mechanics (Spanish)
   Mc Graw – Hill. 4th edition (2015)
2. **POTTER, MERLE**
   Fluid mechanics (Spanish)
   Prentice Editorial – May 2nd Edition (2016)
3. **SHAMES, IRVING**
   Fluid mechanics (Spanish)
   Mc. Graw Hill Editorial, 3rd Edition, (2015)
4. **WHITE, FRANK**
   Fluid Mechanics (Spanish)
   Mc. Graw – Hill Editorial, 1st edition (2015)