Course Title	Fundamentals of pipeline design				
Course Code	OG402				
Course Type	Compulsory				
Level	BSc Level				
Year / Semester	3rd year / 6th semester				
Teacher's Name	Dr.-Ing. Paris A. Fokaides				
ECTS	6	Lectures / week	2	Laboratories/week	1
Course Purpose	Fundamentals of pipeline design is a practical course for candidate mechanical engineers involved in the design and operation of pipelines transporting natural gas and other compressible fluids. This course will help students better understand and apply the principles of fluid mechanics to their daily work in the gas pipeline transmission and distribution industry.				
Learning Outcomes	1. Reproduce the basic properties of natural gas and other compressible fluids that are important in understanding how gas behaves under various conditions of pressure and temperature as it flows through a pipeline. 2. Outline the properties of hydrocarbon gas mixtures, such as gravity, viscosity, and compressibility 3. Explain analytical and graphical methods for the definition of hydrocarbons gas mixtures properties 4. Calculate the pressure drop in a gas pipeline using the general flow equation, the Colebrook, the AGA, the Panhandle and the Weymouth equations. 5. Extend the concepts of pressure drop calculations further to determine the total pressure required for transporting gas in pipelines under various configurations, such as series and parallel pipelines. 6. Calculate the technical requirements of compressor stations required to transport gas in a pipeline and determine their numbers and optimum locations 7. Explore the installion of pipe loops to increase the throughput in a gas pipeline 8. Calculate the effects of pipe diameter, wall thickness, material of construction, and specific safety requirements dictated by design codes				
Prerequisites	ME 200 Thermodynamics I ME 202 Fluid Mechanics I		Corequisites		
Course Content	**1. Pressure drop due to friction** – Ideal and real gases				

	- General flow equation - Colebrook-white plain and modified equation - Panhandle A and B equation - Comparison of flow equations **2. Pressure required to transport natural gas** - Frictional effect - Effect of pipeline elevation - Pipping in series and in parallel - Locating pipe loops **3. Compressor Stations** - Compressor stations locations - Hydraulic balance - Isothermal, adiabatic and polytropic compression - Compressor performance curves **4. Pipe analysis** - Pipe wall thickness - Barlow's equation - Pipe material and grade - Class location **5. Valves and flow measurements** - Purpose and types of valves - Codes for design and construction - Flow measurement - Flow meters **Module 6. Mass and Energy Balance Laboratory Exercises** Laboratory Exercise 1: Aspen Plus – Performance of a pump Laboratory Exercise 2: Aspen Plus – Performance of a compressor Laboratory Exercise 3: Aspen Plus – Pipes performance Laboratory Exercise 4: Aspen Plus – Compressor station sizing
Teaching Methodology	The teaching methodology of this course will be based on lecturing, demonstrating and collaborating. - Lecture notes, comprising of the fundamentals of each module of the course will be prepared and presented in class on a weekly basis. The notes will introduce the major concepts and will focus on specific learning outcomes of the course. - Demonstration activities including the solution of worked examples in class on a weekly basis, as well as laboratorial work will also be employed. For each fundamental concept, at least one worked example will be solved during lectures. The laboratory work will cover all major topics of the course, allowing the students to personally relate to the presented knowledge. - Collaborating teaching through classroom discussion and debriefing will also be encouraged during lectures. Besides from the notes taken by students in class, all of the course material will be made available through the class website and also through the

	eLearning platform. The instructor will also be available to students during office hours or by appointment in order to provide any necessary tutoring.
Bibliography	Textbooks: Menon, E. S. (2005). Gas pipeline hydraulics. Taylor and Francis. Finlayson, B. A. (2012). Introduction to chemical engineering computing. John Wiley & Sons.
Assessment	Students will be assessed through: - An assignment related to the laboratory exercises - A midterm test at the 7th week of the course, examining the pressure drop of natural gas in gas pipes and the pressure required to transfer natural gas - A final test at the end of the semester, in which all material will be examined. The weights of the course assessment are as follows: Assignment: 20% Midterm Exams: 20% Final Exams: 60%
Language	English