SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19OE120 AUTOMOTIVE ELECTRONICS

III YEAR /IV SEMESTER MECHATRONICS

Unit 1 – INTRODUCTION TO ECU

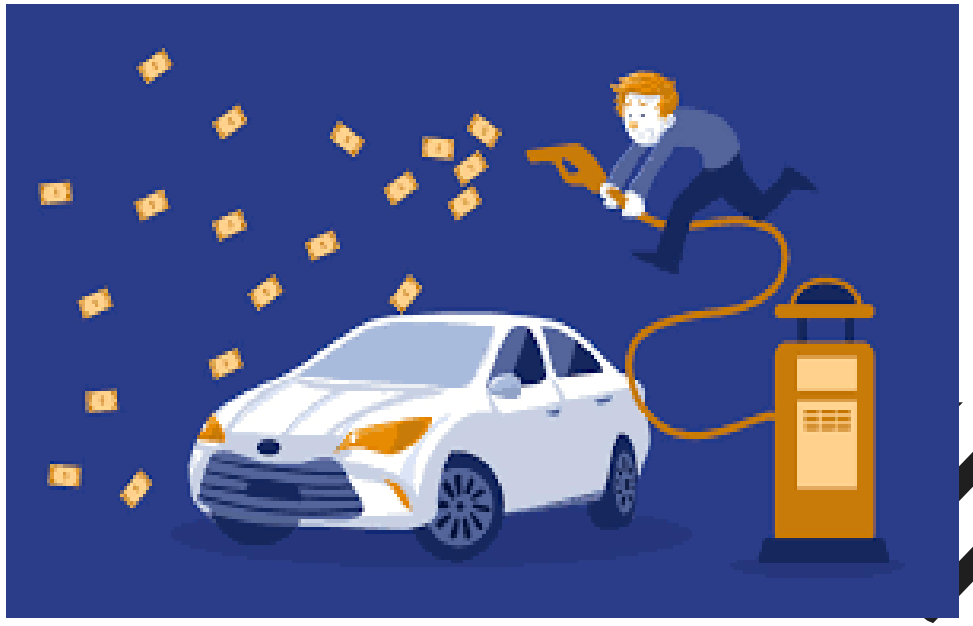
Topic 2 : Motivation for Electronic Engine Control

Motivation for Electronic Engine Control

- Engine control in the majority of engines means regulating fuel and air intake and spark timing to achieve desired performance in the form of power output.
- In 1960s, control of the engine output torque and RPM was accomplished through some combination of mechanical, pneumatic, or hydraulic systems.
- In the 1970s, electronic control systems were introduced.

The initial motivation for electronic engine control came from two government requirement

1. to regulate automobile exhaust emissions under the authority of the Environmental Protection Agency (EPA).
2. to improve the national average fuel economy by government regulation.



EXHAUST EMISSION

CHEMICALS COMPOUNDS OF GASOLINE

- The engine exhaust consists of the products of combustion of air and gasoline mixture.
- Gasoline is a mixture of chemical compounds that are called hydrocarbons.
- This name is derived from the chemical union of hydrogen (H) and carbon (C) in various proportions.
- Gasoline also contains natural impurities and chemicals added by the refiner.
- All of these can produce undesirable exhaust elements

EXHAUST GAS

- **COMBUSTION OF GASOLINE**
- The combustion of gasoline in an engine results in exhaust gases, including

