NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF GEOLOGICAL, MINING AND METALLURGICAL ENGINEERING

MINING ENGINEERING PROGRAM

FI565 – FLUID MECHANICS

I. GENERAL INFORMATION

CODE	**:**	FI565 Fluid Mechanics
SEMESTER	**:**	5
CREDITS	**:**	3
HOURS PER WEEK	**:**	4 (Theory – Practice – Labs)
PREREQUISITES	**:**	ME211 Physical-Chemistry FI456 Strength of Materials
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

This course is theoretical and practical and provides students with the main fundamentals and concepts of the characteristics of the behavior of fluids at rest and in motion under given conditions and considerations. Its general objective is to describe and explain phenomena related to fluid mechanics and their corresponding applications and to provide the basis for the development of the specialty courses.

III. COURSE OUTCOMES

1. Identify the scientific experimental nature of the fluid mechanics and appreciate the rigor and objectivity of the discipline.
2. Work with equations, basic mathematical tools in the study of fluid mechanics.
3. Analyze fundamental laws fluid mechanics and apply them in problematic and specific situation with thoroughness.

IV. LEARNING UNITS

1. FLUID PROPERTIES AND FLUID STATICS / 21 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 / 7 HOURS

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

3. FLUID DYNAMICS / 70 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 underpressure criteria / general aspects of channel flow.

V. LABORATORY EXPERIENCES

Lab 1: Fluid properties: viscosity.
Lab 2: Fluid properties: surface tension.
Lab 3: Manometrics.
Lab 4: Reynolds experience.
Lab 5: Guided technical visit.
Lab 6: Capacity hole discharge.
Lab 7: Outlet discharge.
Lab 8: Outlet calibration using the gravimetric method.

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 (2005)

2. **POTTER, MERLE**
   Fluid mechanics (Spanish)
   Prentice Editorial – May 2nd Edition (2007)

3. **SHAMES, IRVING**
   Fluid mechanics (Spanish)
   Mc. Graw Hill Editorial, 3rd Edition, (1999)

4. **WHITE, FRANK**
   Fluid Mechanics (Spanish)
   Mc. Graw – Hill Editorial, 1st edition (2008)

IX. COURSE CONTRIBUTIONS TO STUDENT OUTCOMES ATTAINMENT

Course contributions to Student Outcomes are shown in the following table:

Level 1: Know
Level 2: Comprehend, calculate
Level 3: Model, apply, solve
Level 4: Apply at advanced level, design. Achievement of Student Outcome

Outcome	Contribution
1. Engineering Design Design and integrate mining systems and components satisfying requirements and needs as well as given technical, economic, social and legal constraints and limitations.	2
2. Problem solving Identify, formulate and solve engineering problems properly using the methods, techniques and tools of mining engineering.	3
3. Sciences Application Apply the knowledge and skills of mathematics, sciences and engineering to solve mining engineering problems.	3
4. Experimentation and Testing Conceive and conduct experiments and tests, analyze data and interpret results.	2
5. Modern Engineering Practice Use and apply techniques, methods and tools of modern engineering necessary for the practice of mining engineering.	3
6. Engineering Impact Understand the impact of mining engineering solutions on people and society in local and global contexts.	3
7. Project Management Determine the budgets, schedules and feasibility of engineering projects, and participate in its management for the attainment of goals.	
8. Environmental Appraisal Take into account the importance of preserving and improving the environment in the development of their personal and professional activities	3
9. Lifelong Learning Recognize the need to keep their knowledge and skills up-to-date according to advances of mining engineering and engage in lifelong learning.	3
10. Contemporary Issues Know and analyze relevant contemporary issues in local, national and global contexts.	2
11. Ethics and Professional Responsibility Evaluate their decisions and actions from a moral perspective and assume responsibility for the executed projects.	
12. Communication Communicate clearly and effectively in oral, written and graphical formats, interacting with different types of audiences.	3
13. Teamworking Appraise the importance of teamworking and participate actively and effectively in multidisciplinary teams.	3