



# **OIL & GAS**

# **CURRICULUM/CONTENT**

**DESIGNED FOR MALKU INSTITUTE OF TECHNOLOGY**



**PREPARED BY: UNIQUE GLOBAL CONNECT SOLUTIONS**



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## **1.0. Philosophy of the Programme**

This programme has been designed to provide unique study, application and technical knowledge through education, training and research that provides an international standard Oil and Gas training of highly skilled basic and middle level professionals responsive to the needs of the local Oil and Gas industry. The following constitutes the pillars upon which the guiding philosophy rests:

- i. search for technical and scientific knowledge that addresses particularly local issues
- ii. application of technical and scientific knowledge to the local industry as well as solve social problems.
- iii. provision of scholarship, through teaching and research, to its students, staff and all others who engage in academic work with the Institute.

The Institute is committed to this philosophy and aims to:

- i. provide education that inculcate high ethical and moral standards in its students to serve humanity
- ii. perform research activities that incorporate cutting-edge technology and that which is environmentally friendly.
- iii. train oil and gas professionals, to international standards, who are highly skilled and service oriented.
- iv. produce oil and gas professionals who have competitive advantage in the local industry.

## **2.0. Objective of the Programme**

The objective of the Certificate Oil and Gas programme is to equip students with the expertise needed to solve problems in the Oil and Gas industry. The programme will:

- provide students with an opportunity to a balance academic, social and ethical developments relevant to the oil industry.
- provide students with relevant knowledge and skills in the field of entrepreneurship and expose them to available opportunities within the Oil and Gas industry.
- provide students with high quality programmes that will equip them with skills.
- teach students the underlying rudiments of the oil and gas exploration in terms of technical services and socio-ethical issues relevant to the local Oil and Gas industry.
- expose students to 21<sup>st</sup> century way of doing business in a socially responsible manner.

- expose students to a wide range of skills relevant to the local oil industry, thereby building human resource capacities for the oil and gas sector particularly for oil and gas reserves acquisition, design and development; maintenance and oil politics
- develop human centred critical and analytical thinking abilities of students.
- prepare students for a career in the oil and gas industry.
- expose students to the dignity of labour through field visits in collaboration with industrial players in the Oil and Gas industry including hands on training through internships.
- establish partnerships with oil and gas industry players as a way of enriching the quality of the programme both locally and internationally.

### **3.0. Expected learning outcome**

Participants at the end of this course are expected to understand the philosophy of oil and gas exploration and the reasons that underscore the need to produce oil and gas in commercial quantities. This course will give participants further insight into the following:

- (i) the nature of crude oil and how oil and gas are formed
- (ii) the operational/technical as well as support activities to explore the oil and gas
- (iii) how these activities are managed effectively for the benefit of all stakeholders
- (iv) understand that the industry is highly political as well as the nature of politics
- (v) understand the importance of Corporate Social Responsibility (CSR) and the role it plays in the oil industry
- (vi) have an in-depth knowledge about entrepreneurship and the available opportunities in the oil and gas industry

### **4.0. Admission Requirements**

The CERTIFICATE-OIL AND GAS programme will be available to the following categories of applicants:

#### **Category A: SSSCE/WASSCE Certificate holders (Secondary School levers)**

Applicant must have passes in three (3) elective subjects, including elective Mathematics and (3) core subjects. The core subjects must include Mathematics, Science and English Language.

#### **Category B: Oil and Gas Professionals**

Applicant must have at least one (1) year experience in the oil and gas or petrol chemical industry.



### **Category C: Mature Persons**

Applicant must have age 25 years or above, passes in Mathematics, English, General Science and petrol chemical experience.

### **Category D: First Degree Graduates**

Applicant must have a first degree and wish to have a career change into the oil and gas industry

**All applicants in categories B and C MUST have at least two (2) years work experience.**

**All categories of applicants may undergo a selection interview.**

### **5.0. Programme Components**

The CERTIFICATE – OIL AND GAS PROGRAMME is a twenty four (24) week programme during which participants are required to study a core module and a maximum of three (3) other modules. Students will however go on recess after the first twelve (12) weeks after which they will come back to finish the second twelve (12) weeks. The programme has been designed in such a way that anybody can enrol to pursue a course irrespective of one's background.

