ME 6016 - ADVANCED IC ENGINES

Part-A

UNIT – 1 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? (Nov/Dec-2013, Apr/May-2014)

a) Turbulence b) F/A ratio c) T, P d) Compression ratio e) Engine speed, size & output d) Engine speed e) Engine Load

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 pre-ignition (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 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 exist 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.

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. What do you understand by knocking? How it can be eliminated? (Nov/Ddec-2012)

When the two flame fronts collide, a server pressure pulse is generated. This pressure wave strikes the cylinder wall and set it vibrating, giving rise to high pitched metallic pinking or ringing round. This is known as knocking.

To avoid or suppress detonation, a high auto-ignition temperature and a long ignition delay will be the desirable qualities for the S.I engine fuels and its efficiency.

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 points which control the detonation (or) Knocking. (Nov/Dec-2012).

Retard spark timing, Increasing engine RPM, Reducing the pressure in inlet manifold by throttling; making the mixture too lean will reduce the power output.

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 –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 is the different range of throttle operation?

(1) Idling (2) Cruising (3) High power.

30. Why a S.I engine requires a rich mixture during idling and at full load? (April/May-2015) (November/December-2013)

During idling the throttle is nearly closed and the suction pressure is very low, exhaust pressure is higher than the intake pressure. This requires rich air-fuel ratio for idling and low speeds. There is a full throttling for full load condition which also requires the same at venture section with respect to air flow, so air-fuel ratio enters into the combustion chamber is in rich condition.

31. What are the principles of Carburetor? How are jet and venture sizes decided? (April/May-2015)

- Carburetor is simple device used to mix fuel and air in a desired stoichiometric ratio. This works under the principle of Bernoulli's theorem. It uses a venturi to change pressure and uses this difference (pressure head) to mix fuel in air.
- Venture size and jet size is decided based on the inlet manifold being used.

32. Define pre-ignition with respect to SI engines. (November/December-2014)

Per-ignition is the ignition of the homogeneous mixture in the cylinder, before the timed ignition spark occurs, caused by the local overheating of the combustion mixture.

33. List down the air-fuel ratio requirements of a S.I engine. (May/June-2012)

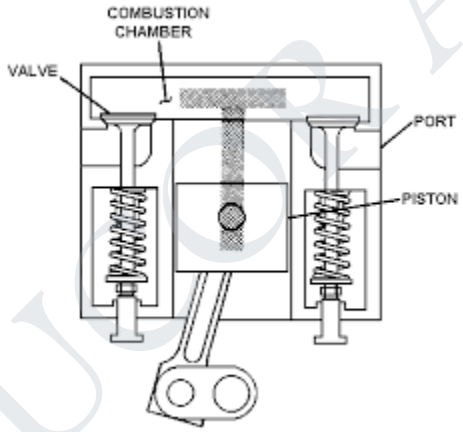
- By using the desired air-fuel ratio, the maximum economy can be gained.
- The air-fuel mixture gives the maximum output.
- The best power mixture is much richer than the chemically correct mixture and the best economy mixture is slightly leaner than the stoichiometric mixture.

34. Mention the different jets used in a carburetor. (May/June-2012)

The different jets used in carburetor are:

Air bleed jet, Compensating jet, Emulsion jet, Back suction control mechanism, Auxiliary air valve, Auxiliary air port.

35. Sketch T-head type combustion chamber used in S.I engines. (May/June-2013)



36. List the different Air-fuel ratios required for different operation conditions of a gasoline engine. (Nov/Dec 2015)

Idling conditions: Mixture must be enriched

Cruising: Mixture must be leaned

High Power: Mixture must be enriched

UNIT – II COMPRESSION IGNITION ENGINES

1. What are the stages of combustion in C.I engine?

The stages of combustion in C.I engine are four stages:

Stage 1: ignition delay period (preparatory phase), **Stage 2:** Period of rapid combustion, **Stage 3:** Period of controlled combustion, **Stage 4:** Period of after burning.

2. What is ignition delay period?

The fuel does not ignite immediately upon injection into the combustion chamber. There is a definite period of inactivity between the time when the first droplet of fuel hits the hot air in the combustion chamber and the time it starts through the actual burning phase. This period is known as ignition delay period.

3. What are two delays occur in ignition delay period?

The two delays occur in ignition delay period are the physically delay and chemically delay. Physical delay is the time between the beginning of injection and the attainment of chemical reaction conditions. Chemical delay is the reaction starts slowly and then accelerates until the inflammation or ignition takes place.

4. List the factors affecting the delay period?

The factors affecting the delay period are:

1. Compression ratio.
2. Atomization of the fuel.
3. Quality of the fuel.
4. Intake temperature and pressure.

5. Explain the effect of quality of fuel factor on the delay period?

Self-ignition temperature is the most important property of the fuel which affects the delay period. A lower self-ignition temperature and fuel with higher cetane number give lower delay period and smooth engine operation. Other properties of the fuel which affects the delay period are latent heat, viscosity and surface tension.

6. Give a comparative statement various characteristics that reduce knocking in S.I and C.I engine (any four)? (or) What do you understand by spark knock and diesel knocks? (May/June-2012)

S.NO	CHARCTERISTICS	S.I ENGINE	C.I ENGINE
1	Ignition temperature of fuel	High	low
2	Ignition delay	long	short
3	Compression ratio	Low	high

4	Inlet temperature and pressure	Low	HIGH

7. Write the classification of combustion chamber in C.I engine?

Combustion chamber in C.I engine is classified into two categories:

1. Direct-injection type 2. Indirect-injection type.

8. What is called direct injection type of combustion chamber?

Direct injection type of combustion chamber is also called an open combustion. In this type the entire volume of the combustion chamber is located in the main cylinder and the fuel is injected into this volume.

