

## **Numerical methods for Modeling and Optimization of IC Engines**

**Course code:** MEA16

**Location:** Onsite delivery, Self-paced, Online Instructor led

**GA Credits:** 7

Engine and vehicle development include different stages of development – Concept development, Mechanical development, Electronics development, System integration, calibration development and validation. Different simulation softwares and packages are available for each of the stages. Modeling is the process by which a real-world problem is translated to a mathematical model, which can be used to gain insights on the real-world problem. This course provides the details of Engine and vehicle modeling which can be useful for concept development, calibration development and validation. Knowledge of the Engine and vehicle modeling are needed for engineers working on engine design, engine optimization, engine modelling and engine validation using various softwares and packages. This course will bring the concepts to the very basic level and understand the various scenarios that affect the Engine functioning. This course doesn't need any prior knowledge. This course clears all the fundamental questions.

### **Learning Objectives**

By attending this course, you will be able to:

- Understand the challenges of IC Engine development
- Understand the importance of Applied mathematics for Numerical modeling
- Apply Different Design of experiments to any system
- Learn scripting and application of python to any optimization problem
- Understand the real-world problems and methods to solve

### **Who Should Attend**

Engineering Management, Engineers charged with Modeling, Design, Calibration and Validation, OBD Engineers, Senior Management from Powertrain, Engine and Vehicles departments.

### **Quizzes and Assessments**

- Every key topic/lesson in the course has a quiz in the Online Self-paced Course. Passing score can change but it is usually set at 80%.
- Students attending the Online Instructor-led course will benefit from Q&A as well as Quizzes on key topics. There will be an opportunity to take a third-party examination at the end of the course.
- Students attending the Onsite training, have further customization options, certification recognized by the host organization, and extended period evaluation licenses of calG

### **Certificates**

By default all students who complete the entire course progression receive an automatic certificate from Gannet Engineering at the end.

Students who further take the Automotive Skill Development Council of India (ASDC) exam receive a "Skill India" certificate in addition. We work with Client organization to issue custom certifications.

## Topical Outline

Please check the course outline at [Gannet Academy](#) for the most current information.

- Python and packages installation
- Challenges in IC Engines development
- DoE designs for Engine Testing
- Lattice Hypercube Sampling Design
- Central Composite Design
- Box Behnken Design
- Sobol Design
- Plackett Burman Design
- Hands-on DoE designs application using PyDoE packages
- IC Engine parameterization
- Global design application
  - Lattice Hypercube Sampling Design
  - Central Composite Design
  - Box Behnken Design
  - Sobol Design
  - Plackett Burman Design
- Local design application
  - Lattice Hypercube Sampling Design
  - Central Composite Design
  - Box Behnken Design
  - Sobol Design
  - Plackett Burman Design
- Accelerating Engine optimization through Surrogate Modeling
- Engine Modeling
- Numerical modeling with Numpy
- Linear polynomial regression
- Gaussian process regression

## Tools learned

- Python
- calG