The programme has been broken down into two (2) main levels and they include;

- Basic Level
- Advanced Level

#### **Basic Level**

The basic level has been designed specifically for participants with West African Senior Certificate Examination, Diploma, HND and First Degree Holders . Considering the technical nature of the programme only participants with science backgrounds will be admitted to enrol to pursue the programme. Prospective students will be required to pursue this programme for a period of 12 weeks (3 months). The 12 weeks shall include a 2 week familiarization exercise with an Oil Company, field visits and 1 week for reporting and presentations.

#### **Advanced Level**

This program is designed for Senior Executives, Executives, Managers, Engineers, Supervisors, Officers in the Oil and Gas Industry. The duration of the course will be for a period of eight weeks (2 months). The 8 weeks programme constitutes 7 weeks of lectures and 1 week for field visits, reporting and presentations. Evening and

Saturday options are also available to cater for those who are engaged during the day.

The programme will be very intensive and interactive.

### **Basic Level**

The following modules will be treated at the basic level;

#### **6.0. Module One: Core Module**

##### **1. Introduction**

- What are Oil and Gas?
- Reservoirs
- Reserves – how are they quantified?
- Reserves – Where are they?

#### **7.0. Module Two: Technical Stream**

##### **1. Oil Service Companies and Contractors**

- Seismic Acquisition
- Seismic Processing
- Drilling
- Well Logging
- Well Completions and Workover
- Well Stimulation Techniques

##### **2. Design and Construction**

- Process Plants
- Pipelines
- Storage and offshore loading
- Roads and accommodation

##### **3. Offshore Technology**

- Exploration and Drilling
- Subsea Technology
- Fixed Production Platforms
- Floating Production Platforms

##### **4. Oil and Gas Field Development**

- Reserves Development
- Primary, Secondary and Tertiary recovery Techniques
- Process and Export
- Associated Gas
- Unassociated Gas: LNG and GTL options
- Shale Gas Impact
- Implications

### ***8.0.Module Three: Support Services Stream***

#### **1. Project Management**

- Project Economics, including Discounted Cash Flow evaluation
- Project Definition
- Planning and Resourcing
- Procurement
- Execution Supervision
- Commissioning and Start-Up

#### **2. Support Services**

- Diving Services
- Environmental Protection
- Catering

#### **3. Operational Support**

- Land Transport
- Marine Transport
- Air Transport, Fixed Wing and Rotary

#### **4. Maintenance Services**

- Rotating Machinery
- Electrical
- General Plant
- IT and Communication

### ***9.0.Module Four: Management Stream***

#### **5. Oil and Gas Management**

- Strategy
- Oil and Gas Simulation
- Project Management
- Emergency Planning
- Environmental Law

#### **6. Oil Politics**

- The Dutch Disease
- Ownership and Control
- Global Governance Initiatives
- Revenue Management
- Oil and Financial Trading

### ***10.0. Module Five: Marketing Stream***

#### **1. Energy Marketing**

- Retail of Petroleum Products
- Marketing of Electricity Gas



**11.0.      *Module Six: Entrepreneurship***

- How to start a business
- How to create and manage a budget
- Cash Flows, Savings and Investments
- Business Planning
- Good Practise in selling
- Customer Service
- Communication Skills
- How and where to secure funding
- Time Management

**12.0.      *Module 7: Corporate Social Responsibility***

- What is CSR (Definitions)?
- History of CSR
- Theories of CSR
- Creating Shared Value
- Business Case
- CSR Strategy and engagement within Companies
- Challenges of CSR
- Effectively communicating CSR
- Global Best Practices



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## **Advanced Level**

The following modules will be treated at the advanced level;

### **13.0. Module 1- Principles and Economics of Oil Refining**

#### **PRINCIPLES AND ECONOMICS OF OIL REFINING**

The programme discusses the quality of crude oil and its value, the refined petroleum products and its quality and the markets that they are traded in. We will study how the size, configurations and complexity of refineries impact on refinery profitability and how margins can be calculated. How refinery operations such as planning, as well as optimization and blending affects refinery profitability. How to manage energy and oil loss in the refinery will also be looked into. Long term planning in market study to forecast product demand and configuration to evaluate processing options will finally be projected.

This program is designed for anyone interested in the economics of the petroleum refining industry, with a deeper look at opportunities to improve refinery profit margins. It is best for refinery planning personnel, oil and gas engineers, Oil Marketing Companies, Oil Trading Companies, Bulk Distributing Companies, consulting companies, insurance firms financial Institutions and government agencies will also find the program useful.

