

## ALTERNATE FUEL AND EMISSION CONTROLS IN AUTOMOTIVES

<b>CourseCode</b>		<b>Year</b>		<b>Semester</b>	
<b>Course Category</b>	Minor in AE	<b>Branch</b>	ME	<b>Course Type</b>	Theory
<b>Credits</b>	4	<b>L – T – P</b>	3 – 1 – 0	<b>Prerequisites</b>	Nil
<b>Continuous Internal Evaluation</b>	30	<b>Semester End Evaluation</b>	70	<b>Total Marks</b>	100

Course Outcomes		Skill	Level	Units
Upon successful completion of the course, the student will be able to				
<b>CO1</b>	Understand the fundamental concepts of Alternative fuels and their emission control	Understand	L2	1,2,3,4,5
<b>CO2</b>	Illustrate various pollutants emitting from automotive and their effects and control techniques	Apply	L3	2,3,4
<b>CO3</b>	Analyse the pollutant characteristics and methodologies, testing equipment used to measure pollutants.	Analyse	L4	1,3,4,5

	Contribution of Course Outcomes towards achievement of Program Outcomes													
	Strength of correlations (3: High, 2: Moderate, 1: Low)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	1	-	-	-	-	2	-	-	-	-	1	3	1
<b>CO2</b>	2	1	-	-	-	-	2	-	-	-	-	1	3	1
<b>CO3</b>	2	1	-	-	-	-	2	-	-	-	-	1	3	1

Syllabus		
UNIT	Contents	Mapped COs
<b>I</b>	<b>Alternate fuels:</b> Introduction to alternate energy sources, availability, properties of biofuels, methanol, ethanol, vegetable oils, biodiesel. Gaseous fuels: hydrogen, natural gas, compressed natural gas (CNG), liquefied petroleum gas(LPG) ,Hydrogen ,Producer gas, Oxygenated fuels: benzol, diethyl ether (DEE), dimethyl ether (DME)-properties and their performance.	<b>CO1, CO3</b>
<b>II</b>	<b>Pollutants and emissions:</b> Types of pollutants, HC, CO, CO2, NOx, smoke and soot other emissions: aldehydes, sulphur, Emission standards-Bharat stage, Euro norms, Effect of emissions on environment, human health, transient operation effects on pollution.	<b>CO1, CO2</b>
<b>III</b>	<b>Performance and emission characteristics:</b> alternate fuels Emission characteristics in SI engines, alcohol – gasoline blends, methanol reformed gas engine. Use of alcohols in CI engines. Properties, production and storage methods of hydrogen, safety precautions, Biogas production and its properties, properties of LPG and CNG. Performance, combustion and emission characteristics of hydrogen, biogas, LPG and CNG in SI and CI engines.	<b>CO1, CO2, CO3</b>
<b>IV</b>	<b>Emission control techniques:</b> Engine design changes, Engine operating	<b>CO1,</b>

	parameters, EGR systems, glow plugs, thermal converters, Catalytic converters: classification, honey comb, 2-way, 3-way catalytic converters, Particulate filter, Selective catalytic reduction (SCR) systems, Fumigation, water injection, secondary air injection, enhanced evaporative emission control system (EVAP), PCV system.	<b>CO2, CO3</b>
<b>V</b>	<b>Methodology and equipment to measure pollutants:</b> testing equipment- Exhaust gas analyzer, Orsat apparatus, NDIR, FID, Chemiluminescent analyzers, Gas chromatography, smoke meters, measurement of CO2 Test procedures: ECE, FTP Tests. SHED Test -chassis dynamometers, dilution tunnels, Cycle test-I, Cycle test-II.	<b>CO1, CO3</b>

### Learning Resources

#### Text books

- 1.V. Ganesan, Internal combustion engines,4/e, McGraw Hill, 2015.
- 2.J. Erjavec, A systems approach to automotive technology, 2/e, Cengage Learning, 2013.

#### Reference books

- 1.J. B. Heywood, Internal Combustion Engines Fundamentals, McGraw Hill, 2017.
- 2.M.F. Hordeski, Alternative Fuels: The Future of Hydrogen, The Fairmont Press, Inc., 2008.
- 3.R.K. Rajput, A textbook of Internal Combustion Engines, 2/E, Laxmi Publications (P) Ltd, 2007.
- 4.Alternative Fuels: Fuel Cells and Natural Gas, Society of Automotive Engineers, Incorporated, 2000.
- 5.S.S. Thips, Alternative Fuels: Concepts, Technologies and Developments, Jaico Publishing House, 2010

#### E- Resources & other digital material

- 1..<https://nptel.ac.in/courses/112/104/112104122/>
- 2..<https://ocw.mit.edu/courses/materials-science-and-engineering/3-080-economic-environmental-issues-in-materials-selection-fall-2005/>