9. What are the types of open combustion chamber?/ state any four important types (shapes) of combustion chambers common in SI engines. (Nov/Dec2015)

In open combustion chamber there are many designs some are

a. Shallow depth chamber b. hemispherical chamber

c. Cylindrical chamber d. Toroidal chamber

10. What are the advantages and disadvantages of open combustion chamber (or) induction swirl? (April/May-213)

Advantages:

1. Minimum heat loss during compression because of lower surface area to volume ratio
2. No cold starting problems
3. Fine atomization because of multihole nozzle

Disadvantages:

1. High fuel injection pressure required and hence complex design of fuel injection pump
2. Necessity of accurate metering of fuel by the injection system, particularly for small engines.

11. What is an indirect injection type of combustion chamber? (May/June-2013, April/May-2014)

Indirect injection type of combustion chamber in which the combustion space is divided into two area and the fuel is injected into the 'pre-chamber' and which is connected to the main combustion chamber by a nozzle or orifice.

12. Write the classification of indirect injection chamber (divided combustion chamber)

Classification of divided combustion chamber is

a. Swirl chamber – in which compression swirl is generation.

b. Pre-combustion chamber – in which combustion swirl is induced.

c. Air cell chamber – in which both compression and combustion swirl are induced.

13. What are the applications of swirl chamber?

Swirl chamber type finds application

a. Where fuel quality is difficult to control

b. Where reliability under adverse condition is more important than fuel economy

c. Use of single hole of larger diameter for the fuel spray nozzle is often important consideration for the choice of fluid chamber engine.

14.) List the advantages and drawbacks of indirect injection chamber:

Advantages:

1. Injection pressure required is low 2. Direction of spraying is not very important

Disadvantages:

1. Poor cold starting performance required heater plugs 2. Specific fuel consumption is high

15. Why specific fuel consumption is high in indirect injection type combustion chamber:

Specific fuel consumption is high because there is a loss of pressure due to air motion through the duct and heat loss due to large heat transfer area.

16. What is turbo charging?

Energy available in the engines exhaust gas is used to drive the turbocharger compressor, which raises the inlet fluid density prior to entry to each engine cylinder. This is called turbo charging.

17. What are the major parts of a turbocharger?

The major parts of a turbocharger are turbine wheel, turbine housing, turbo shaft, compressor wheel, compressor housing and bearing housing.

18. Explain the term turbo lag.

In case of turbo charging there is a phenomenon called turbo lag, which refers to the short delay period before the boost or manifold pressure, increase. This is due to the time the turbocharger assembly takes the exhaust gases to accelerate the turbine and compressor wheel to speed up.

19. Explain the function of waste gate.

In the turbocharger assembly there is a control unit called waste gate. It is a diaphragm operated value that can bypass part of the gases around the turbine wheel when manifold pressure is quite high this unit limits the maximum boost pressure to prevent detonation in S.I engines and engine damage.

20. Why there is a large pressure differences across the injector nozzle are required:

The fuel is introduced in to the cylinder of a diesel engine through a nozzle with a large pressure differences across the nozzle jet will enter the chamber at high velocity to

1. Atomize in to small sized droplets to enables rapid evaporation and

2. Traverse the combustion chamber in the time available and fully utilize the air charge.

21. What is called break up length?

The liquid column bearing the nozzle disintegrates with in the cylinder over a finite

Length called the break up length in to drops of different sizes.

22. What are the different designs of nozzle used?

The different design of nozzle used is single orifice, multi-orifice, throttle or pintle depending on the needs of the combustion system employed.

23. What are the two types of photographic technique used?

To distinguish the liquid – containing core of the jet and the extracts of the fuel vapor region of the spray, which surrounds the liquid core, two types of photographic technique used are backlighting and shadow graph.

24. Explain photographic techniques method:

Back lighting identifies region where sufficient liquid fuel (as ligaments or drops) is present to attenuate the light.

The shadowgraph technique responds to density gradients in the test section so it identifies regions where fuel vapor exists.

25. List the droplet size depends on various factors:

The droplet sizes depends on various factors are

1. Mean droplet size decreases with increases in a. Injection pressure b. air density
2. Mean droplet size increases with increases in fuel viscosity.
3. Size of droplets increases with increases in the size of the orifice.

26. Define flame development angle:

The crank angle interval between the spark discharge and the time when a small but significant fraction of the cylinder mass has burned or fuel chemical energy has been released

27. Define rapid burning angle:

The crank angle interval required to burn the bulk of the charge is defined as the interval between the end of the flame development stage and the end of the flame propagation process.

28. Define Physical delay and Chemical delay. (April/May-2015)

- The **physical delay** is the time between the beginning of injection and the attainment of chemical reaction conditions. During this period, the fuel is atomized, vaporized, mixed with air and raised to its self-ignition temperature. This physical delay depends on the type of fuel, i.e., for light fuel the physical delay is small while for heavy viscous fuels the physical delay is high. The physical delay is greatly reduced by using high injection pressures and high turbulence to facilitate breakup of the jet

and improving evaporation.

- During the **chemical delay** reactions start slowly and then accelerate until inflammation or ignition takes place. Generally, the chemical delay is larger than the physical delay. However, it depends on the temperature of the surroundings and at high temperatures, the chemical reactions are faster and the physical delay

29. What is the effect of increasing the temperature and pressure on knocking in a C.I engine? (April/May-2015)

In order decrease the tendency of knock it is necessary to start the actual burning as early as possible after the injection begins. In other words, it is necessary to decrease the ignition delay and thus decrease the amount of fuel present when the actual burning of the first few droplets starts. By increasing the Inlet air temperature and injection pressure which reduces the ignition delay period so knock is reduced.