The Programme outline includes the following;

- **Crude Oil Quality and Value**
  - Cost and quality of crude oil
  - Factors affecting price of crude oil
- **The refined products slate**
  - Main groups and general petroleum products
  - Factors affecting the quality and value of petroleum products
- **Oil Markets**
  - Dynamics in supply and demand of crude oil and petroleum products
  - Benchmarks
  - Markets and Contracts
  - Arbitrage

- **Refinery size, configuration and Complexity**
  - How size of refineries impacts on profitability
  - Types of refinery configuration
  - How refinery configuration affects profitability
  - How complexity is measured
- **Refinery Crack Spreads or Margins**
  - How to assess industry performance
  - How to calculate crack spreads
- **Operational efficiency**
  - Refinery planning (day-to-day operations optimisation)
  - Refinery scheduling (crude oil, production unit and blending)
- **Energy conservation and loss**
  - Understanding energy in a refinery and its related cost
  - Understanding oil loss and its cost
  - Interaction between energy and oil loss
- **Investing for the future**
  - Assess main trends in crude oil quality that will affect refineries in the future
  - Assess main trends in products demand and specifications that will affect refineries in the future
  - New builds versus upgrades of refineries

#### 14.0. **Module 2- Tank Farm Operations and Management**

##### **TANK FARM OPERATIONS AND MANAGEMENT**

This program is designed for anyone interested in acquiring in-depth practical knowledge of Depot Operations and Management in the Oil and Gas industry, Storage and Transportation of Petroleum products, Receipt of Crude Oil and Petroleum products to a terminal by pipelines and barges. Supply Chain in the Downstream sector in the Oil and Gas industry. It is best for Engineers, Oil Marketing Companies, Oil Trading Companies, Bulk Distributing Companies, Petroleum warehousing, consulting companies, insurance firms financial Institutions and government agencies will also find the program useful. The course outline includes the following;

## **1. a) Level Gauging, draining and Blending of Petroleum Products**

- Customs dipping – ullage and innage
- water level gauging
- product level gauging
- using the product paste
- catchment area draining
- flow rate estimation and transfer monitoring
- tank draining, roof draining and catchment area draining
- Effect of tank measurement errors. Product temperature and free water level gauging.

## **b) Transfer of Products**

- Operational procedure for receiving of products from a ship to the tank farm
- Operational procedure for loading of products from the tank farm to a ship
- Determining the volume of product in a tank
- calculating time taken to stop an in/out product tank
- Reading of Tank Calibration chart

## **2. Chemical and Physical Properties of Petroleum Products**

## **3. Supply Chain at the Downstream Industry**

## **4. Types of Pipelines**

- Flow Pipelines
- Gathering and Feeder Pipelines
- Crude Trunk Pipelines
- Petroleum Product Trunk Pipelines

## **5. Pipeline Regulations and Standards**

## **6. Pipeline Configurations and Operations**

- Oil pumping and compressor stations
- Pipeline product storage
- Pipeline cleaning

- Communications
- Petroleum product shipment
- Pipeline and Marine Receipts
- Product receipt and delivery
- Batch shipments and interface
- Environmental protection

## **7. Marine Tankers and Barges**

## **8. Crude Oil petroleum products marine vessels**

- Supertankers
- Oil tankers
- Barges

## **9. Motor Vehicle and Railroad Transport of Petroleum Products**

## **10. Loading Rack fire protection**

## **11. Aboveground Tank Storage of Liquid Petroleum Products**

- a) Terminals and bulk plants
- b) Tank Farms
- c) Storage Tanks
  - Atmospheric Cone Roof Tanks and Features
  - Atmospheric Floating Roof Tanks and Features
- I. External Floating Roof Tanks
- II. Internal Floating Roof Tanks
- d) Tank Gauging and Sampling
- e) Tank Venting and Cleaning



- Preliminary Preparations
- Control of Ignition Sources
- Removing Residue
- Isolating the Tank
- Vapour Freeing
- Initial Entry, Inspection and Certification
- Cleaning, Maintenance and Repair
- Returning the Tank to Service
- Fire Protection and Prevention

15.0.      **Module 3 Instrumentations and Control Installation in the Oil and Gas Industry**

**INSTRUMENTATIONS AND CONTROL INSTALLATION IN THE OIL AND GAS INDUSTRY**

**Course Description**

The course explains the concept of Custody Transfer for liquid petroleum products. Accuracy is important in terms of uncertainty of measurement; calibration; technical specifications and process requirements. Flow Measurement including orifice plate and DP transmitter; multi-beam ultrasonic flowmeter; Coriolis mass meter; turbine meters amongst others.

