

1152AU136 SUSTAINABLE FUELS FOR NONCONVENTIONAL ENGINES **L T P C**
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1. Preamble

This course provides an introduction to the bio mass, bio fuels, and non-conventional I.C engines and imparts knowledge about the usage of biofuels in nonconventional I.C engines and also the changes in the engine’s design for handling biofuels.

2. Pre-requisite

1151AU216	Automotive Fuels, Lubricants and Coolants
1151AU107	IC Engines

3. Links to other courses

1152AU104	Engine Testing and Certification
1152AU103	Fuel conservation & Alternate fuels

4. Course Educational Objectives

Students undergoing this course are expected to

- The subject mainly deals with various engine parameters and operating conditions.
- The deals with various types of biofuels fuels and their properties, its physical and chemical properties and thermal properties.
- The subject also deals with performance, combustion and emission characteristics and the optimization technique of nonconventional engines such as HCCI, PCCI, LHR engines and dual fuel condition while using bio fuels.
- The students will learn about the gasification and the coupling of gasifier with C.I engine.
- The students will know about the process involved in pyrolysis and the optimization of the products for IC engine application.

5. Course Educational Objectives

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom’s)
C01	Illustrate the properties of various fuels and its influence on C.I engine.	K3
C02	Explain the basics, requirements, construction and working of LHR engines, thermal barrier coatings and material properties and its performance and emission characteristics while using biofuels.	K2
C03	Explain the construction details of HCCI, working principles, combustion, and fundamental study while using biofuels.	K2
C04	Explain the technology and modifications required to operate the engine in dual fuel condition while using biofuels.	K2
C05	Explain about the gasification of biomass, its product and the thermal equations about it and operating the engine using the products thus obtained.	K2

6. Correlation of COs with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	H	L						L	M	H	H
CO2	H	H	H	H	M						L	M	H	H
CO3	H	H	H	H	M						L	M	H	H
CO4	H	H	H	H	L						L	M	H	H
CO5	H	H	H	H	M						L	M	H	H

H- High; M-Medium; L-Low

7. Course Content

UNIT 1 BIOFUELS AND OPERATING CONDITIONS

L- 9

Comparison of Physical and Chemical Properties of Gasoline- Diesel - Biodiesel- Vegetable Oil- Biomass - Biomass and its Products- Carbon Hydrogen and Oxygen Ratio- Operating Conditions and Performance Characteristics of C.I Engine in Bio Fuels- Influence of Injection Pressure-Injection Timing- Compression Ratio- Performance and Emission Characteristics.

UNIT 2 LHR ENGINES

L- 9

Thermal Barrier Coatings and Coating Materials for IC Engines, Properties of Coating Material - Fabrication of Engine with LHR Combustion Chamber-Comparative Studies With Test Fuels With Conventional Engine and Engine with LHR Combustion Chamber- Heat Loss Characteristics.

UNIT 3 HCCI ENGINE

L- 9

Fundamental Concept And Working Principles of HCCI Engine, Challenges of HCCI Combustion-Homogeneous Charge Preparation Strategies- HCCI Fuel Injection Strategies - Studies of Bioethanol, Biogas In HCCI, Domain of Operation- Cold Start, Role of Pre-Combustion Chamber in HCCI Engine- Advantages Over Compression Ignition Combustion.

UNIT 4 DUAL FUEL ENGINE

L- 9

Dual Fuel Technology, Diesel Engine Modifications for Dual Fuel Condition- Alcohol-Diesel Dual Fuel Operation- Performance, Combustion and Emission Characteristics - Effect of Hydrogen on Dual Fuel Mode, Effect Induction Of Hydrogen on Volumetric Efficiency and Combustion Characteristics on Dual-Fuel Mode of Operation.

UNIT 5 GASIFICATION OF BIOMASS FOR IC ENGINE APPLICATION

L- 9

Gasification Principal, Kinetics of Vegetable Oil In TGA- Arrhenius Equations-Biomass Conversion, Producer Gas From Vegetable Oil, Gasifiers, Type of Gasifiers, Characteristics of Gasifier and Its Fuel, Cleaning Producer Gas, Application of Gasification, Studies On Gasification of Vegetable Oil, Coupling The Gasifier With CI Engine.

Total : 45 Hrs

8. References

1. Paul Degobert – Automobiles and Pollution – SAE International SBN-1-56091-563-3, 1991.
2. Ganesan .V - “IC Engines” - Tata McGraw-Hill, 2012.
3. John B. Heywood, “Internal Combustion Engine Fundamentals”, McGraw-Hill Automotive technology Series ISBN 0-07-1000499-8, 1988.
4. Biomass Gasification, Pyrolysis and Torrefaction Practical Design and Theory, 2nd edition • 2013, PrabirBasu.
5. Thipse.S.S., Alternative Fuels; Concepts, Technologies and Developments, Jaico Book Distributors, 2010.
6. Richard.L. Bechtold- Alternative Fuels Guide Book- SAE International Warrendale- 1997.