



**AVIT**  
AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY



**VINAYAKA MISSION'S  
RESEARCH FOUNDATION**  
(Deemed to be University under section 3 of the UGC Act 1956)

# RESEARCH CENTRE FOR ALTERNATE FUELS TESTING

Department of Mechanical Engineering  
Aarupadai Veedu Institute of Technology



## VISION

Research Centre for Alternate Fuels testing is dedicated to develop advanced concepts and methods for performance analysis of bio fueled IC engines, and pursuing solutions through wide-ranging industrial collaborations, discussions and seminars. The center is committed to achieving its mission using innovative science, technology, education and Management, strategies having high impact for all stakeholders.

## MISION

Research Centre for Alternate Fuels testing is an important research community that expands the visibility of research understanding and findings. It aims to create the awareness to the research fraternity about the alternative fuels derived from organic matters (vegetable substance). Since, biofuels derived from organic matters has played a vital role in the environmental issues to reduce the harmful automobile emissions.

# RESEARCH CENTRE FOR

# ALTERNATE FUELS TESTING

## MILESTONE & ACHIEVEMENTS

Research Centre for Alternate Fuels testing Centre was established in the Department of Mechanical Engineering of Aarupadai Veedu Institute of Technology on June 30, 2014. Research Centre for Alternate Fuels testing is dedicated to the research activities in alternative fuels testing and to Determine the impact of biofuels properties on engines efficiency, performance, and emissions. Activities include examining ways to increase alternative fuel vehicles, fuel economy, investigating the potential effects of upcoming blends, and improving the quality of current and future biofuel blends.

S.NO	YEAR	DESCRIPTION
1	2014-2015	<ul style="list-style-type: none"><li>▶ Installation of Research engine setup which includes VCR Engine, AVL five Gas Analyzer, BOSCH smoke meter, worth an amount of 15 Lakhs rupees.</li><li>▶ Consultancy work has been done for an amount of Rs.34,000/-</li><li>▶ 15 UG projects were done by our students.</li><li>▶ As an outcome of 12 research articles published by using this research lab</li></ul>
2	2015-2016	<ul style="list-style-type: none"><li>▶ Consultancy work has been done for an amount of Rs.61,300/-</li><li>▶ 18 UG projects were done by our students.</li><li>▶ As an outcome of 19 research articles published by using this research lab</li></ul>
3	2016-2017	<ul style="list-style-type: none"><li>▶ Additional testing setup up gradation done by providing variable nozzle hole like single, two- and five-hole nozzles purchased.</li><li>▶ Consultancy work has been done for an amount of Rs.1,43,000/-</li><li>▶ 20 UG projects were done by our students.</li><li>▶ As an outcome of 10 research articles published by using this research lab.</li><li>▶ 8 Faculty members registered for their PhD under this alternate fuel thrust research area</li></ul>
4	2017-2018	<ul style="list-style-type: none"><li>▶ Additional testing setup up gradation done by implementing EGR and turbo charger setup with a cost worth Rs.40,000/-</li><li>▶ Consultancy work has been done for an amount of Rs.35,200/-</li><li>▶ 18 UG projects were done by our students.</li><li>▶ As an outcome of 11 research articles published by using this research lab</li><li>▶ 3 Faculty members registered for their PhD under this alternate fuel thrust research area</li></ul>
5	2018-2019	<ul style="list-style-type: none"><li>▶ Additional research setup of bio diesel processor installed with costs around Rs.1,25,000/-, through that we can convert vegetable oils into biodiesel.</li><li>▶ 18 UG projects were done by our students.</li><li>▶ Consultancy work has been done for an amount of Rs.73,750/-</li><li>▶ As an outcome of 22 research articles published by using this research lab</li></ul>
6	2019-2020	<ul style="list-style-type: none"><li>▶ Installation GDI Engine Modification and Eddy current dynamometer worth an amount of Rs 1,65,200/-</li><li>▶ 24 UG projects were done by our students</li><li>▶ Consultancy work has been done for an amount of Rs.26,250/-</li><li>▶ As an outcome of 32 research articles published by using this research lab</li><li>▶ One faculty member completed his PhD under this alternate fuel thrust research area by using this research lab for his experimental works</li></ul>
7	2020-2021	<ul style="list-style-type: none"><li>▶ Additional testing setup up gradation done by implementing HCCI engine test set up under seed money project support scheme of VMRF with an amount of Rs 2,58,420/-</li><li>▶ 13 UG projects were done by our students</li><li>▶ As an outcome of 37 research articles published by using this research lab</li><li>▶ Two faculty members completed their PhD under this alternate fuel thrust research area by using this research lab for their experimental works</li></ul>