  CO2,

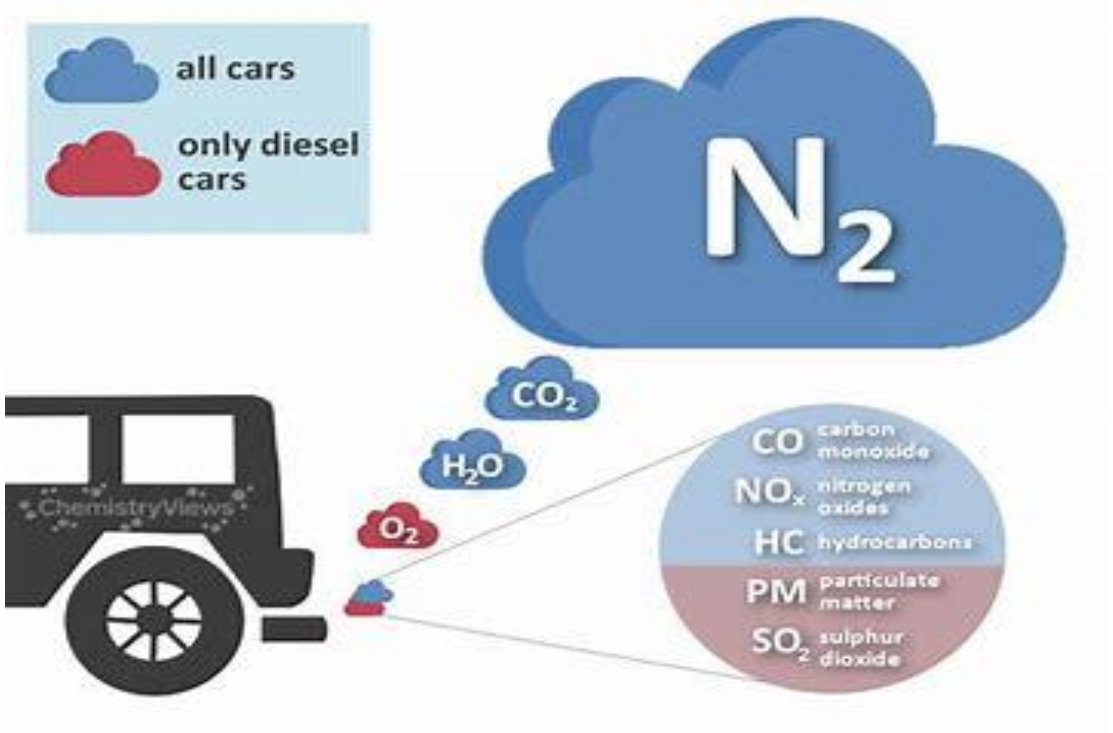
  H2O,

  CO,

  oxides of nitrogen,

  and various

  Hydrocarbons



During combustion process

- During the combustion process, the carbon and hydrogen combine with oxygen from the air, releasing heat energy and forming various chemical compounds.
- If the combustion were perfect, the exhaust gases would consist only of carbon dioxide (CO2) and water (H2O).
- Unfortunately, the combustion of the SI engine is not perfect.
- In addition to the CO2 and H2O, the exhaust contains amounts of carbon monoxide (CO), oxides of nitrogen (chemical unions of nitrogen and oxygen that are denoted NOx), unburned hydrocarbons (HC), oxides of sulfur, and other compounds.
- Some of the exhaust constituents are considered harmful and are now under the control of the federal government.

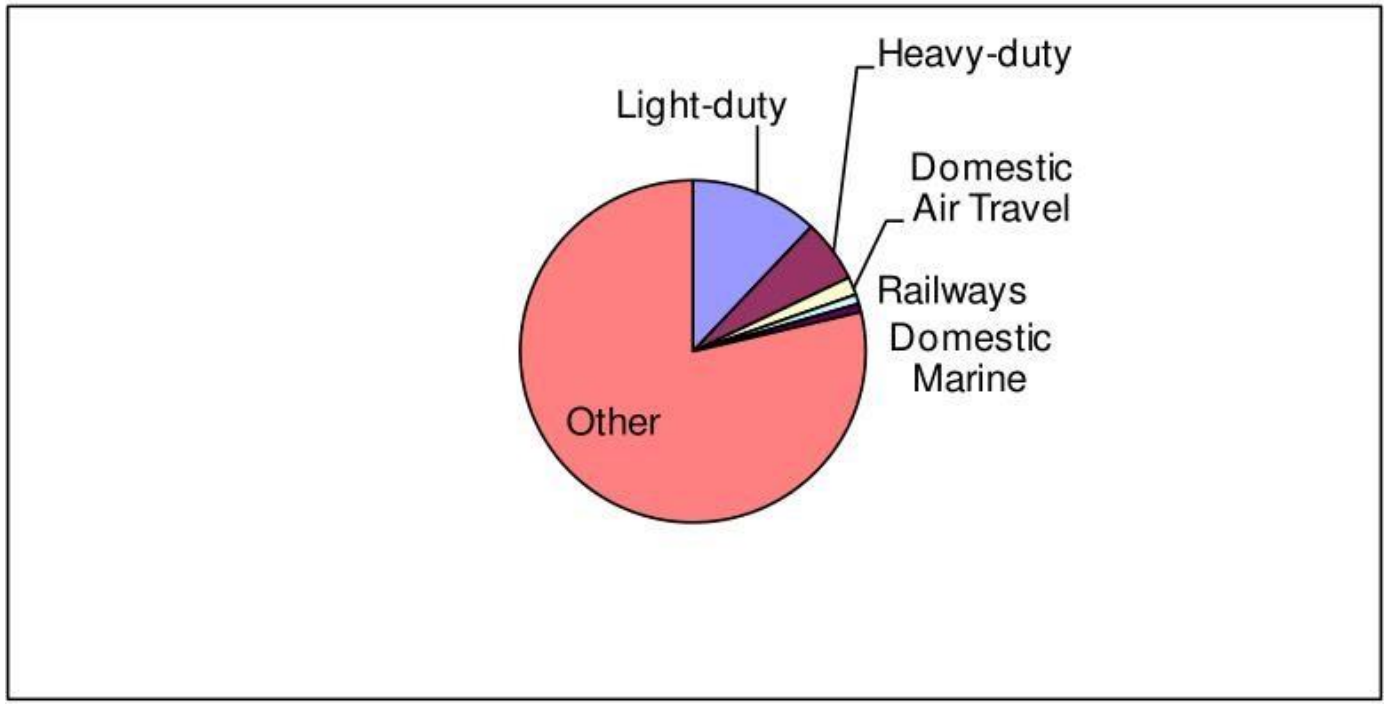
- Types of Emission
  - Exhaust Emission
  - Evaporative Emission
- Pollutants in Exhaust Gas
  - Carbon monoxide(CO)
  - Oxides of Nitrogen(Nox)
  - Hydro Carbons(HC)
  - Smoke and Soot
  - Lead
  - Sulphuric Oxide
  - Particulate