30. How the thermodynamic analysis of a C.I engine is different from S.I engine? (May/June-2012)

The ideal cycle for the S.I engine is Otto cycle whereas for C.I engine, it is diesel or dual combustion cycle. For the certain compression ratio, Otto cycle is more efficient than diesel cycle. But compression ratio in diesel engines is higher than petrol engine. Therefore in practice the efficiency of diesel is higher than that of petrol engine.

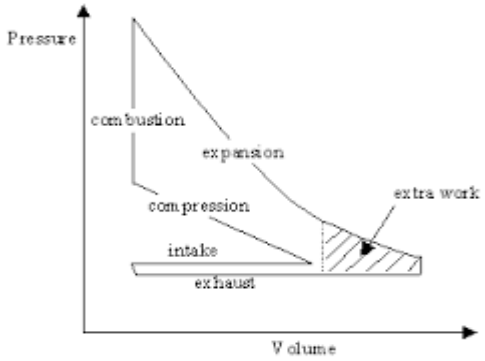
31. What are the advantages of turbocharger? (April/May-2014, Nov/Dec-2013)

- Power output of a given displacement engine is increased.
- Torque characteristics of the turbocharged engine are better.
- Turbocharged engine have more break point ratio, than naturally aspirated engines.
- Reduced fuel consumption
- Reduced noxius exhaust gas emissions.
- Power loss due to increase in air density at higher attitudes is reduces by increasing turbocharges.

32. What is abnormal combustion in C.I engine? How it can be controlled? (Nov/Dec-2012)

- The auto-ignition of the large amount of fuel may cause high rate of pressure rise. This high pressure rise causes the heavy vibration of the engine and creates lot of noise. This phenomenon of combustion causing heavy pressure rise during uncontrolled or abnormal combustion.
- Abnormal combustion can be controlled by using better fuel, rate of fuel supply, knock reducing fuel injector.

33. Draw the ideal P-V diagram of a naturally aspirated engine and turbocharged engine. (November/December-2012)



33. What is the effect of delay period on knock in CI engines? (Nov/Dec 2015)

If the ignition delay period is longer, the actual burning of the first few droplets is delayed and a greater quantity of fuel droplets gets accumulated in the chamber. When the actual burning commences, the additional fuel can cause too rapid a rate of pressure rise resulting in a jamming of forces against the piston and rough engine operation. If the ignition delay is quite long, so much fuel can accumulate that the rate of pressure rise is almost instantaneous. Such a situation produces the extreme pressure differentials and violent gas vibrations known as knocking and is evidenced by audible knock.

34. List any four assumptions made in the thermodynamic analysis of CI engine combustion process. (Nov/Dec 2015)

UNIT – III ENGINE EXHAUST EMISSION CONTROL

1. What are the major exhaust emissions? (April-2014)

The major exhaust emissions are

a. Unburnt hydrocarbons (HC) b. Oxides of carbon (CO and CO_2)

c. Oxides of nitrogen (NO and NO_2) d. Oxides of sulphur (SO_2 and SO_3)

e. Particulates f. Soot and smoke

2. What are the causes for hydrocarbon emission from S.I engine (May-2012)

The causes for hydro carbon emission from S.I engine are

1. Incomplete combustion. 2. Crevice volume and flow in crevices. 3. Leakage past the exhaust valve. 4. Valve over lap. 5. Deposits on walls. 6. Oil on combustion chamber walls.

3. What are the reasons for incomplete combustion in SI engine?

Incomplete combustion is due to

a. Improper mixing due to incomplete mixing of the air and fuel. Some fuel particles do not find the oxygen to react with this cause the emissions.

b. Flame quenching: As the flame goes very close to the walls it gets quenched at the walls leaving a small volume of unreacted air fuel mixture.

4. What are the reasons for flame quenching?

The reason for flame quenching is the expansion of gases. (i) As the piston moves down from TDC to BDC during power stroke, expansion of the gases lowers both pressure and temperature with in the cylinder. This makes combustion slow and finally quenches the flame and causes the emissions. (ii) High exhaust gas contamination causes poor combustion and which in turn causes quenching during expansion. (iii) As the flame goes very close to the walls it gets quenched at the walls leaving a small volume of unreacted air-fuel mixture.

5. How the oil consumption increases in IC engines and what are the effects?

Often as engines ages, due o wear, clearance between the pistons and cylinder wall increases. This increases oil consumption contributes to increases in the emissions in three ways.

a. There is an added crevices volume.

b. There is added absorption – desorption of fuel in the thicker oil film on cylinder walls

c. There is oil burned in the combustion process

6. Write a short note on carbon monoxide emissions.

Carbon monoxide is a colorless and odorless but a poisonous gas. It is generated in an engine when it is operated with a fuel rich equivalence ratio. Poor mixing, local rich regions, and incomplete combustion will also be the source for co emissions.

7. What is photochemical smog?

NO_x is the primary causes of photochemical smog; Smog is formed by the photochemical reaction of automobiles exhaust and atmospheric air in the presence of sunlight.

NO_2 + energy from sunlight □ NO + O +smog

8. What are soot particles?

Soot particles are clusters of solid carbon Spheres. These spheres have diameter from 9nm to 90nm (1nm = 10^{-9}). But most of them are within the range of 15 – 30nm. The spheres are solid carbon with HC and traces of other components absorbed on the surface. Single soot particles may contain up to 5000 carbon spheres.

9. Which is the most effective after treatment for reducing engine emissions?

The catalytic converter is the most effective after treatment for reducing engine emissions found on most automobiles. Co can be oxidized to CO_2 and H_2O in exhaust system and thermal converters if the temperature is held at 600- 700□C. If certain catalysts are present, the temperature needed to sustain these oxidation processes is reduced to 250 – 300°C, making for a much more attractive system.

