**ME 2041 – ADVANCED IC ENGINES**

**UNIT V**

**RECENT TRENDS**

**1. What is lean burn engine?**

Lean burn engine is a layout of Otto cycle engine designed to permit the combustion of lean air fuel mixture and to obtain simultaneously low emission values as high fuel economy. It is designed to operate effectively in the air fuel ratio **14:1-16:1**to **20:1-22:1.** When the lean compression ratio, combustion chamber shape, ignition system, the lean limit are successfully optimized, the engine is refused to as a lean burn engine.

**2. Why lean mixture is preferred in SI engine?**

Lean mixture is preferred in SI engine because of the following facts:

 Lower pollutants.  Good fuel economy.

 Heat transfer losses to the cooing medium are reduced because of lower peak temperatures.

 Since lean mixture are less prove to knocking.

**3. What are the modifications to be made to convert an existing engine as a lean burn engine?**

The modifications to be made to comments an existing engine as a lean burn engine are:

 Increasing the compression ratio of the engine to accurate flame propagation.

 Increasing the swirl and turbulence of the mixture in order to increase flame speed.

 Catalytic activation of the charge in the combustion chamber.

**4. How the stratified charge engine can be characterised?**

The stratified charge engine can be characterised by the following features:

 Relatively high compression ratio

 Ability of direct cylinder fuel injection variations to run unthrottled.

 Stratification of the charge mixture into distinctly different rich and lean air fuel ratios.

**5. List the advantages of the stratified charge engine.**

The advantages of the stratified charge engines are:

Low octane fuels (cheaper fuels) can be used at higher compression ratios.

 Load control can be achieved without air throttling

 Quiet in operation.

 Multi fuels give more or less equal performance.

**6. What are the main disadvantages of the stratified charge engine?**

The main disadvantages of the stratified charge engines are:

 Maximum output (from the air in the cylinder (i.e.) complete utilization of air) is not achieved.

 The added cost of the injection/modified combustion systems.

 Added complication of injection and spark ignition systems.

**7. Write short notes on plasma jet ignition system.**

The plasma jet ignition system uses a plasma jet spark plug. This system can be considered as a form of electrical torch ignition, since the ignition source is hot jet plasma which project well away from the spark plug. The plasma jet ignition sources is turbulent and electrodeless, both desirable features for igniting marginal mixtures.

**8. What are the factors that influence the operation of the plasma jet plug?**

The factors that can influence the operation of the plasma jet plug are the amount of the applied electrical energy, the rate of energy delivery, the cavity volume, the cavity dimensions, the orifice size, the ambient gas pressure and the quantity of fuel present in the cavity.

**9. What are the reasons for automotive engines equipped with gasoline injection system?**

Some of the recent automotive engines are equipped with gasoline injection system instead of a carburetion for the reasons: (1) To have uniform distribution of fuel in a multi cylinder engine. (2) To improve breathing capacity (i.e.) volumetric efficiency. (3) To reduce or eliminate detonation.

**10. What are the types of injection systems?**

1. Gasoline Direct Injection (GDI) in to the cylinder

2. Port injection (a) timed (b) continuous

3. Manifold injection

**11. What are the objectives of the fuel injection system?**

The objectives of the fuel injection system are to meter, atomize and uniformly distribute the fuel throughout the air mass in the cylinder.

**12. What are the components of injection system**?

The components of injection system are:

1. Pumping element 2. Metering element 3. Mixing element

4. Mixture control 5. Timing control

**13. Write notes on continuous injection system.**

Continuous injection system usually has a rotary pump. The pump maintains the fuel line gauge pressure of about **0.75 to 1.5 bar**. The system injects the fuel through a nozzle located in manifold immediately downstream of the throttle plate.

**14. Explain the functions of the following components.**

**(**a) Pumping element, (b) Metering element,

(c) Timing control, (d) Ambient control.

**(a) Pumping element**- moves the fuel from the fuel tank to the injector. This include necessary piping, filter etc.

**(b)Metering element**- measures and supplies the fuel at the rate demanded by load and speed conditions of the engine.

**(c)Timing control**- fixes the start and stop of the fuel-air mixing process.

**(d)Ambient control**-compensates for charges in temperature and pressure of either air or fuel that may affect the various elements of the system.

**15. Write the advantages of homogeneous charge compression ignition engine.**

1. Lower NOx and particulate emissions 2. High thermal efficiency

**16. What are the fuels used in HCCI engines?**

Diesel , gasoline , methanol , natural gas and hydrogen

**17. List the disadvantages of homogeneous charge compression ignition engine.**

 The major problem is controlling the ignition timing over a wide lead and speed.

 Power density is limited by combustion noise and high peak pressure.