A) COURSE

Course Id:	Course
5632	FLUIDS MECHANICS

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
5	1	5	11	80

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:		VII	IV	V	
Course Type (Required/Elective)		Required	Required	Required	
Prerequisite Course:		Thermodynamics	Thermodynamics and Dynamic	Thermodynamics	
CACEI Classification:		ES	ES	ES	

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:
Handle and understand the fundamental concepts of fluid mechanics that help him to understand and to analyze the hydraulic and pneumatic systems, actuated by a working fluid. Leaning on the analysis of fluid flow equations and mathematical equations based on: physics, mechanics and thermodynamics.

D) TOPICS (CONTENTS AND METHODOLOGY)

1.- FLUID PROPERTIES.		**6 hours**
Specific Objective:	Understand the physical properties and the main features of the fluids.	
1.1 Molecular structure. 1.2 Density. 1.3 Specific gravity. 1.4 Specific gravity or relative density. 1.5 Specific volume. 1.6 Absolute and kinematic viscosity. 1.6.1 Energy losses in a moving body immersed in a viscous medium. 1.6.2 Viscosity Measurements. 1.7 Surface tension and capillarity. 1.8 Pressure (concepts). 1.9 Ideal gas law (Gases at a low pressure). 1.10 Thermodynamic relationships in adiabatic flows.		
Readings and other resources	Read the topics suggested bibliography.	

Teaching Methodologies	Exposition in classroom, students questioning, dialogue, solving typical problems, meet laboratory practices, clarification of doubts.
Learning Activities	Do exercises of theme, taken from the suggested bibliography, lab practices and classroom discussion of the results obtained in the laboratory.

2.- FLUID STATICS.		**10 hours**
Specific Objective:	Understand the fundamentals of fluid mechanics.	
2.1 Pressure, density and height relationships in compressible and incompressible fluids. 2.2 Manometers and pressure measuring devices. 2.3 Forces on flat submerged bodies. 2.4 Forces on curved submerged bodies. 2.5 Archimedes principle. Buoyancy force. 2.6 Lineal and angular accelerating containers.		
Readings and other resources	Read the topics suggested bibliography.	
Teaching Methodologies	Exposition in classroom, students questioning, dialogue, solving typical problems, meet laboratory practices, clarification of doubts.	
Learning Activities	Do exercises of theme, taken from the suggested bibliography, lab practices and classroom discussion of the results obtained in the laboratory.	

3.- FLOW OF INCOMPRESSIBLE FLUIDS.		**9 hours**
Specific Objective:	To acquaint the student the behavior of a real incompressible fluid flow through the concept of an ideal incompressible fluid.	
3.1 Streamline theory. 3.2 One-dimensional, two-dimensional and three dimensional flow. 3.3 Continuity equation using the concept of control volume. 3.4 Euler equation of motion. 3.5 Bernoulli equation. 3.6 Applying the Bernoulli equation. 3.6.1 Torricelli theorem. 3.6.2 Flowmeters.		
Readings and other resources	Read the topics suggested bibliography.	
Teaching Methodologies	Exposition in classroom, students questioning, dialogue, solving typical problems, meet laboratory practices, clarification of doubts.	
Learning Activities	Do exercises of theme, taken from the suggested bibliography, lab practices and classroom discussion of the results obtained in the laboratory.	

4.- LOSSES IN AN INCOMPRESSIBLE VISCOUS FLOW.		**25 hours**
Specific Objective:	Understand the losses evaluation due to friction, which happens in a viscous fluid flow.	
4.1 Reynolds number. 4.2 Laminar and turbulent flow in ducts. 4.2.1 Darcy-Weisbach equation. 4.3 Losses in ducts. 4.3.1 Moody diagram. 4.4 Problems: having h, Q o D, as unknowns. 4.5 Flow in piping systems: Parallel piping and Branch piping. 4.6 Problems solution using generalized computer software. 4.7 Flow in open channels. 4.7.1 Most efficient section.		

Readings and other resources	Read the topics suggested bibliography.
Teaching Methodologies	Exposition in classroom, students questioning, dialogue, solving typical problems, meet laboratory practices, clarification of doubts.
Learning Activities	Do exercises of theme, taken from the suggested bibliography, lab practices and classroom discussion of the results obtained in the laboratory.

5.- COMPRESSIBLE FLUID FLOW.		**8 hours**
Specific Objective:	To acquaint the student the compressible viscous fluid flow behavior trough the concept of ideal fluid flow.	
5.0 First law of thermodynamics. 5.1 Sound velocity. 5.2 Bernoulli equation in an adiabatic flow. 5.3 Mach number. 5.4 Stagnant point pressure. 5.5 Critical pressure ratio. 5.6 Convergent and divergent nozzle. 5.7 Isothermal flow. 5.8 Adiabatic flow.		
Readings and other resources	Read the topics suggested bibliography.	
Teaching Methodologies	Exposition in classroom, students questioning, dialogue, solving typical problems, meet laboratory practices, clarification of doubts.	
Learning Activities	Do exercises of theme, taken from the suggested bibliography, lab practices and classroom discussion of the results obtained in the laboratory.	

