Balhaf LNG School of Technology

Graduate Diploma in Petroleum Studies

Major in

Liquefied Natural Gas (LNG)

	INDUCTION ***Launching ceremony*** Administration / Plant visit / Fundamentals of LNG and LNG main risks awareness	Week 39, 2012
Module 01:	**APPLIED THERMODYNAMICS – CRYOGENIC LOOPS** Fundamentals of Reservoir, Drilling and Completion Gas well effluent: composition, characterization parameters Liquid-Vapor equilibrium of pure substances – Vapor Pressure curves ProII Simulation: detailed application of a **Propane Cryogenic Loop** (different optimizations: condenser and chilling temperatures, interest of multiple expansion stages, interest of subcooling…) Liquid-Vapor equilibrium of mixtures – Phase envelop (supercritical condition to avoid two phase flow) ProII Simulation: **MR loops** – Interest of using a mixture Distillation Process – ProII simulation of an LPG Splitter	Week 40, 2012
Module 02:	**NATURAL GAS PROCESSING AND TRANSPORT BY PIPE** Gas specifications – Feed for Natural Gas Processing Hydrate formation condition, water content of gases, Dehydration (TEG + Molecular sieves) Sweetening: H2S and CO2 removal NGL extraction and fractionation – Examples Transport of natural gas in gas phase (Gas Pipe) Overview of natural gas economics	Week 41, 2012
Module 03:	**NATURAL GAS LIQUEFACTION** The LNG world LNG Specific properties Feed gas pre-treatment: filtration, AGR, Dehydration, Mercury removal… Liquefaction processes LNG Storage, (off)loading and transport LNG trends – Research and new developments LNG economic aspects	Week 42, 2012

On Job Training	**FIELD INDUCTION** YLNG induction: - safety and security rules, - muster points, alarms, - behavior… ***Preparation of a report to be presented during course Module 04***	Week 43, 2012
	BREAK	*Weeks 44 & 45, 2012*
Module 04:	**Proll SIMULATION OF GAS PROCESSES** ***Oral presentation of OJT01 works (Jury including YLNG representatives)*** Gas processing plant: primary separator, Sweetening, Dehydration, NGL extraction, compression… Water content of moisture-saturated gases NGL Fractionation – LPG production…	Week 46, 2012
Module 05:	**STATIC EQUIPMENT FOR LNG APPLICATIONS** Piping & Valves Metallurgy – Corrosion – Fundamentals of inspection Thermal equipment: S&T, SW and PF heat exchangers, Air Coolers, Furnaces, Boilers, Vaporizers… Instrumentation & Process control – Safety System (HIPS, ESD, EDP, F&G, USS)	Week 47, 2012
Module 06:	**CASE STUDY: ANALYSIS OF THE DIFFERENT PFD OF YLNG** The aim of this module is to illustrate the previously studied subjects, using schemes from an existing plant in order for the participants to better digest the course content. Typical **UTILITIES** (Nitrogen, Steam, Sea water, Cooling Water, C_2 and C_3 storage, chemicals …) required for an LNG plant are also detailed. Besides, this module enables to familiarize the participants with the various diagrams (Plot Plan, Block Flow Diagram, PFD, PID, Isometrics)	Week 48, 2012
OJT 02:	**PRODUCTION SHIFT WORK: Control room + Liquefaction Plant** Integration within production shift personnel in charge of: - Control room - Feed pretreatment and liquefaction installations on the field - Laboratory analysis and quality control ***Preparation of a report to be presented during Module 07***	Week 49, 2012