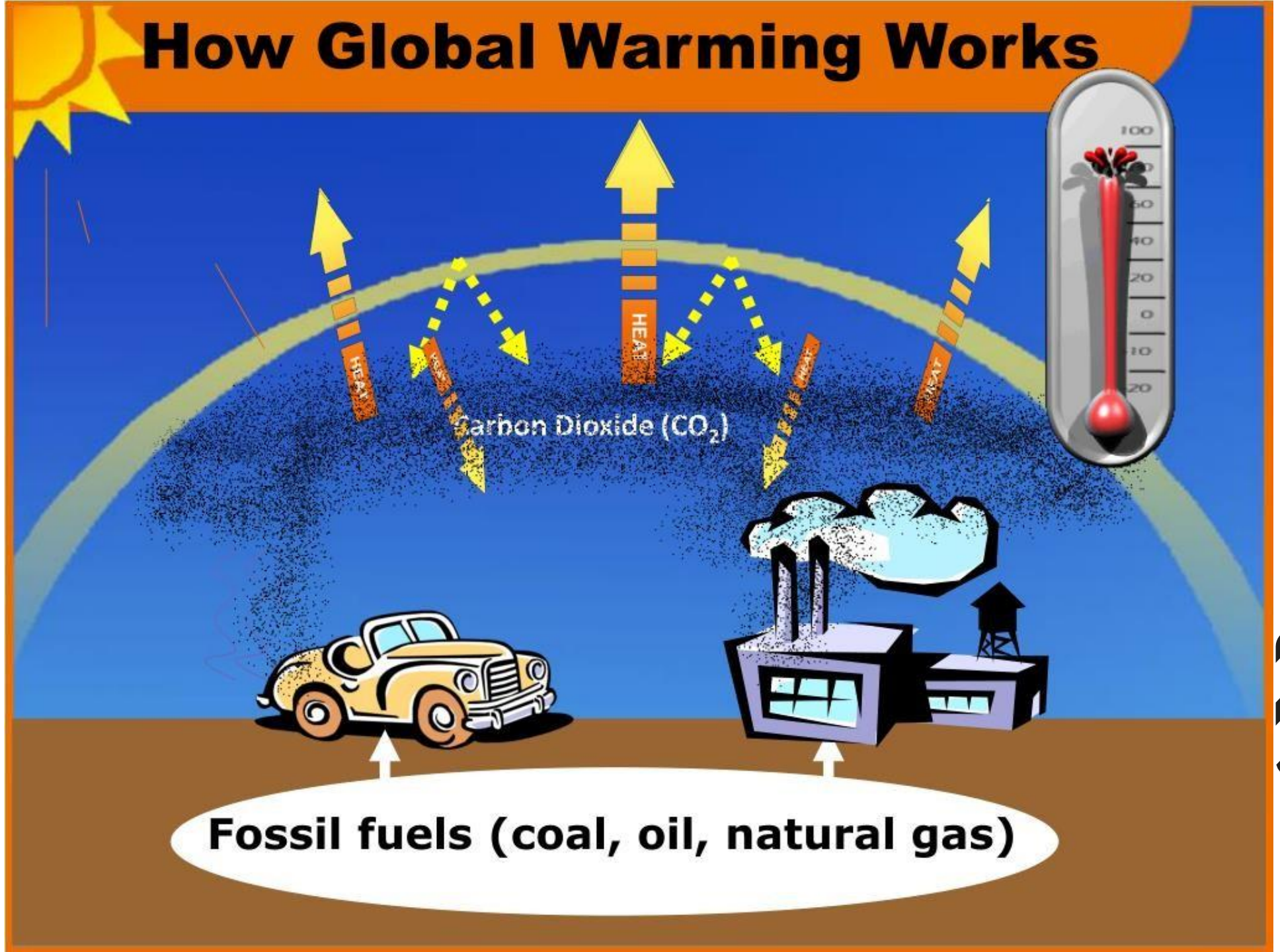
Table 1: Sources, Health and Welfare Effects for Criteria Pollutants				
Pollutant	**Description**	**Sources**	**Health Effects**	**Welfare Effects**
Carbon Monoxide (CO)	Colorless, odorless gas	Motor vehicle exhaust, indoor sources include kerosene or wood burning stoves.	Headaches, reduced mental alertness, heart attack, cardiovascular diseases, impaired fetal development, death.	Contribute to the formation of smog.
Sulfur Dioxide (SO_2)	Colorless gas that dissolves in water vapor to form acid, and interact with other gases and particles in the air.	Coal-fired power plants, petroleum refineries, manufacture of sulfuric acid and smelting of ores containing sulfur.	Eye irritation, wheezing, chest tightness, shortness of breath, lung damage.	Contribute to the formation of acid rain, visibility impairment, plant and water damage, aesthetic damage.
Nitrogen Dioxide (NO_2)	Reddish brown, highly reactive gas.	Motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.	Susceptibility to respiratory infections, irritation of the lung and respiratory symptoms (e.g., cough, chest pain, difficulty breathing).	Contribute to the formation of smog, acid rain, water quality deterioration, global warming, and visibility impairment.
Ozone (O_3)	Gaseous pollutant when it is formed in the troposphere.	Vehicle exhaust and certain other fumes. Formed from other air pollutants in the presence of sunlight.	Eye and throat irritation, coughing, respiratory tract problems, asthma, lung damage.	Plant and ecosystem damage.
Lead (Pb)	Metallic element	Metal refineries, lead smelters, battery manufacturers, iron and steel producers.	Anemia, high blood pressure, brain and kidney damage, neurological disorders, cancer, lowered IQ.	Affects animals and plants, affects aquatic ecosystems.
Particulate Matter (PM)	Very small particles of soot, dust, or other matter, including tiny droplets of liquids.	Diesel engines, power plants, industries, windblown dust, wood stoves.	Eye irritation, asthma, bronchitis, lung damage, cancer, heavy metal poisoning, cardiovascular effects.	Visibility impairment, atmospheric deposition, aesthetic damage.

