**BAYUBALI ENGINEERING SDN BHD**

# INTERNAL COMBUSTION ENGINE (I.C.E.) OPERATOR COURSE

| | | | |
|---|---|---|---|
| **Training Date:** | As per schedule | **Training Venue:** | Kuala Lumpur, Malaysia. |
| **Basic Fee:** | RM2,500.00 + SST per participant (this includes course materials, meals, refreshment and attendance certificate) | | |

## DURATION

14 hours (Two (2) days)

## TARGET GROUP

The course is designed for those interested in becoming ICE-competent drivers, including operation technicians, operation team leaders/coordinators, and maintenance and inspection technicians.

## TARGETED INDUSTRY/INDUSTRIES

Oil & Gas, Petrochemicals, Power Plant, Renewal Energy Plant, Co-Generation Plant, Palm Oil Mills and Refineries, Plywood Industries, Hotels and all industries that are using Internal Combustion Engines.

## CERTIFICATION

This training course complies with DOSH's trained person requirements.

## COURSE OVERVIEW

This course develops competence in Internal Combustion Engine (ICE) systems for individuals interested in the operation and maintenance of these engines.

The course covers the fundamentals of how the design and operation of internal combustion engines affect their performance, efficiency, fuel requirements, and environmental impact. Topics include fluid flow, thermodynamics, combustion, heat transfer, friction phenomena, and fuel properties, with a focus on engine power, efficiency, and emissions.

Participants will explore the design features and operating characteristics of different types of internal combustion engines, including spark-ignition, diesel, stratified-charge, and mixed-cycle engines.

## COURSE OBJECTIVE

This course is required for those who want to operate Internal Combustion Engines (ICE), as mandated by the Department of Occupational Safety and Health (DOSH) under OSHA 2022.

The program also covers the design, installation, operation, and maintenance of these machines, highlighting the characteristic features of various reciprocating piston engine types, gas turbine types, their efficiencies, vulnerabilities, reliability, and operation and maintenance peculiarities.

## COURSE OUTCOMES

At the end of the course, the delegates will be able to: -

- Understand the manpower requirements for operating ICE as outlined in OSHA 2022.
- Describe the fundamentals of ICE, ICE classification, and engine performance.
- Understand the structure, operation, and timing diagrams of various piston engines, including 2-stroke and 4-stroke engines, Diesel Compression Ignition engines, Petrol Spark Ignition engines, turbochargers, starting systems, lubrication systems, fuel systems, and cooling systems, as well as engine operation and maintenance.
- Understand various gas turbine engines, including theory, major components and functions, auxiliary equipment, control systems, fire protection, instrumentation systems, and gas turbine operation, performance, and maintenance.
- Understand material behaviors for rotating machines.

## TRAINING METHODOLOGY

- Lecture
- Pre- and Post-Test
- Classroom discussions
- Short video presentation

## COURSE CONTENTS

**Laws of Malaysia Related to Internal Combustion Engines**

- Overview of the Occupational Safety and Health, 2022

**An Introduction to Internal Combustion Engines**

- Overview of Internal Combustion Engine
- ICE Classifications
- Intermittent Combustion Engine
- Continuous Combustion Engine
- Rotary Engine

**Gas Turbines**

- Basic theory of gas turbine systems
- Gas turbine process
- Types of Gas Turbine applications
- Advantages and Disadvantages of Gas Turbine

- Operating Principles
- Gas Turbine Main Components;
  - Compressor Section
  - Combustion Section
  - Turbine Section
- Gas Turbines Typical Loads
- Classification of Gas Turbines;
  - Basic type of gas turbine;
    - Aero
    - Industrial
  - Gas turbine classifications;
    - Single shaft
    - Spilt shaft
  - Compressor classifications
- Major Components and Its Function
- Start-up and Shutdown Guidelines
- Maintenance Procedures

**Reciprocating Engines**

- Classification of Internal Combustion Engines
  - Method of Ignition
  - Cycle of Operation
  - Numbers of Cylinders
  - Arrangement of Cylinders
  - Speed
  - Method of Cooling the Cylinder
- Engine Performance
- Diesel Engine Plant Auxiliaries
- Lubrication
- Engine Starting Methods
- Starting and Stopping Procedures
- Valves Positions
- Compression Ratio
- Firing Order
- Engine Main Components

**Combustion of Fuels**

- Introduction of Combustion
- Combustion Theory;
  - Perfect combustion
  - Complete combustion
  - Incomplete combustion
- Gaseous Fuels
- Characterization of Gaseous Fuels
- Typical Heating Value of Some Gaseous Fuels
- Liquid Fuels;
  - Characterization of Liquid Fuels
  - Flash Point
- Heat Rate

- Gas Turbine Combustion
- Diesel Engine Combustion;
  - Indirect-Injection Engine
  - Direct-Injection Engine

## ABOUT THE INSTRUCTOR



Ir. Mohd Normarzuki bin Ya'acob graduated with a Bachelor's (Honors) in Mechanical Engineering from the University of Malaya.

He is a registered Professional Engineer with a Practicing Certificate (Mechanical) from the Board of Engineers Malaysia (BEM) and a Corporate Member of The Institution of Engineers, Malaysia (IEM). He is also a certified First Grade Engineer (Steam Boiler and Internal Combustion Engine) by the Department of Occupational Safety and Health (DOSH).

He has worked with several companies, including Equator Engineering Sdn Bhd, Tenaga Nasional Berhad, Petronas Gas Berhad (Gas Processing Plant 5/6 and Centralized Utilities Facility), Qatar Petroleum (Head of Short Technical Training), and is currently the Managing Director of Bayubali Engineering Sdn Bhd.

Throughout his career, he has gained extensive field experience in internal combustion engines, steam boiler operation, troubleshooting, inspection, maintenance, and repair. He also has experience in project management, design, selection, specification, installation, maintenance, operation, plant optimization, and troubleshooting of utility facilities in the oil and gas industry.

He is the co-author of the book 'An Introduction to Steam Machinery,' published by the University of Malaya Publisher.