Course Outline

Day 1
- What is natural gas?
- Origins
- Properties
- Specifications
- End uses and markets for natural gas
- Environmental advantages
- Physical behavior of natural gas systems
- Physical and thermal properties
- Phase behavior analysis
  - Pure substances
  - The phase rule
  - Behavior of mixtures
  - Vaporization by gas pressure
  - Molecular theory of gases and liquids
  - Natural gases
  - Density of natural gas
  - Density of liquids
  - Dense phase
  - Surface tension
  - Viscosity
  - Thermal conductivity of gases
  - Thermodynamic properties
  - Sampling and analysis

Day 2
- Natural gas processing plant Flowsheet
  Equipment and components
- Heat exchange in gas processing
  Heat transfer theory
  Mechanisms of heat transfer
  Process heat duty
- Heat exchangers types
  Shell and tube
  Double-pipe
  Plate and frame
  Aerial coolers
- Fired heaters
- Heat recovery units

Day 3
- Hydrates
  Determination of hydrate formation temperature or pressure
  Condensation of water vapor
  Temperature drop due to gas expansion
  Thermodynamic inhibitors
  Kinetic inhibitors and anti-agglomerators
- Low temperature exchange (LTX) units and line heaters
  LTX units
  Line heaters
  Heat duty
  Fire-tube size
- Condensate stabilization
  Partial pressure
  Multistage separation
  Multi flashes
  Cold feed distillation tower
  Distillation tower with reflux
  Condensate stabilizer design
  Trays and packing
  Condensate stabilizer as a gas processing plant
  LTX unit as a condensate stabilizer
Introduction

The rapidly increasing worldwide demand for natural gas as an energy source requires expertise in gas engineering technology, which involves several production operations such as dehydration, acid gas removal, recovery of natural gas liquids and the production of liquefied natural gas. In addition, one involved in such industry needs to be familiar with different gas sources, specifications, storage requirements, transportation and distribution.

Course Objectives and Benefits

This short course is designed to give the attendants the fundamentals of natural gas handling systems and facilities including some of the details of the process. Specifically, by attending this course you will:

• Gain a deep knowledge of the properties, specifications and end uses of natural gas.

• Gain a deeper understanding of typical natural gas processing operations, including:
  o Dehydration
  o Acid gas removal
  o Recovery of ethane, propane and NGL (natural gas liquids)
  o Sulfur recovery

• Gain a deeper understanding of the production of liquefied natural gas (LNG).

• Gain a deeper knowledge of the different equipment and facilities found in natural gas processing plants.

Day 4

• Acid gas treating
  Gas sweetening processes
  Solid bed absorption
  Chemical solvents
  Physical solvent processes
  Direct conversion of H2S to sulfur
  Sulfide scavengers

  Process selection
  Design procedure for iron-sponge units
  Design procedure for amine systems

• Amine absorber
• Amine circulation rates
• Flash drum
• Amine reboilers
• Amine stripper
• Rich/lean amine exchanger
• Amine cooler
• Amine solution purification
• Materials of construction
• Gas dehydration
  Water content determination
  Glycol dehydration
    Process description
    Choice of glycol
    Design considerations
    System sizing
    Glycol powered pumps
  Solid bed dehydration
    Process description
    Design consideration

Day 5

• Gas processing
  Absorption/lean oil
  Refrigeration
  Choice of process

• Compressors
  Types of compressors
  Specifying a compressor
  Reciprocating compressors process considerations
  Centrifugal compressors process considerations

• Mechanical design of pressure vessels
  Design considerations
  Inspection procedure
  Specification and design of pressure vessels

• Pressure relief
  Relief requirements
  Type of devices
  Valve sizing
  Installation

• Valves, fittings and piping details
  Valve types
  Chokes
  Piping design considerations
Who Should Attend?
Technical and non-technical personnel involved in the activities of natural gas industry. Specifically, technical, operations and maintenance personnel who had limited exposure in this area, or professionals involved in other areas of the gas industry who require a comprehensive overview of natural gas processing will find this course ideally suited for them.

Course Description
This course will start by defining what natural gas is, its properties, specifications and end uses. Then, typical gas processing operations will be discussed, including dehydration, acid gas removal, recovery of ethane, propane and NGL (natural gas liquids), and liquefied natural gas (LNG) operations. Sulfur recovery will also be discussed. Typical equipment and facilities that are found in typical natural gas processing operations will also be discussed including compressors, vessels, relief systems and safety systems.

Course Methodology
A highly interactive combination of lecture and discussion sessions will be managed to maximize the amount and quality of information, knowledge and experience transfer. The sessions will start by raising the most relevant questions, and motivate everybody finding the right answers. The attendants will also be encouraged to raise more of their own questions and to share developing the right answers using their own analysis and experience.

About the Course Instructor
Engr. Maurice Michel Hanna, graduated with Bachelor of Science in Petroleum Refining Engineering from Suez Canal University, Egypt and Master Degree in Petroleum Refining and Petrochemical Industry from Petroleum Institute of Romania, and he is a Certified Saudi Aramco Training Specialist.

He has more than 30 years of extensive field experience oil & gas, petrochemical and other process plants, and mainly in project management, design, selection, specification, installation, maintenance, operation, plant optimization and trouble-shooting of oil, water and gas handling facilities in the oil and gas industry.

Throughout his professional career he have served for several oil & gas companies such as;
• Process Engineer at El-Nasr Petroleum Company, Alexandria, Egypt.
• Senior Technical Instructor at Saudi Aramco, Saudi Arabia.
• Technical Instructor (On-Job-Training) at Saudi Arabian marketing and Refining (SAMARC), Jeddah - Saudi Arabia.
• Process Advisor at Al-Furat Petroleum Company (AFPC), Shell Join Venture (Subcontractor: IHRDC), Syria.
• Production Trainer (On-Job-Training) at Abu Dhabi Marine Operating company (ADMA – OPCO, Subcontractor: IHRDC), United Arab of Emirates.
• Commissioning (Process) Engineer at Middle East Oil Refinery (MEDOR, Subcontractor: TECNIP International), Egypt.
• Production Advisor at Al-Furat Petroleum Company (AFPC) Shell Join Venture (Subcontractor: TriStar Meddle East), Syria.