

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA  
19AME54a - ALTERNATIVE FUELS AND EMISSION CONTROL IN AUTOMOTIVES**

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**Course Objectives:** The objectives of the course are to make the students learn about

- Explain various alcohol and gaseous fuels and their use in SI and CI engines.
- Explain various vegetable oils and their use in CI engines.
- Determine the formation of various emissions from SI engine and control techniques.
- Identify various emission measuring instruments and test procedures.

**UNIT – I**

**12 Hours**

**Alcohol fuels and gaseous fuels:** Properties of alcohols, alcohol – gasoline blends, fuel flexible vehicle, methanol reformed gas engine, dual fuel system, Spark assisted diesel engine, surface ignition engine, ignition accelerators, performance, combustion and emission characteristics in SI and CI engines, Properties of hydrogen, production and storage methods, 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

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Assets the properties of alcohols and alcohol gasoline blends **L5**
- Explain the principles of spark assisted diesel engine and surface ignition engine. **L3**
- Identify the performance, combustion and emission characteristics in SI and CI engines. **L3**
- Explain production, storage methods and emission characteristics of hydrogen. **L3**

**UNIT – II**

**10 Hours**

**Vegetable oils:** Various vegetable oils for diesel engines, structure and properties, problems in using vegetable oils in diesel engines, Methods to improve the engine performance using vegetable oils – preheating, Esterification, blending with good secondary fuels, Semi-adiabatic engine, surface ignition engine, ignition accelerators dual fuelling with gaseous and liquid fuels coils, Performance, combustion and emission characteristics of biodiesel fuelled diesel engines.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List various vegetable oils and its properties used for diesel engines. **L1**
- Identify the problems in using vegetable oils in diesel engines. **L3**
- Explain the methods to improve the engine performance using vegetable oils. **L3**
- Explain the method of blending with good secondary fuels. **L3**
- Determine the performance, combustion and emission characteristics of biodiesel fuelled diesel engine. **L3**

**UNIT – III**

**10 Hrs**

**Emissions from SI engines and their control:** Emission formation in SI engines (CO, HC and NO<sub>x</sub>), Effect of design and operating variables on emission formation, Control techniques – Thermal reactor, exhaust gas recirculation, Three way catalytic convertor and Charcoal canister control for evaporative emission, Positive crank case ventilation for blow by gas control.

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**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain emission formation in SI engines. L3
- Practice the effect of design and operating variables on emission formation in SI engine. L5
- Classify various control techniques on SI engine emission formation. L2
- Choose a control technique for a given application L1
- Explain on positive crank case ventilation for blow by gas control. L3

**UNIT – IV****08 Hrs**

**Emissions from CI engines and their control:** Emission formation in CI engines (HC, CO, NO<sub>x</sub>, Aldehydes, smoke and particulates), Effect of design and operating variables on emission formation, Control techniques – Exhaust gas recirculation, NO<sub>x</sub> selective catalytic reduction, Diesel oxidation catalytic convertor, Diesel particulate filter, NO<sub>x</sub> versus particulates – Trade off

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain emission formation in CI engines L3
- Appraise the effect of design and operating variables on emission formation in CI engine. L5
- Explain various control techniques on CI engine emission formation. L3
- Choose a control technique for a given application L1

**UNIT – V****08 Hrs**

**Emission measuring instruments and test procedures:** Principle of operation of emission measuring instruments used in SI and CI engines, Measurement of CO<sub>2</sub> and CO by NDIR, Hydrocarbon emission by FID, Chemiluminescent analyser for NO<sub>x</sub>, Liquid and Gas chromatograph Spot sampling and continuous indication type smoke meters (Bosch, AVL and Hartridge smoke meters) emission test procedures – FTP, Euro and Bharat norms

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify various emission measuring instruments for SI and CI engines L2
- Apply the principle of operation of emission measuring instruments used in SI and CI engines L3
- Explain the method of measurement of CO<sub>2</sub> and CO by NDIR L3
- Identify the emission of hydrocarbons using FID L3

**Text Books:**

1. Ganesan V, Internal combustion engines, 4<sup>th</sup> Edition, Tata McGraw Hill Education, 2012
2. Thipse.S.S, Alternative Fuels: Concepts, Technologies and Developments, Jaico Publishing House, 2010.

**Reference Books:**

1. Michael F. Horddeski, Alternative Fuels: The Future of Hydrogen, The Fairmont Press, 2008
2. R.K.Rajput, A textbook of Internal Combustion Engines, 2<sup>nd</sup> Edition, Laxmi Publications, 2007
3. "Society of Automotive Engineers", Alternative Fuels: Fuel Cells and Natural Gas, Society of Automotive Engineers, Incorporated, 2000

**Course Outcomes:**

At the end of this Course the student will be able to

- Identify various emissions from SI and CI engines. L3
- Explain the properties of alcohol fuels and gaseous fuels. L3
- Predict the problems by using vegetable oils in diesel engines. L6
- Choose the use of various emission measuring instruments. L3