**ME 2041 – ADVANCED IC ENGINES**

**UNIT I**

**SPARK IGNITION ENGINES**

**1. What are the stages of combustion in a SI engines?**

The stages of combustion in a SI engines are:

FIRST STAGE: Ignition lag (or) preparation phase

SECOND STAGE: propagation of flame

THIRD STAGE: After burning

**2. What are the various factors that affect the flame speed?**

a) Turbulence b) F/A ratio c) T, P

d) Compression ratio e) Engine speed, size & output

**3. Define normal combustion.**

In normal combustion, the flame initiated by the spark travels across the combustion chamber in a fairly uniform manner.

**4. Define abnormal combustion and its consequences.**

Under certain operating conditions the combustion deviates from its normal Course leading to loss of performance and possible damage to the engine are termed as abnormal combustion (or) knocking combustion. Consequences are

 (1). Loss of power (2). Recurring preignition (3). Mechanical damage to the engine

**5. What is equivalence ratio?**

The ratio of the actual fuel-air ratio to the stoichiometric fuel –air ratio.

**6. Short note on SI engine equivalence ratio requirements.**

In a homogeneous mixture with equivalence ratio close to 1.0 the flame speed is normally of the order of 40cm/s .However in a SI engine the maximum flame speed is obtained when φ is between 1.1 and 1.2 (i.e.) when the mixture is slightly richer than stoichiometric.

**7. Write the desirable qualities for SI engine fuel.**

In order to avoid or inhibit detonation, a high auto ignition temperature and a long ignition lag are the desirable qualities for SI engine fuel.

**8. Explain the type of vibration produced when auto ignition occurs.**

Two different vibrations are produced.

1. In one case, a large amount of mixture may auto ignite giving use to a very rapid increase in pressure throughout the chamber and there will be a direct blow on free vibration of the engine parts.

2. In another case, larger pressure differences may exit in the combustion chamber and the resulting gas vibration can force the walls of the chamber to vibrate at the same frequency as the gas.

**9. What is the method to detect the phenomenon of knocking?**

The scientific method to detect the phenomenon of knocking is to use a pressure transfer this transducer is connected, usually to a cathode ray oscilloscope. Thus pressure-time traces can be obtained from the pressure transducer.

**10. List out some of the knock limited parameters.**

The knock limited parameters are:

1. Knock limited compression ratio 2. Knock limited into pressure

3. Knock limited Indicated mean effective pressure. (Klimep)

**11. Define performance number.**

Performance number is defined as the ratio. Of Knock limited Indicated mean effective pressure with the sample fuel to knock limited Indicated mean effective pressure with ISO-OCTANE .when the inlet pressure is kept constant.

**12. List the factors that are involved in either producing (or) preventing knock.**

The factors that are involved in either producing (or) preventing knock are temperature, pressure, density of the unburned charge and the time factor.

**13. List the parameters which are affecting knock in SI engine.**

The parameters which are directly (or) indirectly connected with knocking are inlet temperature of mixture compression ratio, mass of inducted charge, power output of the engine.

**14. List the parameters in time factors that reduce the knocking.**

Parameters are turbulence, engine speed, flame travel distance, combustion chamber shape and location of spark plug.

**15. List the composition factors in the knocking.**

Air –fuel ratio and octane value of the fuel are the composition factors.

**16. What are the objectives to be kept in mind during design of combustion chamber?**

General objectives are

(a) Smooth engine operation (b) Moderate rate of pressure rise

(c) Reducing the possibility of knocking

(d) High power output and thermal efficiency

**17. What are the factors to be considered to obtain high thermal efficiency?**

Following are the factors:

1. A high volumetric efficiency.

2. Anti knock characteristic must be improved.

3. Compact combustion chamber reduces heat loss during combustion increases the thermal efficiency.

**18. Write the different types of combustion chambering SI engine?**

T-Head type, L- Head type, I- Head type, F- Head type.

**19. What are the components required in the fuel injection system?**

Components are –pumping element, metering element, mixing element, distributing element, Timing control, and ambient control.

**20. What are the advantages of fuel –injection in an SI engine?**

Advantages are:

1. Increased volumetric efficiency. 2. Better thermal efficiency

3. Lower exhaust emissions 4. High quality fuel distribution.

**21. List the drawbacks of the carburetion.**

1. Non uniform distribution of mixture in multi cylinder engines.

2. Loss of volumetric efficiency due to retraction for mixture flow and possibility of back firing.

**22. What are the functional requirements of an injection system?**

1. Accurate mixing of the fuel injected per cycle.

2. Timing the injection of the fuel.

3. Proper atomization of fuel into fine droplets 4. Proper spray pattern. 5. No lag during beginning and end of injection.

**23. List some of the important requirements of automobile carburetors.**

1. Ease of starting the engine, particularly under low ambient conditions.

2. Good and quick acceleration of the engine.

3. Good fuel economy. 4. Ensuring full torque at low speeds.

**24. What are the general types of carburetors?**

Types are UPDRAUGHT, DOWN DRAUGHT, and CROSS DRAUGHT.

**25. What are the essential parts, compensating device and additional**

 **system (modern) carburetors?**

Parts – fuel strainer, float chamber, main metering and idling system, the choke & the throttle. Compensating devise- Air –bleed jet, compensating jet, Emulsion tube, auxiliary valve and port, back suction control mechanism.

Additional system –Ant dieseling, richer coasting, acceleration pump and economic (or) power enrichment system.

**26. Define carburetion.**

The process of formation of a combustible fuel –air mixture by mixing the proper amount of fuel with air before admission to engine cylinder is called carburetion.

**27. What are the factors effecting carburetion?**

1. The engine speed

2. The vaporization characteristics of fuel

3. The temperature of the incoming air

4. The design of the carburetor

**28. What are the different types airs –fuel mixtures?**

1.Chemically correct mixture 2. Rich mixture 3. lean mixture.

**29. What are the different range of throttle operation?**

1. Idling .

2. cruising

3. High power.