IFS ACADEMY
Training For The Future!!

In Association with
CONTENANCE
Technology Solution

Post Graduate Diploma in Automotive Thermal System Analysis

Course Curriculum (Duration: 6 Months)

Chapter 1: Powertrain Basics: Architectures, Components and performance Characteristics

1.1 Architectures
- 1.1.1 Conventional Powertrain: Manual Transmission
- 1.1.2 Conventional Powertrain: Automatic Transmission
- 1.1.3 Hybrid Electric: Series Architecture
- 1.1.4 Hybrid Electric: Parallel Architectures
- 1.1.5 Electric Powertrain

1.2 Powertrain Components
- 1.2.1 Prime mover: Diesel, gasoline Engine, motor
- 1.2.2 Clutch: Torque Converter, Wet and Dry
- 1.2.3 Transmission: Automatic and Manual
- 1.2.4 Final Drive
- 1.2.5 Wheels / Tires

1.3 Performance Characteristics
- 1.3.1 Fuel Economy: Measurement and Importance
- 1.3.2 Emissions: BSIV and BSVI norms
- 1.3.3 Grade-ability
- 1.3.4 Water Wading
- 1.3.5 On Board Diagnostics (OBD)

Chapter 2: Engine Basics: Theory

- 2.1 Engine Construction and Operation
- 2.2 Classification – Operating Cycles of S.I. and C.I. Engines
- 2.3 Engine Subsystems Overview

2.4 Performance Testing of Engines:
- 2.4.1 Volumetric Efficiency
- 2.4.2 Friction Power Measurement
- 2.4.3 Performance Curves for SI and CI Engines
- 2.4.4 Heat Balance
- 2.4.5 Performance Maps
- 2.4.6 Combustion Pressure Measurement
- 2.4.7 Reading of P-Theta Diagram and PV Diagram
- 2.4.8 Burn Rate / AHRR Calculation

Chapter 3: CFD Basics

3.1 CFD Introduction
3.2 3D and 1D CFD Applications in Product Development
3.3 1D CFD Equations
3.4 Equations Discretization, Explicit and Implicit Schemes
3.5 Stability Criteria
3.6 Treatment of Flow Junctions
3.7 In-cylinder Flow, Heat Transfer Modeling
3.8 Heat Exchanger Modeling
3.9 Combustion Modeling Overview

Chapter 4: Air Handling Subsystem

4.1 Intake Air Filter
4.2 Turbocharger: Construction, Performance and Modeling
4.3 Intercooler, Charge Air Cooler
4.4 Intake Manifold: Design for SI and CI Engines
4.5 Intake / Exhaust Ports: Volumetric Efficiency
4.6 Exhaust Manifold
4.7 Exhaust Gas Recirculation: Requirement and Tradeoff
4.8 EGR Loop Operation and Controls

Chapter 5: Fuel Subsystem

5.1 SI Engine Fuel Injection
5.2 CI Engine Fuel Injection
5.3 Injection: Controls for Efficient Combustion
5.4 Injection Pressure, Duration and Angle
5.5 Fuel Pump: Construction and Performance
5.6 Fuel Preconditioning
5.7 Cavitation, Fuel Deposition and Injection Issues

Chapter 6: Cooling Subsystem

6.1 Why Engine needs Cooling?
6.2 Cooling Subsystem: Performance and Controls
6.3 Thermostat: Construction and Operation
6.4 Cooling Jacket Types and Design
6.5 Cabin Heater
6.6 Radiator: Construction and Operation
6.7 Fan: Controls and Operation
6.8 Coolant Properties

Chapter 7: Lubrication Subsystem

7.1 Why Engine needs lubrication?
7.2 Lubrication Subsystem: Performance and Controls
7.3 Pump, Strainer, Oil Filter
7.4 Oil Circuit and Distribution

7.5 Piston Cooling Nozzle
7.6 Oil Cooler

Chapter 8: Exhaust After-Treatment Subsystem

8.1 Why exhaust after-treatment?
8.2 Construction and operation of
8.2.1 3 way Catalyst
8.2.2 Diesel Oxidation Catalyst (DOC)
8.2.3 Diesel Particulate Filter (DPF)
8.2.4 Selective Catalytic Reactor (SCR)
8.2.5 Lambda Sensor
8.3 Integration and Control of Exhaust after-treatment System

Chapter 9: Combustion Modeling Approach in Engine System Level Analysis

9.1 Premixed and Diffusion Flame Combustion Why Engine needs Lubrication?
9.2 Combustion in SI engines
9.2.1 Stages of Combustion
9.2.2 Flame Development
9.2.3 Flame Propagation
9.2.4 Abnormal Combustion
9.2.5 Factors affecting knocking
9.3 Combustion in CI engines
9.3.1 Stages of Combustion
9.3.2 Ignition delay
9.3.3 Injection Spray Characteristics: Atomization, Evaporation
9.3.4 Abnormal Combustion

Chapter 10: Project on Engine Thermodynamics / Cooling System / Lubrication Oil System / Vehicle Thermal Management / Fuel Economy Simulation

Software Used: Ricardo / GT-SUITE

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