Level Measurement, traditional methods such as capacitance and hydrostatic techniques are covered together with more modern technologies such as ultrasonic and radar measurements.

**Terminal & Pipeline Configuration**

Explanation on terminal tank gauging; Lease Automatic Custody Transfer (LACT); sediment and water considerations. Pipeline pressure and process characteristics. Truck custody transfer, marine and aviation, on-loading and off loading.

## **Monitoring/Controlling Losses and Flowmeter Selection**

Loss control systems – an applied approach – model based system; leak detection / leak testing. Case studies of marine applications; measurement surveys and measurement reports. Multi-phase flowmetering and applications. API measurement standards and volume correction tables and also rules for selecting flowmeters for custody transfers.

### **Programme outline:**

Upon successful completion of this course, participants will gain knowledge on the following topics:

#### **1. Definition**

- Basic Measurement Concepts
- Performance Terms and specifications
- Advanced Terms
- Definition of Terminology
- P&ID Symbols
- Selection criteria
- Typical Applications

#### **2. Accuracy**

- Uncertainty
- Calibration
- Analysis of Specification
- Process Specification
- Technical Specifications
- Accuracy Specifications

#### **3. Flow Measurement**

- D.P. Meters
- Displacement Meters



- Turbine Meters
- Magnetic Flowmeters
- Ultrasonic Flowmeters
- Doppler Meters
- Vortex Meters
- Coriolis Flowmeter

#### **4. Level Measurement**

- Point Level
- Continuous Level
- Capacitance Measurement
- D.P. Measurement
- Bubbler Tube
- Ultrasonic Measurement
- Radar Measurement
- Radiation Measurement

#### **5. Custody Transfer**

- Scope/Definition
- Contract Requirements
- Static Measurements (Tank Level)
- Dynamic Measurement (Flow Metering)
- Trends in Calibration
- Types of Calibration Test Rigs
- Calibration Systems

#### **6. Terminal Custody Transfer**

- An Introduction to Tank Gauging
- Tank Gauging Techniques
- Quality Assessment
- Uncertainties
- Safety



- Developments
- Future Trends

## **7. Pipeline Meter Selection**

- General Rules
- Maximum Viscosity
- Maximum Flow Rate
- Maximum Pressure
- High Paraffin Content

## **8. Truck Custody Transfer**

- Truck Types
- Receiving Positions
- Safety
- Accountability
- Equipment
- Performance

## **9. Leak Detection**

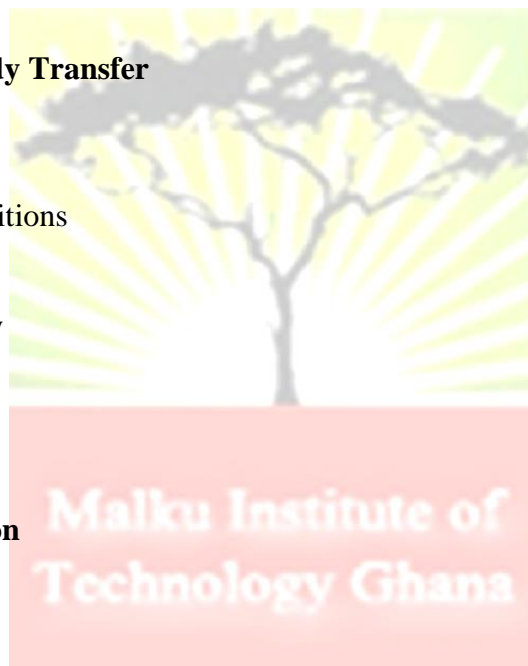
- Localisation
- Human Factor
- Real Time Transient Model
- Leak Testing

## **10. Multiphase Flowmeter**

- Operating Principles
- Multiphase Devices
- Advantages and Disadvantages
- Cross Correlations Flowmeters

## **11. Flowmeter Selection Criteria**

- Cost Considerations



- Application Guidelines
- Advantages & Disadvantages
- Coriolis Flowmeter
- Vortex Shedding
- Magnetic Flowmeter Sizing

16.0.      **Module 4 Introduction to Work Permit System in the Oil and Gas Industry**

**INTRODUCTION TO WORK PERMIT SYSTEM IN THE OIL AND GAS INDUSTRY**

Work Permit System has become very vital in the Oil and Gas industry. The implementation of a well understood permit to work will help in enhancing and improving safety standards in both the upstream and the downstream oil and gas industry and resulting in the reduction of the likelihood of undesired incidents or accidents in working area.

