NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF MECHANICAL ENGINEERING

MECHANICAL-ELECTRICAL ENGINEERING PROGRAM

MN217 – FLUID MECHANICS II

I. GENERAL INFORMATION

CODE	**:**	MN-217 FLUID MECHANICS II
SEMESTER	**:**	5
CREDITS	**:**	3
HOURS PER WEEK	**:**	4 (2 Theory – 2 Practice)
PREREQUISITES	**:**	MN-216. Fluid Mechanics I
CONDITION	**:**	Mandatory

II. COURSE INTRODUCTION

The Fluid Mechanics II is a subject of theoretical and practical nature. The subject begins with the study Internal Flow Study: Loss of energy in pipes and fittings, pipeline circuit in series and in parallel, pumping system and use of spreadsheets; Is continued with Bundary Layer Theory: laminar boundary layer equations, turbulent boundary layer and applications in engineering; Then the Compressible Flow Dynamics: Adiabatic Flow, Shock Wave, Nozzles and Diffusers, Fano Flow and Rayleigh Flow; Is followed by the Study of External Flow: Introduction to Aerodynamics; To finally treat the Natural Gas Transportation: Application of the NTP, ASME B31.8 standards and use of spreadsheet for the design and calculation of external network and internal network of natural gas.

III. COURSE OUTCOMES

At the end of the course, the students will be able to:

1. Design liquid transport systems using national (NTP) and international standards (ASME B31.8) and consideration of the technical-economic criteria and protection of the environment. Evaluate the use of material for pipes, fittings, valves, measurement units and flow control. Select the drive, pump and engine team reflecting on existing literature and the experience of other engineers to make your project successful.

2. Use boundary layer theory in river, sea, land and air vehicles to:
   - Determine the drag forcé by action of the fluid.
   - Determine the power of the motor to be used.
   - Organize flow simulaton in FLUENT software.

3. Design converging nozzles and divergent converging nozzles for industrial use, reflecting on the use of thermodynamic processes.

4. Design Natural Gas Transportation System, making use of NTP and relevant international standards justifying the use of materials in tubes, environmentally friendly accessories.

IV. LEARNING UNITS

1. STUDY OF INTERNAL FLOW / 12 HOURS

Primary Loss and Secondary Losses / Series and Parallel Piping Systems / Applications and use of spreadsheet / Economic Diameter / Design of pumping systems.

2. BUNDARY LAYER THEORY / 8 HOURS

Definition. Main equations / laminar boundary layer. / Boundary layer Thickness / Von Karman momentum equation / Turbulent regime boundary layer / Applications.

3. FLUJO COMPRESIBLE UNIDIMENSIONAL / 18 HOURS

Introducción. Velocidad del sonido. Número de Mach Estados de referencia / Flujo Adiabático Irreversible con área variable, Flujo Adiabático Reversible y Flujo másico / Flujo en toberas y difusores. Eficiencia térmica / Aplicaciones / Ondas de choque / Funcionamiento de tobera subsónica y supersónica / Aplicaciones. Flujo fanno y flujo Rayleigh / introducción a la aerodinámica. Entrega de la monografía Sistema de Bombeo.

4. ESTUDIO DEL TRANSPORTE DE GAS NATURAL / 8 HOURS

Propiedades del Gas natural /Instalaciones Industriales. Red interna / instalaciones Industriales Red Externa / Aplicaciones. Entrega de la monografía Transporte de Aire Comprimido.

V. METHODOLOGY

The course is developed in sessions of theory, practice and laboratory. In theory sessions, the teacher informs on concepts and applications. In the practical sessions, various problems are solved and analyze their solution and reflect on their use in other contexts.

The student must present and expose an integrative project: in the middle and at the end of the course. In all sessions, the active participation of the student is promoted and the cooperative work is used.

VI. EVALUATION FORMULA

Evaluation System "F". Calculation of the Final Average:

FA = (ME + 2FE + PP) / 4

ME: Midterm Exam EF: Final Exam PP: Average of qualified practices

The average of qualified practices (PP) is the arithmetic average of the 3 highest marks of the qualified practices

VII. BIBLIOGRAPHY

[1] POTTER C. Merle y WIGGERT C. David. Mecánica de Fluidos Cuarta edición. México, International Thomson Editores, S.A. de C.V., 2015.

[2] MOTT Robert L. Mecánica de Fluidos Séptima edición. México, PEARSON EDUCACIÓN, 2015.

[3] NTP 110. NTP 111. ASME B31.8

Lima, August 2016