10. What is a catalyst?

A catalyst is a substance that accelerates chemical reaction by lowering the energy needed for it to proceed. The catalyst is not consumed in the reaction and so functions indefinitely unless degraded by heat age contaminants or other factors.

11. List the materials used as catalyst.

The catalyst materials most commonly used are **a**. platinum **b.** palladium **c.** rhodium.

12. Why catalytic converter called as three way converters?

Catalytic converters are called as three way converters because they are used to reduce the concentration of CO, HC and NO_x in the exhaust.

13. What are the types of ceramic structure used in catalytic convertor?

Inside the container is a process ceramic structure through which the exhaust gas flows.

a. The ceramic is a single honey comb structure with many flow passages.

b. Some converters use loose granular ceramic with the gas passing between the packed spheres.

14. List out the drawbacks of catalytic converters.

a. Sulphur offers unique problems for catalytic converters some catalyst promote the conversion of SO_2 to SO_3 which eventually converted to sulphuric acid. This degrades the catalytic convertor and contributes to acid rain.

b. Catalytic converters are not very efficient when they are cold. When an engine is started after not being operated for several hours it takes several minute for the converter to reach an efficient operating temperature called as cold start up problem.

15. What are the methods of catalytic converters preheating?

The methods of catalytic converters preheating included the following

a. By locating the converters close to the engine b. By having superinsulation c. By employing electric preheating d. By using flame heating e. Incorporating thermal batteries.

16. List the invisible and visible emission

Invisible emission: Water vapour, carbon dioxide, oxides of nitrogen, unburnt hydrocarbons, carbon monoxide, aldehyes.

Visible emission: Smoke, particulate.

17. What are the methods of measuring the following emission?

a. Oxides of nitrogen = CHEMILUMINESCENCE ANALYZER

b. Carbon monoxide = NON DISPERSIVE INFRARED ANALYZER

c. Unburned hydrocarbons = FLAME IONIZATION DETECTOR (FID)

18. What is a three way catalytic convertor? Give the catalysts used in it. (April/May-2015)

A **catalytic converter** is an emissions control device that converts toxic pollutants in exhaust gas to less

toxic pollutants by catalyzing a redox reaction (oxidation or reduction). Platinum, Palladium and rhodium are used as a catalyst.

19. What are emission norms? Give the major pollutants that are to be controlled. (April/May-2015)

Emission norms are legal requirements governing air pollutants released into the atmosphere. Emission norms set quantitative limits on the permissible amount of specific air pollutants that may be released from specific sources over specific timeframes. They are generally designed to achieve air quality standards and to protect human health. In India it is named as Bharat Stage, in European countries EURO norms. Emission like NO, CO, HC can be controlled by using these norms.

20. What is green house effect? (December-2013)

The green house effect is a process by which thermal radiation from a planetary surface is absorbed by atmospheric green house gases, and is re-radiated in all directions. This radiation is sent back towards the surface and the lower atmosphere; it results in an elevation of average surface temperature above what it would be in the absence of the gases.

21. Define conversion efficiency of a catalyst. (December-2013)

The green house effect is a process by which thermal radiation from a planetary surface is absorbed by atmospheric green house gases, and is re-radiated in all directions. This radiation is sent back towards the surface and the lower atmosphere; it results in an elevation of average surface temperature above what it would be in the absence of the gases.

22. What is the principle of FID? (May-2012)

Flame ionization detector is based on the principle of detection of ions formed during combustion of organic compounds in a hydrogen flame. The generation of these ions is proportional to the concentration of organic species in the sample gas stream. Carbon monoxide and carbon are not detectable by FID.

23. What is the principle of NDIR analyser? Indicate the disadvantage of using it for measuring UBHC emission. (May-2013)

A Non-Dispersive Infrared Sensor (NDIR) is a simple spectroscopic device often used as gas detector. It is called non-dispersive because wavelength which passes through the sampling chamber is not pre-filtered instead of a filter is used before the detector.

Disadvantages:

- SO2 and NO2 is difficult to analyze
- More costlier
- It is complicate to operate.

24. Why smoke is formed in a C.I engine? (May-2013)

Smoke is formed due to incomplete combustion in the engine. Smoke is of different forms

- Blue
- White (or) cold smoke
- Black (or) hot smoke

25. List the factors responsible for formation of NOx during combustion. (Nov/Dec 2015)

- Increase in combustion temperature
- Slightly lean mixture
- Increase in stoichiometric ratio.

26. Indicate any four locations within the SI engine cylinder where unburnt HC form. (Nov/Dec 2015)

- Combustion chamber walls
- Piston ring
- Piston
- Exhaust valve, valve seat
-

UNIT-IV ALTERNATIVE FUELS

1. Write the advantage and disadvantage of alcohol as a fuel?/State any two reasons for using ethyl alcohol as a SI engine fuel. (Nov/Dec 2015)

The **advantages** of alcohols a fuel are:

1. It is a high octane fuel with antiknock index number (octane number) of over 100.
2. Alcohols have low sulphur content in the fuel.
3. It produces less overall emissions when compared with gasoline

Disadvantages:

1. Alcohols have poor ignition characteristics in general.
2. There is a possibility of vapor lock in fuel delivery system.
3. It has poor cold weather starting characteristics due to low vapor pressure and evaporation.

2. What is the problem with gasoline-alcohol mixture as a fuel?

Problems with gasoline-alcohol mixture as a fuel are the tendency for alcohol to combine with any water present. When this happens the alcohol separates to locally from the gasoline, resulting in a non-homogenous mixture. This causes the engine to run erratically due to the large air-fuel ratio difference between the two fuels.