**Program outline:**

**1. Introduction**

**2. Works Requiring Permit**

- Major and minor maintenance work
- Inspection
- Construction
- Alteration
- Hot work
- Cleaning activities of process equipment
- Entry into confined space
- Excavation
- Vehicle entry into process areas
- Work at height
- Handling of materials using mechanized means in operating areas
- Erection and dismantling of scaffold
- Radiography
- Isolation and energisation of electric equipment/ facilities



### **3. Types of work permit**

- Cold work permit
- Hot works
- Entry in a Confined Space Permit and Clearance
- Excavation Permit and clearances
- Electrical Isolation and Energisation Permit and Clearances
- Working at Height Permit
- Works Exempted / Partially Exempted from Requirement of Permit

### **4. General requirements of work permit**

### **5. Responsibilities of permit signatories**

- Shift in charge
- Head of Department
- Safety officer or Safety head
- Receiver/Executing Authority

### **6. Work permit procedure and guidelines**

- Electrical Isolation and Energisation Permit
- Permit for Working at Height
- General Permit Requirements
- Other Permit Requirements

### **7. Surrendering of work permit**

### **8. Surveillance and withdrawal of permit**

### **9. Training and awareness**

### **10. Audit of work permit system**

## **17.0. Module 5-Oil Politics and Oil and Gas Management**

### **Oil and Gas Management**

- Strategic Management
- Oil and Gas Simulation
- Project Management
- Emergency Planning
- Environmental Law

### **Oil Politics**

- The Dutch Disease
- Ownership and Control

- Corporate Social Responsibility
- Global Governance Initiatives
- Revenue Management
- Oil and Financial Trading

#### **18.0. Module 6-Introduction to Project Management in Oil and Gas**

- Project Economics, including Discounted Cash Flow evaluation
- Project Definition
- Planning and Resourcing
- Procurement
- Execution Supervision
- Commissioning and Start-Up

#### **19.0. Module 7-Exploration, Drilling and Production**

##### **20.0. Contact Hours**

A minimum of 20 contact hours a week for 8 weeks and 12 weeks respectively. Guided Learning Hours GLH.

##### **21.0. Duration**

The duration for the certificate in Oil and Gas programme (Basic level) shall be 12 weeks and the advanced level shall be 8 weeks.

##### **22.0. Mode of Assessment**

Attendance	5%
Continuous Assessments	25%
Mini Projects/seminars and presentations	30%
Exams	20%
Internship	20%

##### **23.0. Grading**

69 +	Distinction
60-69	Merit
46-59	Pass
Below 40	Fail

##### **24.0. Class Size**

Minimum	30 per a module
Maximum	40 per a module

### **25.0. Methods for teaching and learning**

Formal lectures, seminars and presentations including class discussions to include analysis and review of various case studies. Students will be actively engaged to contribute and make it very participatory. Class participation will however be one of the criteria for assessment.

### **26.0. Learning Aid**

A learning resource material will be provided to guide and serve as a quick reference point for contents of the programme. Other academic materials, as much as possible, will be made available to the student to help him/her with the course. This will include a pack or portfolio of books and stationary and other relevant materials that will enhance teaching and learning.

### **27.0. Recommendation**

In all there are seven (7) comprehensive modules with regards to both the Basic and the Advance Level. It is important to note that all the modules and all the courses under each module especially with the Basic level cannot be rolled out at the same time. Rolling out all the modules and courses at the same time will require more human resource (facilitators), more lecture halls etc and this may pose a lot of financial cost and burden on Malku Institute of Technology. We however recommend the following;

- Modules should be rolled out progressively
- A maximum of 4-5 modules should be started with
- The remaining modules can be rolled out/implemented over a period of 2-3 years

The above mentioned recommendations are all with respect to the Basic Level.

In as much as the course has been broken into Basic and Advanced Level we recommend that Malku Institute of Technology should start with the advance level as it would be much easier to attract participants to pursue the programme. Malku Institute of Technology can start getting students enrolled for the Basic Level once they start with the Advance Level.