

**B.E Semester: VII**  
**Automobile Engineering**  
**Subject Name: Alternate fuels and energy system (AE706D)**

**Course Objective:**

- To present a problem oriented in depth knowledge of Alternate fuel and energy system.
- To address the underlying concepts and methods behind alternate fuel and energy system.

**Teaching / Examination Scheme:**

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVA	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
AE706D	Alternate fuels and energy system	4	0	0	4	4	3	70	30	20	-	120

**Detailed Syllabus:**

Topic no	Details
1	<b>Introduction:</b> Working process of I.C. Engine. Study of various parameters related to properties of different types of fuel (Rating of fuel, Ignition quality, volatility, calculations of Air / Fuel ratio, Calorific Value) as input and output in terms of results (Fuel efficiency, Fuel requirement, Engine efficiency and Engine life). Sources of fossil fuel, scope of availability of fossil fuel in future.
2	<b>Need for Alternative Fuels:</b> Effects of constituents of Exhaust gas emission on environmental condition of earth (N <sub>2</sub> , CO <sub>2</sub> , CO, NO <sub>x</sub> , SO <sub>2</sub> , O <sub>2</sub> ) Pollution created by Exhaust gas emission in atmosphere. Green house effect, Factors affecting green house effect. Study of Global Carbon Budget, Carbon foot print and Carbon credit calculations. Emission norms as per Bharat Standard up to BS – IV and procedures for confirmation on production.
3	<b>Alcohol:</b> Sources of Methanol and Ethanol, methods of it's production. Properties of methanol & ethanol as engine fuels, Use of alcohols in S.I. and C.I. engines, performance of blending methanol with gasoline. Emulsification of alcohol and diesel. Dual fuel systems. Improvement / Change in emission characteristics with respect to % blending of Alcohol.
4	<b>Bio Diesels:</b> Base materials used for production of Bio Diesel (Karanja oil, Neemoil, Sunflower oil, Soyabean oil, Musturd oil, Palm oil, Jatropha seeds). Process of separation of Bio Diesel. Properties Diesel blended with vegetable oil, and difference in performance of Engine.
5	<b>Hydrogen:</b>

	<p>Hydrogen as a substitute fuel. Study Properties, Sources and methods of Production of Hydrogen, Storage and Transportation of hydrogen. Also, the economics of Application and Advantages of hydrogen (Liquid hydrogen) as fuel for IC engine/ hydrogen car. Layout of a hydrogen car.</p> <p><b>Fuel Cells:</b> Concept of fuel cells based on usage of Hydrogen and Methanol. Power rating, and performance. Heat dissipation, Layout of fuel cell vehicle.</p>
6	<p><b>Biogas:</b> Introduction to Biogas system, Process during gas formation, Factors affecting biogas formation. Usage of Biogas in SI engine &amp; CI engine.</p> <p><b>LPG &amp; CNG:</b> Properties of LPG &amp; CNG as engine fuels, fuel metering systems, combustion characteristics, effect on performance, emission, cost and safety.</p>
7	<p><b>Solar Power:</b> Solar cells for energy collection. Storage batteries, layout of solar powered automobiles. Advantages and limitations.</p>
8	<p><b>Electric &amp; Hybrid Vehicles:</b> Layout of an electric vehicles, advantages &amp; limitations. Systems components, electronic controlled systems, high energy and power density batteries. Types of hybrid vehicles.</p>
9	<p><b>Vegetable Oils:</b> Various Vegetable oils for Engines – Esterification – Performance and emission characteristics.</p> <p><b>Synthetic Alternative Fuels:</b> Di-Methyl Ether (DME), P-Series, Eco Friendly Plastic fuels (EPF).</p>

### Lesson Planning:

Sr. No.	Date/Week	Unit No.	% Weightage	Topic No
1	1 <sup>st</sup> , 2 <sup>ed</sup> , 3 <sup>ed</sup>	Unit 1	20 % .	1,2
2	4 <sup>th</sup> , 5 <sup>th</sup> , 6 <sup>th</sup>	Unit 2	20 %	3
3	7 <sup>th</sup> , 8 <sup>th</sup> , 9 <sup>th</sup>	Unit 3	20 %	4
4	10 <sup>th</sup> , 11 <sup>th</sup> , 12 <sup>th</sup>	Unit 4	20 %	5,6
5	13 <sup>th</sup> , 14 <sup>th</sup> , 15 <sup>th</sup>	Unit 5	20 %	7,8,9

### Instructional Method & Pedagogy:

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.

- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.

### **Students Learning Outcomes**

- The student can identify different areas of alternate fuels and energy system.
- Can find the applications of all the areas in day to day life.

### **Recommended Study Materials**

#### **Text & Reference Books:**

- Alternate Fuels by Dr. S. Thipse, Jaico Publications
- “Automotive Emission Control” by Crouse, AND Anglin – McGraw Hill.
- “Alternative Fuels Guidebook” by Bechtold R..
- SAE Paper nos. 840367, 841333, 841334.
- “Internal Combustion Engines” by Ganeshan – Tata McGraw Hill.
- “Internal Combustion Engines” by Heywood John.
- The properties and performance of modern alternative fuels” – SAE Paper no. 841210.