# MAJOR RESEARCH AREAS



- Engine Combustion
- Alternative fuels
- Exhaust gas after-treatment
- Biodiesel and other biofuels
- Primary alcohols and bio-butanol
- HCCI of gasoline and diesel like fuels
- Regulated and unregulated emissions
- Split Injection Strategy
- GDI Engine



VCR ENGINE WITH EDDY CURRENT DYNAMOMETER

## MAJOR FACILITIES

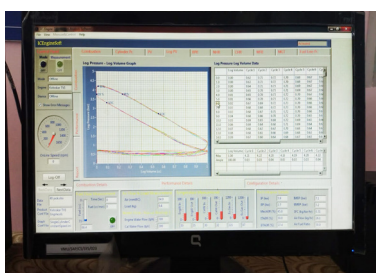
### SINGLE CYLINDER, FOUR STROKE, CRDI VCR (VARIABLE COMPRESSION RATIO) ENGINE

The setup consists of single cylinder, four stroke, CRDI VCR (Variable Compression Ratio) engine connected to eddy current dynamometer. It is provided with necessary instruments for combustion pressure, crank-angle, airflow, fuel flow, temperatures and load measurements. The setup enables study of CRDI VCR engine performance with programmable ECU at different compression ratios and with different EGR. Engine performance study includes brake power, indicated power, frictional power, BMEP, IMEP, brake thermal efficiency, indicated thermal efficiency, Mechanical efficiency, volumetric efficiency, specific fuel consumption, Air fuel ratio, heat balance and combustion analysis.



ENGINE PERFORMANCE AND EMISSION ANALYSIS TEST SETUP

## DATA ACQUISITION SYSTEM



SOFTWARE : LAB VIEW BASED  
ENGINE SOFT

High Speed Combustion Data Acquisition (DAQ) systems are very important for engine combustion and performance investigations. It is provided with necessary instruments for combustion pressure, crank-angle, airflow, fuel flow, temperatures and load measurements. These signals are interfaced to computer through high speed data acquisition device.

## EMISSION MEASUREMENT EQUIPMENT



AVL SMOKE DENSITY METER

This Research Centre has world class emission characterization systems for regulated and unregulated gaseous emission species. This equipment is capable of measuring regulated pollutant species like NO<sub>x</sub>, CO, CO<sub>2</sub>, HC and smoke opacity.

## BIODIESEL PILOT PLANT

In this setup, a new method has been employed to produce Bio-Diesel. The production of the Bio-Diesel is done by using Bio-Diesel processor. It requires the used vegetable oil, methanol and the lye with the accurate proportionate. It consists of the mono alkyl esters formed by a catalyzed reaction of the triglycerides in the oil or fat with a simple monohydric alcohol. The reaction conditions generally involve a trade-off between reaction time and temperature as reaction completeness is the most critical fuel quality parameter. This process has been developed to produce biodiesel from high free fatty acid feed stocks, such as recycled restaurant grease, animal fats, and soap stock. The objective of this bio-diesel plant is to produce the bio-diesel by using the bio-diesel processor



SAMPLE BIODIESEL



BIODIESEL PROCESSOR

## CURRENT RESEARCH

- Experimental investigations of HCCI/ PCCI combustion in a single cylinder research engine using conventional fuels and biofuels.
- Experimental investigations of combustion characteristics and emissions of a biodiesel fueled engine.
- Experimental investigations of fuel sprays of biodiesel, straight vegetable oils and their blends with mineral diesel.
- Engine Performance, Combustion and Emission Characteristics of GDI engine with gasoline / blended fuels - in Stratified and Homogeneous mode
- Engine Performance, Combustion and Emission Characteristics of liquid fuels in RCCI mode
- Leveraging the benefits of Hydrous and An Hydrous Ethanol in Advanced Engine Fuel System

## LIST OF EQUIPMENTS

- APEX MAKE PSP 240PE Research Engine setup with programmable open ECU
- AVL Make Exhaust five gas analyser- O<sub>2</sub>.CO.CO<sub>2</sub>.HC,NOX
- Bosch Smoke Meter
- EGR Set Up – NOX Emissions reduction technique used in IC Engines
- Turbo charge - Turbodriven Forced Induction Device for Combustion chamber.
- Open ECU to control Fuel Injection Timing, Fuel Injection Pressure, Ignition Timing, etc
- Engine Modification - Piston, Cylinder Head, Fuel Supply System and any other modifications.
- 3 Way catalytic converter - Oxidizes Carbon Monoxides & Hydro Carbons & reduces Nitrogen Oxide.
- Fuel Injection Driver for 4 injectors and 2 High Pressure Pumps control
- Bio Diesel production pilot plant for a capacity of 10 ltr production per day

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## FACILITIES

- Computerized Research engine set up,
- Diesel and Petrol mode VCR Engine Soft for Engine performance and combustion analysis
- Performance and combustion analysis Using EGR Concept Set up
- Performance and combustion analysis Using Turbo Charger Set up
- Programmable open ECU for engine tuning in Petrol mode
- Programmable open ECU for engine tuning in Diesel mode
- Split Injection Strategies
- HCCI, PCCI and RCCI Engine
- Port fuel injection systems
- Exhaust gas analyzer (5 Gas)
- Bosch Smoke meter
- Production of biodiesel using Advanced Bio Fuel Plant

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## RESEARCH CONSULTANCY SERVICES

Research and consultation work in the field of alternative fuels have been carried out with the following details

### Test with Blends

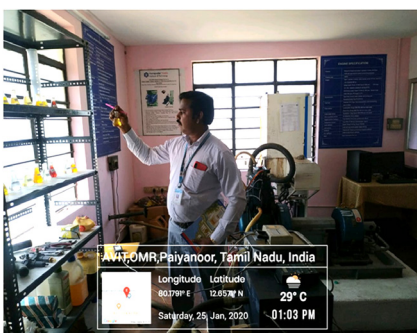
- Testing with all Liquid Fuels (Diesel, Petrol, Alcohols, blends etc.)
  - Single Compression ratio Variable Load
  - Variable Compression ratio Variable Load
  - Single Compression ratio Variable Load Variable Nozzle Hole
  - Single Compression ratio Variable Load with EGR
  - Variable Compression ratio Variable Load with EGR

- Single Compression ratio Variable Load with Turbocharger
- Variable Compression ratio Variable Load with Turbocharger
- Single Compression ratio Variable Load with EGR & Turbocharger

- HCCI & RCCI Mode Engine performance and Emission Analysis
- Additional manifold gas injection
- Selective Catalytic Converter
- Dual fuel gas, Liquid at CI, SI Mode Operation
- Production of biodiesel using Advanced biodiesel Processor

## CONSULTANCY FEE DETAILS : TEST WITH SINGLE BLEND

■ Single Compression ratio Variable Load	-	Rs. 1750/-
■ Variable Compression ratio Variable Load	-	Rs. 1750/-
■ Single Compression ratio Variable Load Variable Nozzle Hole	-	Rs. 2500/-
■ Single Compression ratio Variable Load with EGR	-	Rs. 2000/-
■ Variable Compression ratio Variable Load with EGR	-	Rs. 2000/-
■ Single Compression ratio Variable Load with Turbocharger	-	Rs. 2200/-
■ Variable Compression ratio Variable Load with Turbocharger	-	Rs. 2800/-
■ Single Compression ratio Variable Load with EGR & Turbocharger	-	Rs. 2250/-
■ Variable Compression ratio Variable Load with EGR & Turbocharger	-	Rs. 3250/-
■ GDI Engine application per cycle of operation	-	Rs. 2500/-
■ HCCI/PCCI Engine operation per cycle of operation	-	Rs. 2500/-



## TERMS & CONDITIONS

We do not need any information that you feel may breach the confidentiality of your work.

Plastic or glass vials with snap caps can be used as containers for biofuels samples. Please make sure that the seal of your vials are tight and that the vials are wrapped properly to prevent breakage during shipment.

Samples must include SDS/MSDS – We must have a copy on file. Please include it in the package to avoid delays. If we already have the latest version of an SDS on file for your product, please indicate so on your submittal form.

Analyses are started immediately upon receipt of samples to ensure meet our promised experiments and commitments.

Change experiments are welcome, but please be aware that partial or full charges will apply based on how much work has been completed by the time of the change request.

The relinquished by, shall make no deduction from the invoice price of the Services on account of any set-offs or claim or counter-claim unless both the validity and the amount thereof have been admitted by an authorized representative of the sample provider.

## FACULTY MEMBERS ASSOCIATED



Dr.M.Prabhakar



Mr. K. Surendra  
babu



Dr.S.Sangeetha



Mr. N. Lakshmi  
narayanan



Mr. J. Senthil



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Dr.M.Saravana  
Kumar



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Mr.N.Siva Kumar



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