6.- PRINCIPLE OF LINEAR & ANGULAR MOMENTUM.		**10 hours**
Specific Objective:	Introduce the student in the basic design of reaction and impulse turbines through velocity diagrams, as well as its performance evaluation.	
6.1 Linear momentum equation using the control volume. 6.2 Angular momentum equation using the control volume. 6.3 Applications. 6.3.1 Impulse turbine. 6.3.2 Reaction turbine. 6.3.3 Propulsion.		
Readings and other resources	Read the topics suggested bibliography.	
Teaching Methodologies	Exposition in classroom, students questioning, dialogue, solving typical problems, meet laboratory practices, clarification of doubts.	
Learning Activities	Do exercises of theme, taken from the suggested bibliography, lab practices. Presentation of topics related to the subject.	

7.- LIFT AND DRAG.		**7 hours**
Specific Objective:	Understand the principles of lift and drag on solid objects immersed in a fluid flow.	
7.1 Boundary layer. von Kármán integral momentum equation. 7.1.1 Boundary layer thickness. 7.1.2 Laminar and turbulent boundary layer on a flat plate. 7.2 Drag. 7.3 Lift.		
Readings and other resources	Read the topics suggested bibliography.	

Teaching Methodologies	Exposition in classroom, students questioning, dialogue, solving typical problems, meet laboratory practices, clarification of doubts.
Learning Activities	Do exercises of theme, taken from the suggested bibliography, lab practices. Presentation of topics related to the subject.

8.- DIMENSIONAL ANALYSIS AND SIMILITUDE.		**5 hours**
Specific Objective:	That the student knows and applied the dimensional analysis, useful in many aspects of engineering.	
8.1 Dimensional analysis. 8.2 Pi Buckingham theorem. 8.3 Common dimensionless parameters. 8.3.1 Euler number (Inertial force vs Pressure force). 8.3.2 Reynolds number (Inertial force vs Viscous force). 8.3.3 Froude number (Inertial force vs Gravitational force). 8.3.4 Mach number (Inertial force vs Elastic force). 8.3.5 Weber number (Inertial force vs Surface tension force).		
Readings and other resources	Read the topics suggested bibliography.	
Teaching Methodologies	Exposition in classroom, students questioning, dialogue, solving typical problems, meet laboratory practices, clarification of doubts.	
Learning Activities	Do exercises of theme, taken from the suggested bibliography, lab practices. Presentation of topics related to the subject.	

E) TEACHING AND LEARNING METHODOLOGIES

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a) The teaching-learning process will take place in a dynamic way; the teacher will be conducting this process and promote the active participation of students.
b) From the previous reading by the students, the teacher will start the sessions with an introduction to the subject, raise questions, axes discussion and open the debate to the group.
c) The teacher will explain the development of concepts, techniques or processes provide examples and open a space to raise questions and doubts. He subsequently applied to solve problematic situations students individually, as a team or group, putting into practice the knowledge acquired.
d) It will be promoted the student reflection and expression of their ideas, questions and views through questions and comments.
e) Doubts raised will be clarified, the required aspects will deepen or expand the necessary information, making an effort to draw conclusions; in addition to other modalities proposed by the teacher and will be released at the beginning of the course.

PRACTICES:

For the experiments, they are considered a total of 16 one-hour sessions. Practices to be performed are listed below:

1. Laboratory and its Regulations.
2. Fluid Properties.
3. Statics of fluids.
4. Forces on submerged surfaces.
5. Measuring Instruments.
6. Laminar flow and Turbulent Flow.
7. Friction losses.
8. Losses on Accessories.
9. Calculation of pipe networks.

10. Losses elastic fluids.
11. Linear Momentum.
12. Moment of Momentum.
13. Drag coefficient.
14. Practice proposal per student.

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1st. Partial Evaluation	16 Sessions	Exam 80%, Tasks 20%	1 y 2
2nd Partial Evaluation	16 Sessions	Exam 80%, Tasks 20%	3 y 4
3rd. Partial Evaluation	16 Sessions	Exam 80%, Tasks 20	5
4th. Partial Evaluation	16 Sessions	Exam 80%, Tasks 20	6
5th. Partial Evaluation	16 Sessions	Exam 80%, Tasks 20	7 y 8
Final Ordinary Evaluation		100% (Average of the Partial Evaluations)	
Other activities:			
Extraordinary Exam	Week 17 of the semester in course	Exam 100%	Topics 100%
Title Exam	According to the program of the School Secretary.	Exam 100%	Topics 100%
Regularization Exam	According to the program of the School Secretary.	Exam 100%	Topics 100%

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books

1. ROBERT L. MOTT, Mecánica de Fluidos aplicada, Pearson, 6a Edición, 2006.
2. MUNSON YOUNG OKIISHI, Fundamentos de mecánica de fluidos, Limusa Wiley, 2007.
3. F. M. WHITE: Mecánica de Fluidos. McGraw-Hill, 5a Edición, 2004.

Complementary Books

1. FOX W.R. MC. DONALD A.T., Introducción a la mecánica de fluidos, Mc Graw-Hill 4a edición, 2000.
2. STREETER V.L. WYLE E.B., Mecánica de los fluidos, Mc Graw-Hill 9a Edición, 2000.

Internet Links