

Advanced Thermal Engineering Laboratory / ICGT Laboratory

About the Laboratory

The **Advanced Thermal Engineering Laboratory/ICGT Lab.** is a well-equipped teaching and research facility of the Department of Mechanical Engineering that provides practical exposure in **thermal engineering, internal combustion engines, steam power systems, fuel testing, and emission analysis.** The laboratory enables students to understand the performance, efficiency, combustion characteristics, and environmental aspects of thermal energy conversion systems through hands-on experimentation.

The laboratory houses modern equipment including **Variable Compression Ratio (VCR) engines, multi-cylinder petrol engine with Open ECU, steam turbine test rig, engine test bed, computerized bomb calorimeter, computerized viscometer, AVL modular diagnostic system, data acquisition system, flue gas analyser, biogas analyser,** and other advanced instrumentation. These facilities support experiments on engine performance, combustion analysis, emission measurements, fuel property evaluation, thermal efficiency, and energy conversion processes.

The laboratory supports **B.Tech., M.Tech., and Ph.D. programmes** by providing facilities for laboratory courses, student projects, and research activities in thermal engineering, internal combustion engines, alternative fuels, combustion, and emission control. The laboratory also promotes practical learning, analytical skills, and research aligned with modern energy and automotive technologies.

Faculty In-Charge

Dr. Rajneesh

Technical Staff

Mr. Rahul — Technical Assistant

Laboratory Courses

Course Code	Course Name	Programme
MEPC412	Internal Combustion Engines and Gas Turbines Lab	B.Tech.
MME3C09	Advanced Internal Combustion Engines	M.Tech.

Major Equipment

Equipment	Quantity	Utilization
Single-Cylinder Multi-Fuel VCR Engine	01	B.Tech. / M.Tech. / Ph.D.
Single-Cylinder VCR Diesel Engine	01	B.Tech. / M.Tech. / Ph.D.
Multi-Cylinder Petrol Engine with Open ECU	01	B.Tech. / M.Tech. / Ph.D.
Steam Turbine Test Rig	01	B.Tech. / M.Tech. / Ph.D.
Computerized Viscometer	01	B.Tech. / M.Tech. / Ph.D.
Engine Test Bed	01	B.Tech. / M.Tech. / Ph.D.
Computerized Bomb Calorimeter	01	B.Tech. / M.Tech. / Ph.D.
AVL Modular Diagnostic System	01	B.Tech. / M.Tech. / Ph.D.
Biogas Analyser	01	B.Tech. / M.Tech. / Ph.D.
Flue Gas Analyser	01	B.Tech. / M.Tech. / Ph.D.
Data Acquisition System	01	B.Tech. / M.Tech. / Ph.D.

Laboratory Photographs

SINGLE CYLINDER MULTI-FUEL VCR ENGINE



To study the performance of multi-fuel, single cylinder, petrol engine connected to regenerative type dynamometer. Rated Power – 5 HP @ 1800 RPM, Bore Dia.: 87.5 mm, Stroke: 110 mm

Features:-

1. Same engine can be operated with petrol as well diesel with.
2. Provision to vary Compression Ratio – 5 to 11 for SI mode and 12 to 20 for CI mode
3. Computerized air flow measurement
4. Computerized fuel flow measurement
5. Computerized water flow measurement
6. Exhaust gas calorimeter system

AVL MODULAR DIAGNOSTIC SYSTEM (Emission Analyzer)



To do emission analysis of any kind of engine.