3. Write the sources for methanol?

Methanol can be obtained from many sources, both fossil and renewable. These include coal, petroleum, natural gas, biomass, wood landfills and even the ocean.

4. Write the source for ethanol?

Ethanol can be made from ethylene (or) from fermentation of grains and sugar. Much of it is made from sugarcane, sugar beets, and even cellulose (wood and paper).

5. What are the techniques of using alcohol in diesel engine fuel?

The techniques of using alcohol in diesel engine are:

1. Alcohol diesel emulsions.
2. Dual fuel injection.
3. Alcohol fumigation.
4. Surface ignition of alcohols.

6. What are the methods are adopted for induction of alcohol into intake manifold?

The methods are adopted for induction of alcohol into intake manifold micro fog unit, pneumatic spray nozzle, vaporizer, carburetor and fuel injector.

7. List the advantages of hydrogen as an IC engine? (Dec-2013)

Advantages

1. Low emissions.
2. Fuel availability.
3. Fuel leakage to environment is not a pollutant
4. High energy continent per volume when stored as a liquid.

8. List the disadvantages of using hydrogen as a fuel?

Disadvantages

1 Difficult to re fuel.

2 Fuel cost would be high at present day's technology and availability.

3 Poor engine volumetric efficiency.

4 High NOx emission because of high flame.

9. Write the methods for hydrogen can be used in SI engines?

Hydrogen can be used in SI engines by three methods

1 By manifold induction

2 By direct introduction of hydrogen into the cylinder.

3 By supplementing gasoline.

10. List the advantages and disadvantages of natural gas?

Advantages:

1 Octane number is around 120, which makes it a very good SI engines fuel.

2 Low engine emissions

3 Fuel is fairly abundant worldwide.

Disadvantages:

1 Low energy density resulting in low engine performance.

2 Low engine volumetric efficiency because it is a gaseous fuel.

3 Refueling is a slow process.

11. Write the two types of LPG used in automobiles engine?

Two type of LPG used in automobile engines:

One is propane and the other is butane, sometimes in mixture of propane and butane is used as LPG in auto mobile engine.

12. What are the advantages of LPG?

1 LPG mixes with air at all temperatures.

2 LPG has high antiknock characteristics.

3 There is no crack case dilution, because the fuel is in the form of vapor.

13. Write the disadvantages of LPG?

1 A special fuel feed system is required for liquid petroleum gas.

2 A good cooling system is quite necessary.

3 The vehicle weight is increased due to the use of heavy pressure cylinder for storing LPG.

14. Write the improvements required for the LPG vehicle in future?

1 Effort must be made to have more LPG filling stations at convenient locations, so that LPG tank can be filled up easily.

2 Safety devices are to be introduced to prevent accidents due to explosion of gas cylinders (or) Leakage in the gas pipes.

3

15. Compare the petrol and LPG?

PETROL	LIQUIED PETROLEM GAS
Octane rating of petrol is 81	Octane rating of LPG is 110.
Petrol has odours	LPG is odourless.
In order to increase octane number	LPG is lead free with high Octane number.

16. What are the problems of using methanol in an engine? (April/May-2015)

Methanol fuel is corrosive to certain materials commonly used in engines and fuel lines.

17. List down four properties that are important in the selection of a fuel for an engine. (April/May-2015)

- Octane Number and Cetane Number
- Volatility
- Density
- Calorific Value

18. Compare the octane number and the calorific value of alcohol with petrol. (May-2012)

- Calorific value of alcohol is lower than the petrol and 65% greater weight of ethanol is required compared to petrol.
- Octane number of alcohol is greater than the petrol. Alcohol has more than 100 octane number.

19. List down the major constituents of natural gas and LPG. (May-2012)

Natural gas:

- High octane number gives out high flame speed which results in high compression ratio.
- Low engine emission
- It can be made from coal.

LPG:

- LPG mixes with air at all temperatures.
- LPG is in the form of vapour so, there is no crankcase dilution.
- High compression ratios.
- LPG contains less carbon than petrol.

20. What is trans-esterification? List down any two vegetable oils. (Dec-2012)

Tras-esterification is the process of exchanging the organic group R" of an ester with the organic group R' of an alcohol.

Alcohol+Ester→Diff. Alcohol+Diff.Ester

Peanut oil, Linseed oil, rapeseed oil are the types of vegetable oils.

21. Give the composition of LPG and CNG. (Dec-2012)

Composition of LPG:

Propane and butane are combined together to form LPG.

Composition of CNG:

It is obtained by the process of drilling wells. It contains water, sulphur, and the impurities.

22. State the significance of stoichiometric air-fuel mixture. (May-2013)

Engine operating at full throttle and constant speed with varying A/F ratio. The mixture corresponding to the maximum output on the curve is called the best power. Mixture with a A/F ratio of approximately 12:1. It is the best economy A/F mixture.

23. Comment on the water tolerance of alcohol blends. (May-2013)

Alcohol has a tendency to easily combine with any water present. This makes the engine to run erratically due to the large air-fuel ratio difference between the two fuels.

24. What are the commonly used alternate fuels? (Dec-2013)

Methanol, ethanol, hydrogen, natural gas, compressed natural gas, liquefied petroleum gas, alcohol, biogas, producer gas, etc., are some of the commonly used alternate fuels.

25. Can one use solid fuels for I.C engines? If so how? (Apr-2014)

It is difficult to handle the solid fuels and its waste.

- Complicated engine design and the fuel feed system makes the usage of solid fuel a restricted one.
- Attempts are being made to generate gaseous or liquid fuels from charcoal for use in I.C engines.

26. Can alcohol be used for C.I engines? Explain. (Apr-2014)

Alcohol cannot be used as a fuel in C.I engine because; cetane rating for the fuel should be high for good combustion process for C.I engine. It is not so, for alcohol. Alcohol has less cetane rating when compared to petrol.