OJT 03:	**PRODUCTION SHIFT WORK: Utilities, LNG Storage, and Jetty** Integration within external shift personnel in charge of: - Utilities (nitrogen, Stream, Sea water, Cooling water, C2 and C3 storage, chemicals…) - Jetty, offloading, and marine operations - LNG storage tanks ***Preparation of a report to be presented during Module 08***	Week 50, 2012
	BREAK	*Weeks 51,2012 to 01, 2013*
Module 07:	**PUMPS – ELECTRICAL MOTORS** ***Oral presentation of OJT02 works (Jury including YLNG representatives)*** Fundamentals of fluid flow – Friction loss calculation for single flow Centrifugal pumps: technology, design, operation Reciprocating pumps: technology, design and operation	Week 02, 2013
Module 08:	**COMPRESSORS** ***Oral presentation of OJT03 works (Jury including YLNG representatives)*** Gas compression and expansion laws Centrifugal compressors: technology, design and operation Reciprocating compressors: design, technology and operation Overview of turbo-expanders	Week 03, 2013
Module 09:	**GAS TURBINES – POWER GENERATION AND DISTRIBUTION** Gas turbines: - gas turbine equipment - operating conditions and performances - Selection criteria - Operation Power generation and distribution	Week 04,2013
OJT 04:	**MAINTENANCE OJT: Static Equipment** Integration within maintenance personnel in charge of: - Mechanical maintenance and inspection - Instrumentation and process control – Safety system - Power generation and distribution ***Preparation of a report to be presented during Module 10***	Week 05, 2013

OJT 05:	**MAINTENANCE OJT: Rotating Equipment** Integration within maintenance personnel in charge of: - Pumps - Compressors - Gas Turbines ***Preparation of a report to be presented during Module 11***	Week 06, 2013
	BREAK	*Weeks 07 & 08, 2013*
Module 10:	**SAFETY ENGINEERING SPECIFIC TO LNG** ***Oral presentation of OJT04 works (Jury including YLNG representatives)*** Physical properties of LNG related to safety: Flash Point, Fire Point, Auto-ignition, Flammability limits… Hazards specific to LNG: Rapid Phase Transition (RPT), Roll-over, Sloshing, Cryogenic liquid jets… LNG Hazard prevention and mitigation measures during operation: LNG Spillage, LNG clouds, LNG fire. Risk assessment – Hazid, Hazop, consequence analysis… Plant lay-out – Case study Risk reduction and consequence mitigation Active and passive fire detection systems Flare and liquid drainage systems Emergency escape and rescue	Week 09, 2013
Module 11:	**HSE IN OPERATION AND DURING WORKS** ***Oral presentation of OJT05 works (Jury including YLNG representatives)*** **Safety in production operations**: - use of utilities, - BD and drainage, - mechanical and electrical lock-out… **Safety in works**: - lifting and rigging, confined space, works at height, - use of tools, radioactive, electrical… Safety management – Responsibilities	Week 10, 2013
Module 12:	**LNG PLANT OPERATION – Practice of Dynamic Simulator** *Practice of dynamic Simulator* Commissioning, Start-up (including defrost, derime), Shutdown operations Normal Operation: influence of main operating condition, composition of MR etc	Week 11,2013

OJT 06:	**PRACTICAL HSE TRAINING** Practical HSE training: - LNG Spill control - fire fighting exercises - All other practical HSE training required by YLNG ***Preparation of a report***	Week 12, 2013
	BREAK	*Week 13 & 14, 2013*
	FINAL INTERNSHIP (1 of 2)	*Weeks 15 – 18, 2013*
	Team work: 2 to 3 trainees maximum per group **YLNG contribution:** • Define the internships subjects • Supervise the progress of the internship work (a TUTOR is assigned for each group) • Participations to the JURY **IFP School / IFP Training contribution:** • Validate the subjects of the internships • Part-time assistance to the trainees • Participation to the JURY	
	BREAK	*Weeks 19 & 20, 2013*

FINAL INTERNSHIP (2 of 2)	*Weeks 21 – 24, 2013*

Team work: 2 to 3 trainees maximum per group

YLNG contribution:

- Define internships subjects
- Supervise the progress of the internship work (a TUTOR is assigned for each group)
- Participations to the JURY

IFP School / IFP Training contribution:

- Validate the subjects of the internships
- Part-time assistance to the trainees
- Participation to the JURY

BREAK	*Week 25, 2013*
INTERNSHIP JURY: presentation of the results	**Week 26, 2013**