Features:-

1. Exhaust Gas Measurement

Parameter	Measurement	Resolution
1. CO	: 0 ... 15 % Vol.	0.01 % Vol.
2. HC	: 0 ... 30 000 ppm vol.	1 ppm (0 – 2000 ppm)
3. CO ₂	: 0 ... 20 % Vol.	0.01 % Vol.
4. O ₂	: 0 ... 25% Vol.	0.01 % Vol.
5. NO	: 0 ... 5000 ppm Vol.	1 ppm Vol.
6. Lambda	: 0 ... 9.999	0.001
7. Engine Speed	: 400 ... 6000/8000 RPM	1 RPM

2. Opacity Measurement

Parameter	Measurement	Resolution
1. Opacity	: 0 ... 99.9 %	0.1 %
2. Absorption (k-Value)	: 0 ... 99.99 %	0.01 l/m
3. Engine Speed	: 400 ... 6000/8000 RPM	1 RPM
4. Oil Temperature	: 0° ... 125° C	1° C
5. Atmospheric Rel. Humidity	: 0-100 % Rel Non Condensing	

SINGLE CYLINDER VCR DIESEL ENGINE



To do performance evaluation of variable compression ratio engine and analyse the same with the help of open ECU. Single cylinder, 4 stroke, water cooled, Power 3.5 kW @ 1500 rpm, CR range 12-18

The following parameters can be studied:-

1. Brake power
2. Indicated power
3. Frictional power
4. Brake mean effective pressure
5. Indicated mean effective pressure
6. Brake thermal efficiency
7. Indicated thermal efficiency
8. Mechanical efficiency
9. Volumetric efficiency
10. Specific fuel consumption
11. Air to fuel ratio
12. Heat balance
13. Combustion analysis

MULTI CYLINDER PETROL ENGINE WITH OPEN ECU



To study the performance of 3 cylinder, 4 stroke, Petrol Engine, Power: 27.6 kW @ 5000 RPM, CR: 9.2, Bore Dia.: 66.5 mm, Stroke: 72 mm, Swept Volume: 796 cc

Features:-

1. To study the performance of 3 cylinder, 4 stroke, petrol engine connected to dynamometer in computerized mode with open ECU.
2. To study the performance of 3 cylinder, 4 stroke, petrol engine connected to dynamometer in manual mode.
3. To draw pressure –crank angle plot, pressure volume plot and calculate indicated power of the engine.
4. To study the maximum power generated by the engine.
5. To study the BSFC and brake thermal efficiency.
6. To perform Morse test.

ENGINE TEST BED



To do performance analysis of any type of internal combustion engine. Provisions of engine blow by and coolant conditioning unit. Eddy current dynamometer (Max. torque 400 NM @ 1500 to 2400 RPM, Max: rated power 100 kW @ RPM 2400 to 6000 RPM). Engine 4 cylinder CRDI Turbo diesel engine of Maruti of capacity 1200 cc

Features:-

1. To perform overall analysis of any type of IC engine.
2. To perform experiment on effect of any type of coolant on an engine.
3. To perform experiment on blow by of an engine.
4. To perform experiment on emission analysis of an engine.

COMPUTERISED VISCOMETER



Features:-

1. To measure the viscosity of various kinds of fluids such as bio-fuels, petrol, diesel etc.
2. To determine the viscosity resistance and absolute viscosity of the liquids.
3. Measurement range is 100000 MPA with 4 spindles, 6/12/30/60 rotor speed (rpm), + 5 % Newtonian fluid.