Global Climate Change

- Gas and diesel burning vehicles also contribute to global climate change.
- The Earth's atmosphere acts like a blanket, trapping some of the sun's heat near the planet's surface. Without this natural insulation, the average temperature on Earth would be -18°C
- Vehicle emissions also contain CO2, an important Green house gas (GHG).
- If the atmosphere gets too thick with GHGs, too much heat gets trapped. That can mean problems for the whole world.

Global Climate Change




How Global Warming Works
HEAT
HEAT
HEAT
HEAT
Carbon Dioxide (CO_2)
Fossil fuels (coal, oil, natural gas)

- The exhaust emissions controlled by government standards are CO, HC, and Nox
- Automotive exhaust emission control requirements began in the United States in 1966.
- Auto manufacturers found that the traditional engine controls not sufficientnto meet these emission limits and maintain adequate engine performance
- so they turned to electronic controls

REFERENCES

- William B. Ribbens, “Understanding Automotive Electronics”, Butterworth Heinemann Woburn, 7th Edition, 2012.
- Robert Bosch, “ Bosch Automotive Electrics and Automotive Electronics”, Springer View, 5th Edition, 2013.
- Tom Denton, “Automobile Electrical and Electronic Systems”, Elsevier, 3rd Edition, 2003.

THANK YOU

SNS INSTITUTIONS