

Some modules of this training can be offered as distance learning

## IC Engine Training for Engineers

60 days

MGMPTH-EN-P

### Overview

#### LEVEL

Expert

#### PURPOSE

This course provides a high level, modern training in the engine field (gasoline and Diesel).

Because of the duration, the training can be recognized by a ENSPM diploma of Internal Combustion Engines Specialized Master, awarded by IFP School, provided satisfying results are obtained at the tests and a good assessment is given on the work done in the framework of a professional thesis development.

#### LEARNING OBJECTIVES

Upon completion of the training, participants will have acquired the requested knowledge and skills to be engine engineer.

Upon completion of the course, participants will be able to:  
know every field of IC thermal engine,  
act as an experienced engineer as well as a project leader.

### Agenda

#### INTRODUCTION TO ENGINE STUDY & TESTS

3 d

Operating cycles of reciprocating, theoretical and real engines. Combustion process. Combustion equation. Fuel/air ratio. Combustion energy aspects. Balances.

#### THERMODYNAMICS APPLIED TO ENGINES

2 d

Going through real cycles, methods and practical.

#### HYDROCARBONS & CAR FUELS

3 d

Introduction to refining. Gasoline fuels, Diesel fuels and biofuels: characteristics and adaptation. Composition/exhaust emissions relations.

#### COMBUSTION - EXHAUST EMISSIONS & AFTER-TREATMENT

7 d

Atmospheric phenomena: smog and greenhouse effect, consequences and regulations.  
Combustion: pollutants origins, combustion process, combustion systems.  
Exhaust gas after-treatment.

#### PERFORMANCES & MEASUREMENTS

3 d

Practical on dyno bench and on simulator: parametric physic measures, engine performances characterization, exhaust gas analysis, interpretation of results.

#### ENGINE ARCHITECTURE & TECHNOLOGIES

7 d

Fixed parts: cylinder-block and cylinder head, cylinder head gasket; clamping techniques.  
Mobile coupling system: crankshaft, conrods, pistons, bushings; balance.  
Timing: lift, dynamics, drive, technologies; variable timing.

## MATERIALS & PROCESSES

4 d

Metallurgy. Ferrous and non-ferrous metals foundry. Machining. Plastic materials. Prototyping process and methods.

Visit of a foundry.

## ENGINE THERMICS - LUBRICATION & LUBRICANTS

2 d

Cooling: thermal balance and engine needs, restrictions and design of the cooling circuit, Diesel specificities.

Lubrication and lubricants: tribology, roles, characteristics and classifications, how it affects after-treatment, lubrication circuit, blow-by gas.

## LOADING & COMPONENTS OF THE AIR CIRCUIT

6 d

Loading: pressure losses, acoustic applied to loading intake and exhaust lines, supercharging.

Supercharging: turbocharger operating, technology, adaptation to engine.

Other components: throttle valve, EGR, interface with the engine control.

## DIESEL & GASOLINE INJECTION SYSTEMS - IGNITION

5 d

Basic principles. Diesel common-rail injection systems. GII, GDI and ignition. Fuel circuits. Common rail: specificities, HP pump, rail, injectors. Technological issues. Interface with the engine control.

## CONTROL & PTD (POWERTRAIN DEVELOPMENT)

9 d

PT control: automatism, gasoline and Diesel torque structure, gasoline and Diesel depollution, EGR and OBD. PT supervision and inter-systems. Development: gasoline and Diesel PTD, automatic transmission.

On simulator: study and calibration of a control law.

## GEARBOX & TRANSMISSIONS

2 d

Manual, robotized and automatic gearboxes: principles and technologies, clutch and damped flywheel clutch, differential, transmission cams and seals.

## ADAPTATION OF THE PWT TO THE VEHICLE

2.5 d

Vibro-acoustics: bases, PT characterization, lab methods, pressure pulsation noises and sound quality. PT installation in a vehicle.

## HYBRID & ELECTRIC PWT

1 d

Serial and parallel architectures. On-board energy storages. Power electronics. Electric engines.

Installation and thermal management.

## RELIABILITY

3 d

Introduction to damage modes. Rules of analysis. Failure examinations.

## EVALUATIONS - CONCLUSIONS

0.5 d