

Approval: 8th Senate Meeting

Course Name: Alternative Energy Sources for Transportation

Course Number: EM505

Credits: 3-0-0-3

Prerequisites: ME 355 IC Engines or teachers consent

Intended for: UG/PG

Distribution: Elective for ME

Semester: odd/even

Course Preamble: Energy source for transportation in today's world is predominantly hydrocarbons of fossil origin. However, there is increased attention towards developing alternative sources as the transportation sector is growing at a rapid pace. This is driven by factors such as energy security (to dependence on fuel imported from abroad), environmentally benign alternative fuels and sustainability. The course is intended to give knowledge about the potential alternative fuels, the need for them and the challenges in the development of alternative fuels.

Modules:

Module 1 [5 Lectures]

Introduction: Description about primary energy use sector and energy requirement for transportation sector, Requirement of transport fuels in India and share of various sources, Transportation need and economic and environmental impact of various transportation modes. Relationship between energy Efficiency with CO₂ emission reduction Fuel properties and fuel specifications,

Module 2 [15 Lectures]

Overview of engine technology and effect of fuel properties on advanced engine technologies: Efficiency and emission challenges and prevailing emission norms, brief pollutant formation mechanisms, Measures adopted for conforming these norms such as advances in engine fuel injection technology, exhaust gas recirculation, intake pressure boosting, engine control system and interrelation between various control parameters, after treatment technologies, advanced combustion concepts like HCCI, GDI etc. Alternative fuel acceptability factors: Well to wheel emission analysis, Modification requirements and migration route from conventional technology, Liquid and gaseous fuels, Fuels and engine material compatibility, Lubricating oil degradation, dual fuel, Multi fuel engines

Module 3 [8 Lectures]

Alcohol fuels (ethanol, methanol, butanol), availability and production technology, utilisation in SI and CI engines, material compatibility and lubricating oil effects; Biodiesel: Production method of esters (biodiesel) and hydrotreated vegetable oil (renewable diesel), application in diesel engines, blending with other fuels for performance improvement, material compatibility, lubricating oil degradation etc; Other liquid fuels: DME (di-methyl ether), Fischer-Tropsch liquids, GTL, BTL, CTL, DMF, Fuel properties, availability, production technology, fuel injection, engine performance, emissions, combustion and material compatibility considerations.

Module 4 [8 Lectures]

Gaseous Hydrocarbon Fuels: LPG, LNG, CNG, HCNG, Availability and production technology, Utilisation in CI and SI engines, Fuel supply system, Performance and emissions studies, Biogas, Safety features required while handling gaseous fuels.

Module 5 [6 Lectures]

Alternative Vehicles: Fuel cell technology, Electric vehicles and battery requirement, Hybrid vehicle technology.

Text Books:

1. Richard L. Bechtold, Alternate Fuels – Transportation Fuels for Today and Tomorrow, Society of Automotive Engineers (SAE) – 2002
2. AS Ramadhas (Eds.). Alternative Fuels for Transportation. Boca Raton: CRC Press Taylor & Francis Group ISBN1439819572; 2011
3. M.K. Gajendra Babu, K.A. Subramanian, Alternative Transportation Fuels: Utilisation in Combustion Engines, CRC Press - 2013