ALTERNATIVE FUELS AND EMISSIONS
(Professional Elective I)

I Semester

Course Code: 19ME2252

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Prerequisites: Engineering Thermodynamics and Thermal Engineering

Course Outcomes: At the end of the course the student shall be able to

CO1: Interpret the suitable alternative fuels like CNG and LNG.
CO2: Explain the characteristics of alcohols in SI & CI engines.
CO3: Analyze the various gaseous alternative fuels for IC engine applications.
CO4: Determine various properties of bio fuels and their significance in IC engines.
CO5: Explain the concepts of Electrical vehicle, Fuel cell and solar cars.

UNIT-I: **(10-Lectures)**

Need for alternate fuel : Availability and properties of alternate fuels, general use of alcohol, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternative energy sources. Like EV, hybrid, fuel cell and solar cars.

Learning outcomes: At the end of this unit, the student will be able to

1. Explain the need for alternative fuels (L2)
2. List the properties of various alternative fuels (L1)
3. Interpret the viable alternative energy source (L2)
4. Demonstrate the working of EV, hybrid, fuel cell and solar cars (L2)

UNIT-II: **(10-Lectures)**

Alcohols: Properties as engine fuel, alcohol and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

Learning outcomes : At the end of this unit, the student will be able to

1. Explain the importance of alcohol as an alternative fuel (L2)
2. Explain the performance of SI engines fueled with alcohols (L2)
3. Summarize the combustion and emission characteristics of SI and CI engines (L2)

UNIT-III: **(10-Lectures)**

Natural Gas, LPG, Hydrogen and Biogas: Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG using LPG in SI & CI engines, performance and emission of LPG. Hydrogen; storage and handling, performance and safety aspects.

Learning outcomes: At the end of this unit, the student will be able to

1. Explain modifications required by the engine to utilize gaseous fuels (L2)

2. Illustrate the performance of SI & CI engines fueled with Gaseous fuels (L2)
3. List the various storage and handling techniques of gaseous fuels (L2)

UNIT-IV: (10-Lectures)

Technical Background of Diesel/Biodiesel fuels-Oil feed stocks-Transesterification-Biodiesel production from Vegetable oils and waste cooking oil-High blend levels of biodiesel-Testing, Biodiesel-Oxidation stability-Performance in Engines, Properties of bio-fuels and their importance in the context of IC Engines. Vegetable Oils: Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, biodiesel and its characteristics.

Learning outcomes: At the end of this unit, the student will be able to

1. Explain the processes of preparation of Biodiesel. (L2)
2. List the properties required for the biodiesels used in IC engines (L1)
3. Illustrate the performance of biodiesels in IC engines (L2)

UNIT-V: (10-Lectures)

Electric, Hybrid, Fuel Cell and Solar Cars: Layout of an electric vehicle, advantages and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

Learning outcomes:At the end of this unit, the student will be able to

1. Illustrate the working of Electric, Hybrid, Fuel Cell and Solar vehicles. (L2)
2. List the advantages and limitations of electric vehicles (L1)
3. Explain the high energy and power density batteries (L2)

TEXT BOOKS:

1. S.S. Thipse, *Alternate Fuels*, Jaico Publishing house, India, 2010

REFERENCE BOOKS:

1. G.R. Nagpal and S.C. Sharma, *Power Plant Engineering*, 16th Edition, Khanna Publishers, 1995.

2. Alcohols as motor fuels progress in technology, Series No. 19 – SAE Publication USE – 1980.