COMPUTERIZED BOMB CALORIMETER



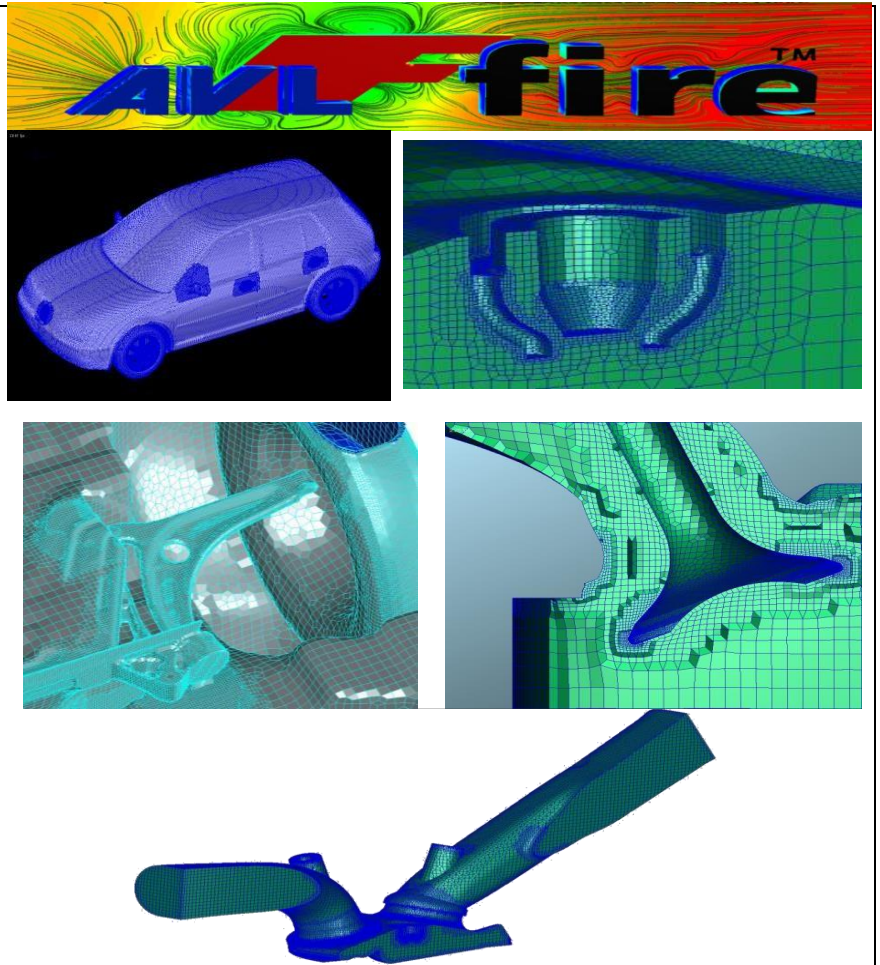
Features:-

- To determine heat of combustion of solid and liquid fuels namely coal, agro fuels, Dry black liquor and furnace oil.

Software

AVL FIRE

(Engine combustion software for diesel / Gasoline / Gas engines and sub systems for parts design optimization through build in function / subroutines / library functions)



Main features

- CAD data import and manipulation
- automated grid generation resulting in either
 - hexahedron-dominated or
 - tetrahedron-dominated grids
- setup and handling of models with (multiple) moving boundaries
- includes a series of tools for grid, surface and edge model manipulation

To study & simulate

1. In-cylinder Analysis
2. Engine Thermal Analysis
3. Vehicle Thermal Management
4. Port Flow Optimization
5. Intake System CFD Simulation
6. Intake Manifold Simulation, EGR Distribution
7. Exhaust Manifold flow Simulation
8. Exhaust after Treatment Flow Analysis

HIGH SPEED DIESEL ENGINE



To perform analysis of the engine running on bio-fuels

Features:-

- To make a heat balance sheet.
- To conduct the experiments on different types of bio-fuels.

STEAM TURBINE TEST RIG



To measure the steam turbine efficiency, steam quality, flow rate and condenser effectiveness. Steam Turbine Capacity: 2 kW, Boiler capacity: 400 kg/hr, at 15 kg/cm².

Features:-

1. To find the line steam quality.
2. To find the isentropic work produced by turbine.
3. To perform the demonstration of Rankine cycle operated thermal power plant.

BIO-GAS ANALYSER



To analyse biogas with digital hand held portable biogas analyser.

Features:-

- To measure the contents of biogas

FLUE GAS ANALYSER



To analyze flue gas of any type of internal combustion engine.

Features:-

- To measure flues gases like CO₂, SO_x, NO_x and CO

DATA ACQUISITION SYSTEM



To acquire data like temperature and pressure of various locations (28 ports).

Features:-

- To record various quantities like temperature/pressure at many locations simultaneously

