



Course Code OGEE-522	Course Title LNG Systems	ECTS Credits 7.5
Prerequisites None	Department Engineering	Semester Fall
Type of Course Required	Field Oil, Gas and Energy Engineering	Language of Instruction English
Level of Course 2 nd Cycle	Lecturer(s) Dr Constantinos Hadjistassou	Year of Study 1 st /2 nd
Mode of Delivery Face-to-face	Work Placement N/A	Co-requisites None

Objectives of the Course:

The main objectives of the course are to:

- Review the Liquefied Natural Gas (LNG) market focusing on major producers and importers, market trends, cost drivers and challenges;
- Elaborate on natural gas field extraction and processing, gas compression, acid gas removal, dehydration and hydrocarbon recovery;
- Present the main natural gas liquefaction cycles: a) Joule-Thomson, b) Classical cascade, b) Mixed-refrigerant, c) Pre-cooled mixed refrigerant;
- Outline the LNG storage facilities, namely, above ground metal tanks, above or subterranean concrete tanks, inground frozen earth tanks & mined caverns;
- Present export and import facilities, (LNG) pipelines, floating storage and regas units;
- Explain the main LNG tank(er) designs, containment systems, gas boil-off issues, LNG hazards such as roll-over and sloshing;
- Detail safety & security considerations for LNG plants, storage & transport

Learning Outcomes:

After completion of the course students are expected to be able to:

1. Appreciate the dynamics of the LNG market and existing & emerging export and import countries, cost considerations and patterns;
2. Understand the natural gas field processes, role of compression stations, sour gas removal, dehydration and hydrocarbon fractionation;
3. Compare and contrast the different natural gas liquefaction cycles and refrigeration issues;
4. Understand the engineering and construction aspects of LNG storage facilities, materials, insulation systems, common failures, limitations;
5. Familiarize with (LNG) pipelines, floating, storage & regas units, land regas terminals;
6. Learn about the dominant LNG carrier designs of prismatic & spherical geometries, containment systems and land and marine gas boil-off utilization;

7. Understand the layout of LNG plants, LNG storage and export option as well as safety and security considerations.

Course Contents:

- The US, EU, and Asian LNG markets, market trends and LNG unique features;
- Major LNG export players (Qatar, Australia, Indonesia) and import countries (Japan, South Korea, India, China), emerging markets, forthcoming projects;
- Natural gas quality metrics, stream processing including liquids removal, water gaseous components and acid gases;
- Liquefaction refrigeration cycles: a) Joule-Thomson cycle, b) Classical cascade, c) Mixed-refrigerant, d) pre-cooled mixed refrigerant;
- Characteristics of above ground metal tanks, above or underground concrete pre-stressed tanks, inground frozen earth tanks and mined caverns;
- Export and import LNG facilities, floating storage and regas vessels, pipeline insulation, LNG carrier loading arms, on-board LNG re-liquefaction, etc.;
- Particulars of dominant LNG tanker designs, containment systems, gas boil-off use, stratification, roll-over and sloshing;
- General arrangement of LNG plants, LNG storage, characteristics of LNG ships;
- Safety and environmental issues associated with LNG plants, security challenges such as cyber attacks and strategies on how to guard against them.

Learning Activities and Teaching Methods:

Lectures, Projects, Discussion

Assessment Methods:

Homework, Project assignments, mid-term exam, final exam.

Required Textbooks / Reading:

Title	Author(s)	Publisher	Year	ISBN
Fundamentals of Natural Gas Processing	Kidnay J Arthur & Parrish R William	Taylor & Francis	2006	978-0-8493-3406-1

Recommended Textbooks / Reading:

Title	Author(s)	Publisher	Year	ISBN
Natural Gas Engineering Handbook	Guo Boyun and Ghalambor Ali	Gulf Publishing Company	2005	0976511339
Engineering Data Book, 12th ed.	Gas Processors Suppliers Association (GPSA)	GPSA	2004	9789998095533
Advanced Natural Gas Engineering	Wang Xiuli and Economides J Michael	Gulf Publishing Company	2009	9781933762388