FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Automobile Engineering)**

Semester: **VI**

Course Code: **202010601**

Course Title: **Alternative Fuels and Energy Systems**

Course Group: **Professional Core Course**

Course Objectives: The course is intended to understand need of alternative fuels for automotive applications. The course also covers production process, storage, dispensing, combustion and emission characteristics of various gaseous and liquid alternative fuels along with some prominent alternative drive trains.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Internal		External		Total
Lecture	Tutorial	Practical		Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	50 / 18	25 /9	50 / 17	25 / 9	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction:** Need for alternate fuels, Advantages & limitations, Implementation barriers in India, Concept of Petroleum fuels, Estimation of petroleum reserves, availability and properties of alternate fuels, A.S.T.M. standards, EURO and Bharat Stage standards, Important properties of fuels.	5

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2	**Bio-diesels:** Base materials used for production of Bio Diesel (Karanj oil, Neem oil, Sunflower oil, Soya been oil, Mustard oil, Palm oil, Jatropha seeds, algae), Bio diesel production process, Process of separation of Bio Diesel, Advantages, disadvantages, Properties of biodiesel, Engine performance, storage, dispensing and combustion process. **Vegetable Oils:** Various Vegetable oils for Engines, Esterification, Performance and emission characteristics.	**7**
3	**Alcohol:** Sources and use of Methanol and Ethanol in I.C. engine, Properties, applications, advantages, disadvantages, production process, storage, dispensing, combustion process, emission and performance characteristics of methanol & ethanol as engine fuels, Emulsification of alcohol.	**5**
4	**LPG & CNG:** Properties of LPG & CNG as engine fuels, fuel metering systems, Production, storage, dispensing, combustion characteristics, emission, effect on performance, components of conversion kit, cost and safety.	**6**
5	**Biogas:** Introduction to Biogas system, composition of biogas, Production process, Types of biogas plants, Process during gas formation, Factors affecting biogas formation, storage, dispensing, emission characteristics, Usage of Biogas in IC engine.	**5**
6	**Hydrogen:** History, physical and chemical properties, Hydrogen storage for automobile applications (I.C. Engine, Fuel Cell), Compressed, liquid, metal hydrides, Chemical storage.	**5**
7	**Solar Powered Vehicles:** Layout and working principle of solar powered automobiles, applications, advantages, disadvantages, Solar cells for energy collection, PV solar energy.	**4**
8	**Non-conventional I.C. Engine:** Introduction, Duel fuel / Multi fuel engine, stratified charge, adiabatic engine, Variable Compression Ratio engine, Free piston engine, Sterling engine, Wankel engine. **Other Alternative Fuels:** Di-Methyl Ether (DME), Pyrolysis gas/oil, Synthetic gas/oil from plastic, rubber, coal, wood etc., Eco Friendly/Waste Plastic fuels (EPF).	**5**
9	**Flex Fuel Technology:** Introduction, need, advantages, Technological impact in India.	**3**

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List of Practicals / Tutorials:

1	To Study different properties of fuels and Need for alternative fuels.
2	To understand Biodiesel as an alternate fuel for a vehicle.
3	To understand Alcohol (Methanol & Ethanol) as an alternate fuel.
4	Demonstration of Liquefied Petroleum Gas (LPG) based vehicle.
5	Demonstration of Compressed Natural Gas (CNG) based vehicle.
6	Study of Biogas as an alternate fuel.
7	Study of Hydrogen based vehicle.
8	Demonstration of Solar powered vehicles.
9	To understand working of non-conventional I.C. engines.
10	Industrial visit/Seminar to enhance learning process.

Reference Books:

1	Alternate Fuels, Dr. S. Thipse, Jaico Publications.
2	Hydrogen and Fuel Cells: Emerging Technologies and Applications,Bent Sorensen, Elsevier Academic Press, UK
3	Automotive Emission Control, Crouse and Anglin , McGraw Hill
4	Alternative Fuels Guidebook, Bechtold R.
5	Hydrogen and Fuel Cells: A Comprehensive Guide, Rebecca L. and Busby, Penn Well Corporation, Oklahoma.

Supplementary learning Material:	
1	NPTEL Resources

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment

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Internal Evaluation :
The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
25	25	35	5	5	5	

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand need and latest trends in alternate fuel technology.	**20**
CO-2	Understand importance of liquid fuels like alcohol & biodiesel.	**25**
CO-3	Understand significance & emissions with gaseous fuels like LPG, CNG, Biogas.	**25**
CO-4	Understand future fuels like hydrogen and alternative drive lines.	**20**
CO-5	Understand concept and working of Non-conventional I.C. engines and some other alternate fuels.	**10**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2027

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