27. Indicate any two limitations of vegetable oil as a CI engine fuel. (Nov/Dec 2015)

- Reduce the kinematic viscosity of oil by preheating it or with some other technique.
- It can be converted into biodiesel by transesterification process.

UNIT-V RECENT TRENDS

1. What is lean burn engine?

Lean burn engine is a lay out 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:

1 Lower pollutants.
2 Good fuel economy.
3 Heat transfer losses to the cooing medium are reduced because of lower peak temperatures.
4 Since lean mixture is less proving 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:

1 Increasing the compression ratio of the engine to accurate flame propagation.
2 Increasing the swirl and turbulence of the mixture in order to increase flame speed.
3 Catalytic activation of the charge in the combustion chamber.

4. How the stratified charge engine can be characterized?

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

1 Relatively high compression ratio
2 Ability of direct cylinder fuel injection variations to run unthrottled.
3 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.

1 Load control can be achieved without air throttling

2 Quiet in operation.

3 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:

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

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

3 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 electrode less, 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 is the objective 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? (Nov-2012)

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?

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

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

18. What is multivalve engine? Indicates its advantages. (April/May-2015) (Nov-2012)

In an IC engine process a **multi-valve** or **multivalve** engine is one where each cylinder has more than two valves. Multi-valve engines have mainly 3 advantages.

- Firstly, it increases the coverage of valves over the combustion chamber, allowing faster breathing thus enhance power at high rev.
- Secondly, it allows the spark plug to be positioned in the center of combustion chamber, enabling quicker flame propagation, more even and more efficient burning.
- Thirdly, using more but smaller valves instead of two large valves means lower mass for each valve. This prevent the valves "float" from its designed position at very high rev, thus enabling the engine to rev higher and make more power as a result.

19. What do you understand by CRDI system? Give its salient features. (April/May-2015)

CRDI stands for Common Rail Direct Injection meaning, direct injection of the fuel into the cylinders of a diesel engine via a single, common line, called the common rail which is connected to all the fuel

injectors. Salient Feature of CRDI systems are,

- Closed loop control feedback controlled by ECU
- Required amount of fuel is delivered, excess fuel is returned to tank
- High pressure fuel is injected into the combustion chamber (Apprx 1000 bar pressure)

20. Mention the principle of a surface ignition engine. (May-2012)

Surface ignition engine is also known as "Hot bulb" engine. It is mounted on the cylinder head into which fuel is sprayed. It is connected to the cylinder by a narrow passage and is heated by combustion gases while running an external flame, such as a blow torch or slow-burning which is used for starting on later models electro heating or pyrotechnics were sometimes used.

21. How the in-cylinder pressure is measured in an engine? (May-2012)

In- cylinder pressure is measured during the four strokes of engine operation. The pressure during the expansion is the most important, because the cylinder pressure is pushed on the piston to produce power.

22. What is the working principle of pre-chamber stratified charge engine? (May-2013)

Pre-chamber stratified charge engine is a type of internal combustion engine, used in automobiles, in which fuel is injected into the cylinder just before ignition. This allows for higher compression ratios without "knock" and leaner air/fuel ratio in conventional internal combustion engines.

24. Define charge stratification. (Nov-2013)

Charge stratification is the process of delivering the mixture that is sufficiently rich for combustion in the immediate vicinity of the spark plug and in the remainder of the cylinder, a very lean mixture that is so low in fuel that it could not be used in a traditional engine on a engine with stratified charge, the delivered power is no longer controlled by the quantity of admitted air, but by the quantity of petrol injected, as with a diesel engine.

25. What is the function of chare amplifier? (Nov-2013)

- Enables quasi-static measurements in certain situations such as constant pressures on piezo lasting several minutes.
- Piezo element transducer can be used in much hotter environments than those with internal electronics.
- Gain is dependent only on the feedback capacitor.

26. Write short note on pressure pick up used in engine measurements. (Apr-2014)

The pick up is used for measuring the cylinder pressure must have a linear output and a good frequency response.

27. What are the advantages of gasoline direct injection? (Apr-2014)

- Low emission of NOx

- Higher compression ratio
- More power production
- Low fuel consumption

28. How does a lean burn engine differ from conventional engine? (Nov/Dec 2015)

In a lean burn engine the fuel must be injected into the combustion chamber where there is intensive swirling air motion. This concentrates the fuel around the spark plug which keeps the ignition duration constant for every cycle, preventing misfiring which gives higher efficiency compare than the conventional engine. In conventional engine, beyond the stoichiometric air fuel ratio the engine begins to misfire resulting in an unsteady combustion cycle which leads to increase in HC emission.

29. List the components present in the measuring chain for pressure measurement in engine research. (Nov/Dec 2015)

- variable capacitance
- strain gauge
- LVDT
- Piezoelectric and piezoresistive

Part- B

UNIT- I

1. Discuss why a modern carburetor is being replaced by an injection system in SI engine?
2. Explain the factors that affect the process of carburetion?
3. What are different air –fuel mixture on which an engine can be operated?
4. Explain the following1. Rich mixture, 2. Stoichiometric mixture 3. Lean mixture.
5. How the power and efficiency of the SI engine vary with air- fuel ratio for different load and speed conditions?
6. By means of suitable graph explain the necessary carburetor performance to fulfill engine requirements?
7. Explain why a rich mixture is required for the following 1. Idling 2. Maximum power and sudden acceleration.
8. Describe briefly the MPFI system with a neat sketch?
9. Explain port injection and throttle body injection system?
10. Describe D- MPFI and L-MPFI injection system?
11. Briefly explain the stages of combustion in SI engines with a P-Ɵ, elaborating the flame front Propagation **(May-June-2012, Nov/Dec-2012, April/May-2015, May/June-2013, Nov/Dec-2013, (Nov/Dec 2015))**
12. Explain the various factors that influence the phenomena of knock in SI engines? **(Nov/Dec-2013)**

13. Explain the effete of various engine variables on SI engine knock. **(April/May-2015)**
14. What are the various types of combustion chamber s used in SI engines? Explain them briefly? **(April/May-2015, May/June-2013)**
15. Discuss the air-fuel ratio requirements of a S.I engine. **(Nov/Dec-2012, April/May-2015)**
16. Explain briefly the various factors influence the flame speed in S.I engine. **(May/June-2013, Nov/Dec-2013)**
17. Explain a simple carburetor with a neat sketch. List out the advantages and disadvantages.**(Nov/Ddec-2013)**
18. Describe the features of any two S.I engine combustion chambers. **(May/June-2013, Nov/Dec-2012)**
19. Discuss the various factors that are to be considered in the design of S.I engine combustion chamber. **(Nov/Dec-2012)**
20. What is meant by abnormal combustion? Explain the phenomena of knock in S.I engines **(Apr/May-2014)**
21. Explain how the jet size and venture size are determined for a carburetor used in SI engine. **(Nov/Dec 2015)**
22. Give the functions of boost venture, emulsion tube, acceleration pump and altitude compensation mechanism present in actual carburetors. **(Nov/Dec 2015)**

UNIT – II

1. Bring out clearly the process of combustion in CI engines and also explain the various stages of combustion. What is delay period and what are the factors that affect the delay period? **(May/June-203, April/May-2015,Nov/Dec 2015)**
2. Explain with figures various types of combustion chambers used in CI engines.
3. Explain Turbo charging in CI engines.
4. Explain with heat sketch about the air vition
5. What are the effects of trubocharging on CI engines?
6. Compare induction swirl with compression swirl with respect to their advantages and disadvantages.
7. What are the main factors affecting the penetration of the fuel spray in CI engines?
8. Explain about the fuel spray behavior?
9. Discuss the characteristics of DI and IDI diesel engines with neat sketches. **(May/June-2012, April/May-2015)**
10. What do you understand by turbo-charging? Why S.I engines are not usually turbocharged? Give the boost pressure angle range for SI and CI engines. **(April/May-2015)**

11. What do you understand by thermodynamic analysis of C.I engine combustion process? Explain in detail giving the governing equation. **(April/May-2015)**
12. Explain the phenomenon of spray and combustion on C.I engine. **(April/May-2014)**
13. What are the factors affecting the delay period in C.I engines and summarize them. **(May/June-2013)**
14. What are the various factors that affects the delay period in C.I engine combustion? Discuss. **(Nov/Dec-2013)**
15. Explain with the help of a P-v diagram, the various stages of combustion in a C.I engine. **(May/June-2012, Nov/Dec-2012)**
16. Discuss about the normal combustion and abnormal combustion in a C.I engine. **(May/June-2012)**
17. Describe with a neat sketch the features of any one type of combustion chamber employed in the modern day diesel engines. **(Nov/Dec-2012)**
18. Explain briefly the open combustion chamber and Ricardo swirl chamber used in C.I engines **(Nov/Dec-2013)**
19. Explain the principle of operation of a turbocharger with a neat sketch. Indicate the objectives of turbo charging. **(May/June-2012, Nov/Dec-2012, (Nov/Dec 2015))**
20. Explain from first principles how the thermodynamic model to simulate the CI engine combustion heat release is developed. What are the assumptions made in this model? **(Nov/Dec 2015)**

UNIT III

1. Describe in detail the causes of hydrocarbon emissions from SI engines.
2. What are catalytic converters? How are they helpful in reducing HC, CO and NOx emissions?
3. Give a brief account of emissions from CI engines.
4. Explain the internationally accepted methods of measuring the following invisible emission
   i) Oxides of nitrogen (ii) Carbon monoxide (iii) Unburned hydrocarbons
5. What is smoke and classify the measurement of smoke?
6. Explain the mechanism of formation of CO, UBHC and NOx emissions. **(May-2012, Nov-2012, April/May-2015, Nov-2013)**
7. Why three way catalytic converters are employed in the modern day S.I engine driven vehicles? Show the plot of pollutants versus air fuel ratio and conversion efficiency versus air fuel ratio for all the major pollutants from S.I engine. **(Nov-2012, April/May-2015)**
8. With the help of neat sketch describe the principle of operation of FID analyser. **(Nov-2012, April/May-2015)**
9. Draw the Indian driving cycle and explain the various stages. **(Nov-2012, April/May-2015)**
10. With the help of a neat sketch explain the principle of operation of NDIF enlister. **(May-2012)**

11. Draw the Indian driving cycle and explain the various stages. **(May-2012)**
12. Write a note on emission norms indicating clearly the need end the pollutants that are converted in the norms. **(May-2012)**
13. Specify the main emission form multi-cylinder passenger car engine how is the air-fuel ratio controlled so as to reduce emissions? **(May-2013)**
14. What is driving cycle? Discuss its significance with regarding emissions. **(May-2012)**
15. What are the methods to reduce particulate matter emissions. **(May-2012)**
16. Explain the functioning of a three way catalytic convertor, with sketch mention the limitation of catalytic convertor. **(May-2012)**
17. With a simple sketch, explain briefly the working principle of particulate trap. **(Nov-2013)**
18. What are the various types of instruments used for the measurement of emission from IC engines? With a schematic diagram, describe in detail the chemiluminescence method of measuring oxides of nitrogen. **(Nov-2013)**
19. What is smoke and explain the principle used in the measurement of smoke? **(Nov-2013)**
20. Explain in detail how the un burnt hydrocarbon emissions occur inside the cylinder during the compression and power strokes of the SI engine. **(Nov/Dec 2015)**
21. Explain with neat sketches the construction of pellet type and honeycomb type catalytic converters. Also explain how the catalytic surfaces are fabricated and discuss in detail how they perform the catalytic conversion. **(Nov/Dec 2015)**

UNIT – IV

1. Explain the reasons for looking for alternate fuels for IC engines.
2. Explain alcohols as alternate fuels for IC engines bringing out their merits and demerits.
3. Explain the possibility of using reformulated gasoline and water gasoline mixture as alternate fuel.
4. Can alcohol be used for CI engines? Explain.
5. Explain with a neat sketch the surface-ignition alcohol engine.
6. What are the advantages and disadvantages of using hydrogen in SI engine.
7. Explain the two methods by which hydrogen can be used in CI engine.
8. What is natural gas? List the advantages and disadvantages of using natural gas as alternate fuels?
9. Give a brief account of LPG being used as an alternate fuel in SI engine? **(Dec-2012)**
10. What are the advantages and disadvantages of using LPG in SI engines?
11. Compare important properties of LPG with petrol. **(May-2014)**
12. Discuss the salient properties of hydrogen as a fuel. **(April/May-2015)**

13. List down the advantages and disadvantages of using bio diesel in C.I engines. **(April/May-2015)**
14. What modifications are required in a C.I engine to use gaseous fuels? Explain. **(April/May-2015)**
15. Explain the combustion and emission characteristics of using hydrogen in a C.I engine. **(April/May-2015)**
16. Explain the performance combustion and emission characteristics of C.I engine using biodiesel as a fuel. **(May-2014)**
17. List down the advantages and disadvantages of using biodiesel in engines. **(May-2012)**
18. Explain any two techniques of using 100% alcohol in C.I engines indicating the salient features. **(Dec-2012)**
19. Compare the important properties of natural gas with petrol. **(Dec-2012)**
20. Describe the modifications required for using CNG in a C.I engine. **(Dec-2012)**
21. Compare the properties of gasoline, methanol, and ethanol as engine fuel and explain how they influence combustion and emission characteristics of engine. **(May-2013)**
22. Discuss the change in properties of alcohol-petrol blends and their effects on the performance of the engine. **(May-2013)**
23. How does ethanol manufactured from grains and sugarcane? Explain. **(Dec-2013)**
24. Compare the properties of alcohol and gasoline as engine fuels. **(Dec-2013)**
25. What are the advantages and disadvantages of hydrogen as an engine fuel? **(Dec-2013)**
26. Discuss briefly a hydrogen engine with a neat sketch. **(Dec-2013)**
27. Give a table describing in detail the comparison between alcohol, hydrogen, natural gas, LPG and vegetable oils for their suitability as IC engine fuel. Consider all important factors pertinent to engine combustion. **(Nov/Dec 2015)**
28. What are the major engine modifications needed when unconventional fuels or their blends are used in conventional diesel powered CI engine? Explain in detail. **(Nov/Dec 2015)**

UNIT – V

1. What is the necessity for gasoline injection? Explain with suitable sketch.
2. With neat sketch, explain the exhaust emissions with different air-fuel ratio lean burn spark ignition engines.
3. What do you understand by charge stratification? Explain the method of achieving the same with suitable sketches. Discuss the advantages and disadvantages of charge stratification.
4. Explain briefly plasma – jet ignition system.
5. What is a learn burn engine? What are the advantages of using learn mixture in SI engine?

6. Explain the characteristics of Homogeneous charge compression ignition engine. **(May-2012)**
7. Explain gasoline direct injection engine.
8. What is lean burn engine? Explain its advantages and disadvantages. **(April/May-2015)**
9. With a neat sketch explain the operation of an electronic fuel injection system used in a SI engine. **(April/May-2015)**
10. Explain the operation of CRDI engine with a neat sketch. **(Dec-2012, April/May-2015)**
11. Discuss the method of obtaining the rate of heat release rate from engines **(May-2012, April/May-2015)**
12. What do you understand by lean burn mixture and stratified charge engine? Indicate their advantages. **(May-2012)**
13. Discuss the operation of gasoline direct injection system with a block diagram showing clearly all the sensors. **(May-2012)**
14. What is surface ignition engine? Explain its advantages and disadvantages. **(Dec-2012)**
15. With a neat sketch explain the operation of a stratified charge engine. **(Dec-2012)**
16. Discuss the method of obtaining pressure crank angle diagram. List down the parameters that can be studied from the pressure crank angle diagram. **(Dec-2012)**
17. Describe with a sketch how a C.I engine can be controlled electronically. **(May-2013)**
18. What is stratified charge? Give its significance. **(May-2013)**
19. Describe the features of homogeneous charge compression ignition and common rail direct ignition engine with neat sketch. **(April-2014, May-2013)**
20. Briefly discuss about the necessity of pressure pick, check amplifier in an I.C engine. **(May-2013)**
21. Write short note on surface ignition engine. **(April-2014, Dec-2013)**
22. Write short note on CRDI diesel engine. **(April-2014, Dec-2013)**
23. Explain briefly the electronic engine management system used in modern engines. **(Dec-2013)**
24. Using a neat layout diagram explain any one type of multipoint port fuel injection (MPFI) system employed in modern petrol cars. Explain the types of sensors used for measurement of air mass flow, temperatures, speed and pressure. **(Nov/Dec 2015)**
25. Explain the procedure adopted to arrive at the specification of piezo electric sensor charge amplifier crank angle encoder and AD convener with data storage for heat release analysis of a given IC engine. **(Nov/Dec 2015)**