

Course code	Course Name	L-T-P – Credits	Year of Introduction
AU361	ALTERNATIVE FUELS AND ENERGY SOURCES	3-0-0-3	2016
Prerequisite : Nil			
Course Objectives			
<ul style="list-style-type: none"> To impart the basic concepts of energy and its sources. To develop a clear understanding about the alternative fuels for I.C engines. 			
Syllabus			
Introduction- Types of energy sources, Alcohols for SI and CI Engines- Vegetable oil as diesel fuels, Hydrogen energy & Fuel Cells, CNG- LNG- Biogas- Wind Energy, Solar power- Collection and storage of solar energy, Electric vehicles- Design considerations- limitations- opportunities for improvement			
Expected outcome.			
<ol style="list-style-type: none"> The students will understand the energy conversion, utilization and storage for renewable technologies. The students will be familiar with the potential of using renewable energy technologies as a complement to the extent possible, replacement for conventional technologies and the possibility of combining renewable and non-renewable energy technologies in hybrid systems. To understand the environmental aspects of energy usage and conversion 			
Text Book:			
<ol style="list-style-type: none"> Jack Erjavec, Alternative fuels, Cengage publications Mathur & Sharma, IC engines, Dhanpat Rai publications 			
References:			
<ol style="list-style-type: none"> T. K. Garrett, Automotive fuels system, SAE INC, Warrendale, 1991 Keeith Owen & Trevor Colley, Automotive Fuels reference book, SAE Richard L. Bechtold, Alternate fuels guide book, SAE Energy research group, Alternate liquid fuels, Willey Eastern Ltd Nagpal , Power Plant Engineering, Khanna Publishers G.D Rai, Solar energy utilization, Khanna Publishers, 2004 Dr.N.K.Giri, Automobile technology, Khanna publications 			
Course Plan			
Module	Contents	Hours	Sem Exam Marks
I	Introduction Types of energy sources - conventional and non-conventional energy and their availability. Scenario of conventional automobile fuels, need for alternative energy sources. I.C engine fuel ratings- octane number, cetane number, diesel index, fuel properties, additives, fuel quality aspects related to emissions. Implementation barriers for alternative fuels	7	10%
II	Bio fuels for SI and CI Engines <i>Alcohols for SI engines-</i> manufacture of methanol, manufacture of ethanol, comparison of properties of alcohols and gasoline as SI engine fuels, engine performance with pure alcohols, alcohol	7	20%

	gasoline fuel blends-gasohol- E85. Vegetable oils as diesel fuels - vegetable oils as diesel fuels, straight vegetable oils and bio-diesels, performance properties of engines with bio-diesel, Ethers of alcohols.		
FIRST INTERNAL EXAMINATION			
III	Hydrogen energy & Fuel Cells Properties of hydrogen, sources of hydrogen, production of hydrogen, electrolysis of water, thermal decomposition of water, thermo – chemical production and biochemical production, storage and methods, applications to engines, modifications necessary, hazards and safety systems for hydrogen , performance characteristics in engines. Emissions from hydrogen fuel engines. Fuel cell - working, advantages and limitations.	7	20%
IV	CNG, LNG, Biogas, Wind Energy Gaseous fuels: Availability of CNG, LNG, properties, modification required to use CNG in engines. Production of Biogas, application of bio-gas as a single fuel and dual fuel. Basics of Wind Energy, current and future technologies; Wind turbine and its components.	7	15%
SECOND INTERNAL EXAMINATION			
V	Solar power Collection and storage of solar energy, collection devices, flat plate collectors, concentrating type collectors, storage methods, principle and working of photovoltaic conversion, application to automobiles.	7	15%
VI	Electric vehicles Design considerations, limitations, opportunities for improvement, applicability of electric cars, cost of electric cars, types of motors. Batteries- types, capacities, limitations, future possibilities.	7	20%
END SEMESTER EXAM			

Question Paper Pattern

Maximum marks: 100

Time: 3 hours

The question paper shall consist of three parts

Part A

4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B

4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C

6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed