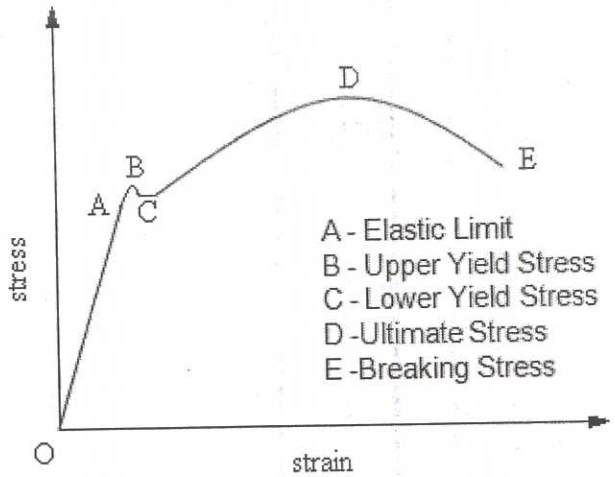
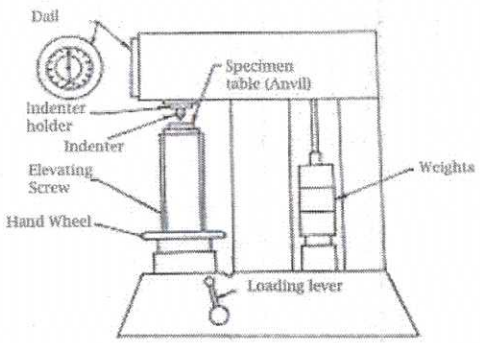
SCHEME OF EVALUATION

(Scoring Indicators)

REVISION: 2015 **COURSE CODE: 2021**

COURSE TITLE: BASIC MECHANICAL ENGINEERING

Qst. No.	Scoring Indicator	Split up score	Sub Total	Total
	PART A			
I.1	Any four from following: Strength, Hardness, Toughness, Brittleness, Creep, Fatigue, Stiffness, Ductility, Malleability, Elasticity, Plasticity	0.5x4	2	2
I.2	Steam above the saturation temperature is known as super heated steam	2	2	2
I.3	Petrol Engine – Otto Cycle Diesel Engine – Diesel Cycle	1 x 2	2	2
I.4	Heat energy liberated from the interior mater and the crust of the earth is known as geothermal energy.	2	2	2
I.5	Flat plate collector, Parabolic Collector.	1 x 2	2	2
	PART B			
II.1	 Stress Strain Diagram for ductile material like mild steel is given above. Each point in the curve is explained in the following sections. **Limit of proportionality (Point A):** It is the limiting value of the stress up to which stress is proportional to strain. **Elastic limit:** This is the limiting value of stress up to which if	6x1	6	6

	the material is stressed and then released (unloaded), Strain disappears completely and the original length is regained. Hooks law states that within the elastic limit, the stress is proportional to the strain for an isentropic material. **Upper Yield Point (B):** This is the stress at which, the load starts reducing and the extension increases. This phenomenon is called yielding of material. **Lower Yield Point (C):** At this stage the stress remains same but strain increases for some time. **Ultimate Stress (D):** This is the maximum stress the material can resist. At this stage cross sectional area at a particular section starts reducing very fast. This is called neck formation. **Breaking Point (E):** The stress at which finally the specimen fails is called breaking point. Let L_i and L_f be the initial and final length, d_i and d_f be the initial and final diameters and A_i and A_f be the initial and final area of the test specimen.			
II.2	Hardness of a material is generally defined as Resistance to the permanent indentation under static and dynamic load. When a material is required to use under direct static or dynamic loads, only indentation hardness test will be useful to find out resistance to indentation. This test is an indentation test used for smaller specimens and harder materials. In this test indentor is forced into the surface of a test piece in two operations, measuring the permanent increase in depth of an indentation from the depth increased from the depth reached under a datum load due to an additional load. Measurement of indentation is made after removing the additional load. Indentor used is the cone having an angle of 120 degrees made of black diamond. Rockwell hardness tester gives the direct reading of hardness number on a dial provided with the machine. The specimen may be cylinder, cube, thick or thin metallic sheets. Rockwell hardness tester gives the direct reading of hardness number on a dial provided with the machine.  	6 X 1	6	6

II.3	If saturated steam does not contain any water particles in it, then it is known as dry saturated steam. If saturated steam contains water particle in suspension, it is known as wet steam. Dryness fraction is the ratio of mass of dry steam to the mass of wet steam which contains it.	2 X 3	6	6
II.4	Different fittings and devices necessary for the operation and safety of the boiler are known as boiler mountings 1. Safety valves 2. Water level indicator 3. Fusible plug 4. Pressure Gauge 5. Feed check valve 6. Blow – off cock 7. Steam stop valve	1 1X 5	6	6
II.5	<table><tr><th>SI ENGINE</th><th>CI ENGINE</th></tr><tr><td>Working based on otto cycle</td><td>Working based on diesel cycle</td></tr><tr><td>Spark plug is used</td><td>Fuel injector is used</td></tr><tr><td>Fuel air mixture is taken during suction stroke</td><td>Only air is taken in suction stroke</td></tr><tr><td>Fuel used is petrol</td><td>Fuel used is diesel</td></tr><tr><td>Light weight</td><td>Heavy weight</td></tr><tr><td>Low compression ratio</td><td>High compression ratio</td></tr><tr><td>High speed engine</td><td>Low speed engine</td></tr><tr><td>Maximum efficiency is lower</td><td>Maximum efficiency is higher</td></tr></table>	1X6	6	6
II.6	Otto Cycle engine, Diesel cycle engine Two stroke engine ,Four stroke engine V engine, radial engine Inline engine	2X3	6	6
II.7	Advantages 1. Wind energy is inexhaustible 2. Eco friendly 3. Construction needs less time and simple 4. Wind energy is free and does not need transportation Disadvantages 1. High initial cost 2. Wind power is not consistent and steady 3. Phenomenon such as tornadoes can smash the whole plant. To avoid this costly designs and controls are required. 4. Cost per unit power production is high compared to other major power plants.	1X6	6	6

PART C

UNIT I

III.(a)	The cast iron is obtained by re-melting pig iron with coke and limestone in a furnace known as cupola. Following figure shows the various parts and zones of cupola furnace.	4	9	9

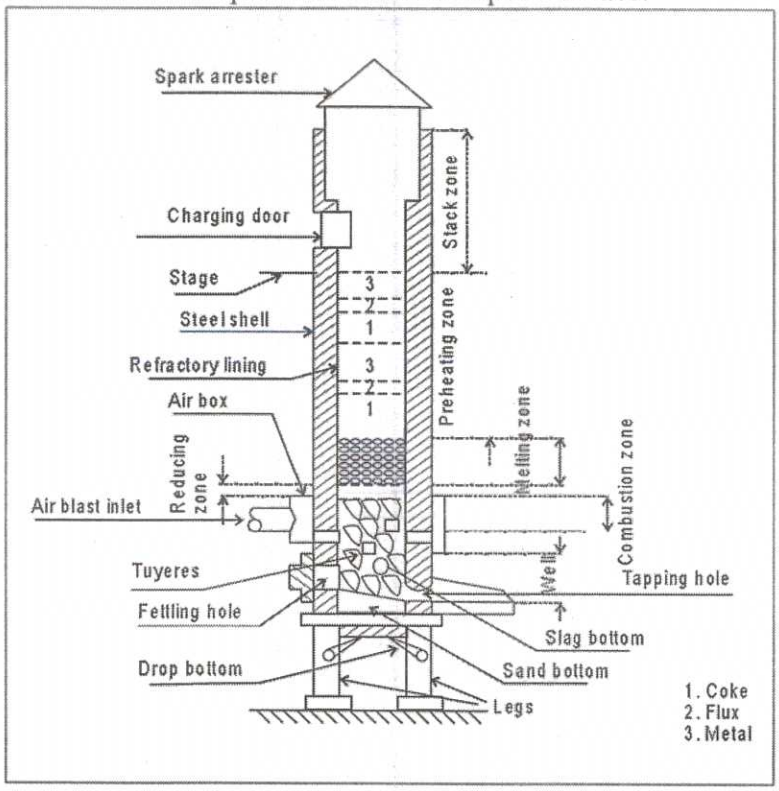


Fig 5

Various numbers of chemical reactions take place in different zones of cupola. The construction and different zones of cupola are discussed as under.

1. Well

The space between the bottom of the tuyeres and the sand bed inside the cylindrical shell of the cupola is called as well of the cupola. As the melting occurs, the molten metal is get collected in this portion before tapping out.

2. Combustion zone

The combustion zone of Cupola is also called as oxidizing zone. It is located between the upper of the tuyeres and a theoretical level above it. The total height of this zone is normally from 15 cm. to 30 cm. The combustion actually takes place in this zone by consuming the free oxygen completely from the air blast. The heat generated in this zone is sufficient enough to meet the requirements of other zones of cupola. The

heat is further evolved also due to oxidation of silicon and manganese. A temperature of about 1540°C to 1870°C is achieved in this zone. Few exothermic reactions take place in this zone these are represented as:

$C + O_2 \longrightarrow CO_2 + Heat$

$Si + O_2 \longrightarrow SiO_2 + Heat$

$2Mn + O_2 \longrightarrow 2MnO + Heat$

3. Reducing zone

Reducing zone of Cupola is also known as the protective zone which is located between the upper level of the combustion zone and the upper level of the coke bed. In this zone, CO_2 is changed to CO through an endothermic reaction, as a result of which the temperature falls from combustion zone temperature to about 1200°C at the top of this zone. The important chemical reaction takes place in this zone which is given as under.

$CO_2 + C\ (coke) \longrightarrow 2CO + Heat$

4. Melting zone

The lower layer of metal charge above the lower layer of coke bed is termed as melting zone of Cupola. The metal charge starts melting in this zone and trickles down through coke bed and gets collected in the well. Sufficient carbon content picked by the molten metal in this zone is represented by the chemical reaction given as under.

$3Fe + 2CO \longrightarrow Fe_3C + CO_2$

5. Preheating zone

Preheating zone starts from the upper end of the melting zone and continues up to the bottom level of the charging door. This zone contains a number of alternate layers of coke bed, flux and metal charge. The main objective of this zone is to preheat the charges from room temperature to about 1090°C before entering the metal charge to the melting zone. The preheating takes place in this zone due to the upward movement of hot gases. During the preheating process, the metal charge in solid form picks up some sulphur content in this zone.

6. Stack

The empty portion of cupola above the preheating zone is called as stack. It provides the passage to hot gases to go to atmosphere from the cupola furnace.

Working of Cupola Furnace

The fire is ignited using firewood and then small amount of coke is used to pick fire. The little oxygen is then supplied for combustion. Lime, coke, and metal in balanced proportions are charged through the charging door upon the coke bed and at proper time on starting the blower. Air is forced from wind box

	through tuyers into furnace. The forced air rise upward rough the stack furnaces for combustion of coke. Besides being fuel, the coke supports the charge until melting occurs. On increase of temperature, the lime stone melts and forms a flux which protects the metal against from excessive oxidation. Lime also fuses and agglomerates the coke ash. The melting occurs and proceeds and molten metal is collected at the bottom. Molten metal may be tapped at intervals or the tap-hole may be left open with metal flowing constantly. In most cupolas slag is drained from the slag hole at the back of furnace. When metal is melted completely the bottom bar is pulled sharply under the plates and bottom is dropped. All remaining slag, un-burned coke or molten metal drops from the furnace. When the melt charge has cooled on closing furnace, it is patched and made ready for the next heat.			
III.(b)	The liquid penetrant test is one of the oldest methods of non-destructive testing. It is based on the old oil and whiting process. The oil and whiting method consisted of applying dirty penetrating oil to the test surface, wiping the oil from the surface after a few minutes and then coating parts with an alcohol-chalk suspension solution. Where cracks existed, the dirty oil is seeped through the white coating. Thus, it indicates the presence of discontinuities. LPT is widely implemented in industry for inspection of industrial products since it requires minimal capital, small expenditure for implementation and it can accommodate a variety of test-object materials, shapes and sizes, test locations and environmental conditions. The outcome of a penetrant inspection is largely dependent on the human operator. LPT can be used to inspect almost any material such as Metals, Glass, ceramic, Rubber, plastics etc provided that its surface is not extremely rough or porous. Liquid penetrant inspection is used to inspect flaws like fatigue cracks, quench cracks, grinding cracks, overload and impact fractures, porosity, laps, seams, pin holes in welds, lack of fusion or braising along the edge of the bond line. The penetrant test procedure consists of following six basic processing steps. 1. Pre-cleaning and drying of test object surfaces to be inspected 2. Applying liquid penetrant to surface to be inspected and permitting it to seep into surface discontinuities. 3. Removing excess liquid penetrant from test surface 4. Applying developer to test surface to enhance indications formed by penetrant entrapments in	6 X 1	6	6

discontinuities

5. Inspecting surface for penetrant indications
6. Post-cleaning to remove process residues (In some cases, a treatment to prevent corrosion may be required).

IV.(a) A blast furnace is a refractory-lined chamber with a diameter of about 9 to 11 m at its widest and a height of 40 m in which hot gases are forced into the lower part of the chamber at high rates to accomplish combustion and reduction of the iron. Atypical blast furnace and some of its technical details are illustrated in following Figure.

4 9 9

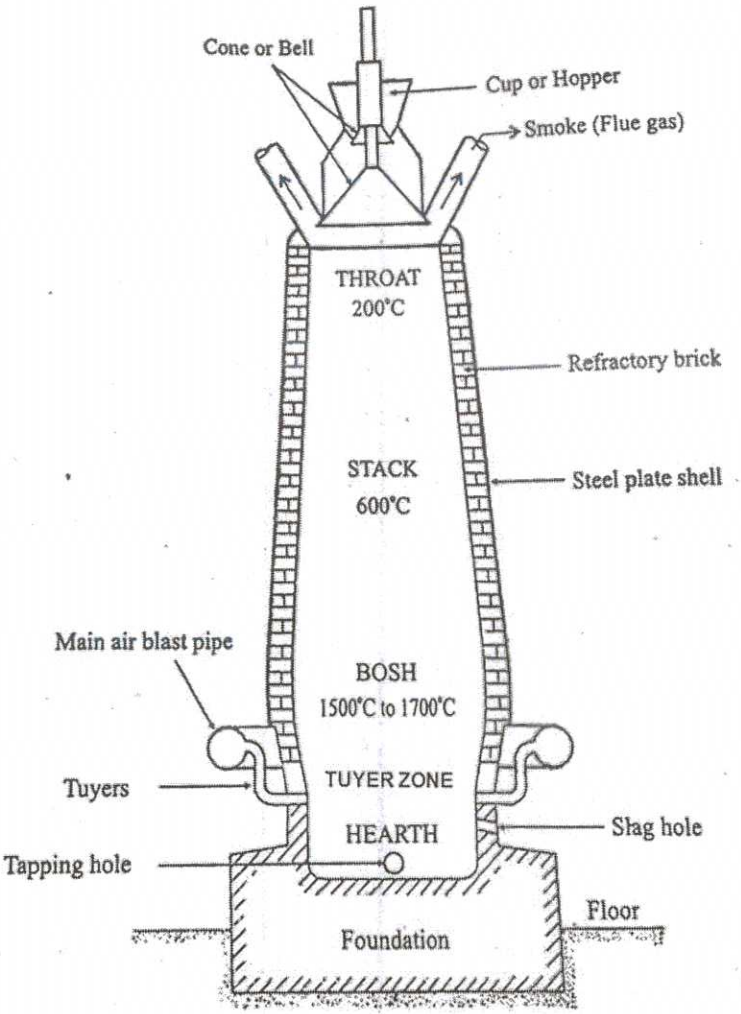


Fig 5

The blast furnace consists of the following regions

1. **Stack or shaft**
   - here burden is completely solid
   - burden get heated from 200 -1200 degree centigrade at the end of the stack region.
   - the success of b/f process depends upon the

efficiency of solid gas intercation occurs in the stack portion since . Max reduction occurs in stack portion.

2. **Bosh**
   - burden start to soften and get fuse except coke
   - slag starts forming (flux)
   - Wall in this region is parallel then it is tapered downwards and cross-section reduces to 20-25%

3. **Tuyer zone**
   - combustion of coke occurs
   - formation of co gas
   - except the central coke all the coke are burns and in entire burden is in molten state.

4. **Hearth**
   - Stratification of metal and slag occurs and it is tapped into laddles through tap holes
   - unburnt coke floats on the metal and stay over it and forming a dead man zone
   - smallest cross section of the furnace
   - walls are parallel

The charge slowly descends from the top of the furnace toward the base and is heated to temperatures around 1650°c. Burning of the coke is accomplished by the hot gases (CO, H2, CO2, H2O, N2, O2, and fuels) as they pass upward through the layers of charge material. The carbon monoxide is supplied as hot gas, and it is also formed from combustion of coke. The Co gas has a reducing effect on the iron ore; the reaction (simplified) can be written as follows (using hematite as the starting ore)

$Fe_2O_3 + CO \longrightarrow 2FeO + CO_2$

Carbon dioxide reacts with coke to form more carbon monoxide

$CO_2 + C\ (coke) \longrightarrow 2CO$

which then accomplishes the final reduction of FeO to iron

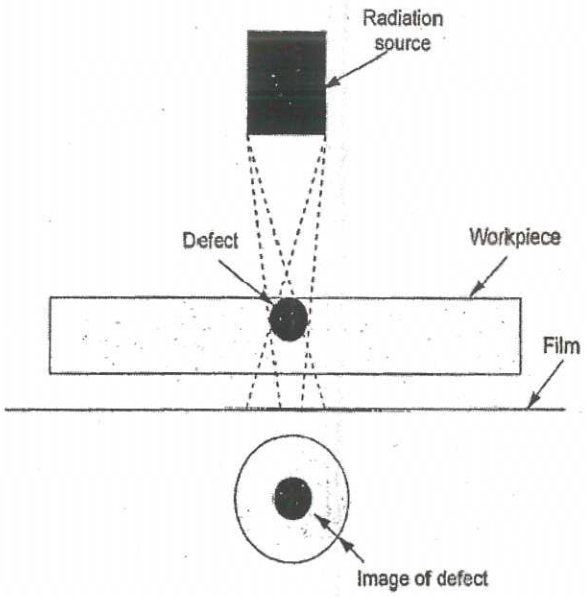
$FeO + CO \longrightarrow Fe + CO_2$

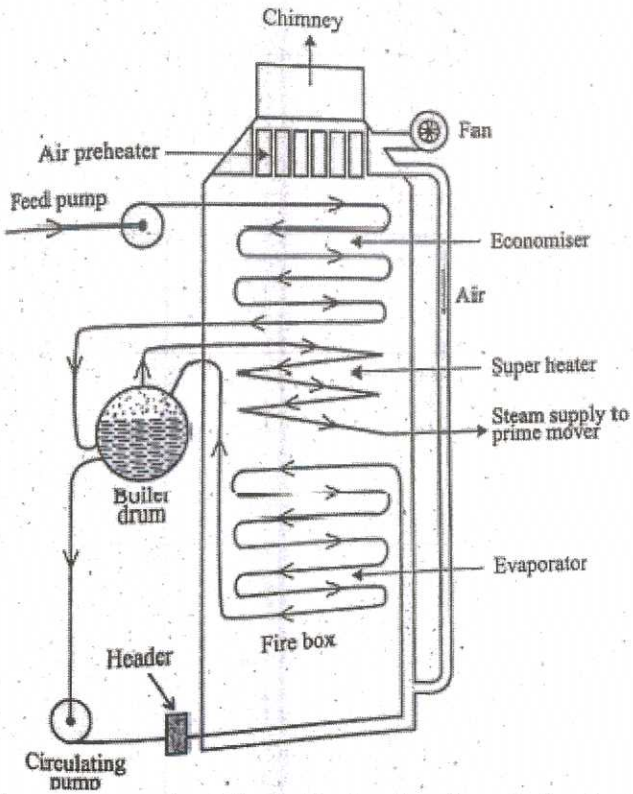
The molten iron is collected at the base of the blast furnace. The role played by limestone can be summarized as follows. First the limestone is reduced to lime (CaO) by heating, as follows

$CaCO_3 \longrightarrow CaO + CO_2$

The lime combines with impurities such as silica (SiO_2), sulphur (S), and alumina (Al_2O_3) in reactions that produce a molten slag that floats on top of the iron. The slag is removed through slag hole at regular interval of time and the pig iron is collected at hearth is tapped through tapping hole.

Approximately 7 tons of raw materials are required to produce

	1 ton of iron. The ingredients are proportioned about as follows: 2.0 tons of iron ore, 1.0 ton of coke, 0.5 ton of limestone. A significant proportion of the by-products are recycled.			
IV.(b)	Radiography is a non- destructive examination method that uses a beam of penetrating radiation such as x-rays and gamma rays. When the beam passes through a component, some of the radiation energy is absorbed and the intensity of the beam is reduced. Variations in beam intensity are recorded in film and they are seen as difference in shading that is typical types and sizes of any flaws present. Three basic elements of radiograph are a radiation source or probing medium, the test piece or object being evaluated and a recording medium which (usually film). Variations in the intensity of x-rays or gamma rays that pass through a material can be presented as a (a) visible permanent image, (b) visible real time image and (c) meter reading. A permanent image is recorded in an X-ray film, radiographic paper etc. X-ray film is used more extensively than all other recording mediums. Radiography can be used with most materials for the detection of both internal and surface defects.  **Applications:** 1. Radiography can be used to inspect most types of solid material, both ferrous and non-ferrous alloys as also non-metallic materials and composites.	6X1	6	6

	2. It can be used to inspect the condition and proper placement of components for proper liquid fill level in sealed components, etc. 3. The method is used extensively on castings, weldments, forgings and parts when there is a critical need to ensure freedom from internal flaws. 4. Radiography is well suited to the inspection of semiconductor device for cracks, broken wires, unsoldered connections, foreign material and misplaced components, whereas other methods are limited in ability to inspect semiconductor devices.			
V.(a)	**UNIT II**  It is a high pressure water tube boiler having forced circulation system. Feed water from hot well is supplied to the storage and separating drum through the economiser. Most of the sensible heat is supplied to the feed water passing through the economiser. The water from the boiler drum is drawn by the circulating pump, pressurised to about 2.5 bar above the drum pressure and supplied to headers, which distribute the water to the evaporator	Fig 5 4	9	9

tubes. Here some water is convened in to steam and a mixture of water and steam then passes in to the boiler drum
Steam separated in the boiler is further passed through the superheater and finally supplied to the prime mover.
There is an air preheater whose function is to preheat the air supplied to the boiler furnace for combustion of the fuel.

Advantages of LaMont boiler

- High steam evaporation rate
- High pressure steam can be generated
- Steam at super critical temperature can be generated
- Reduced size of boiler drum
- High velocity forced circulation of water through the tube eliminates scale formation trouble in the pipes
- Quick starting

V.(b) Stuffing box is fitted on the crank end of the cylinder block. The main function of the stuffing box is to prevent the leakage of steam and at the same time the free movement of piston rod and eccentric rod

2 X 3 | 6 | 6

D slide valve is situated in the steam chest and its function is to admit the steam to the cylinder and exhaust the steam from the cylinder at the proper time.

Flywheel is a heavy cast iron wheel mounted on the crank shaft to prevent the fluctuation of the engine speed. The flywheel stores energy when excess energy is being transmitted by the engine and gives this energy back when the power exerted by the engine is minimum.

VI.(a)

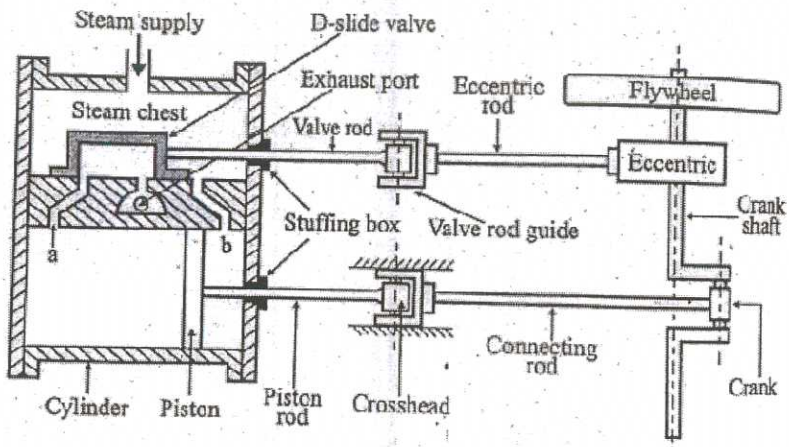


Fig 5

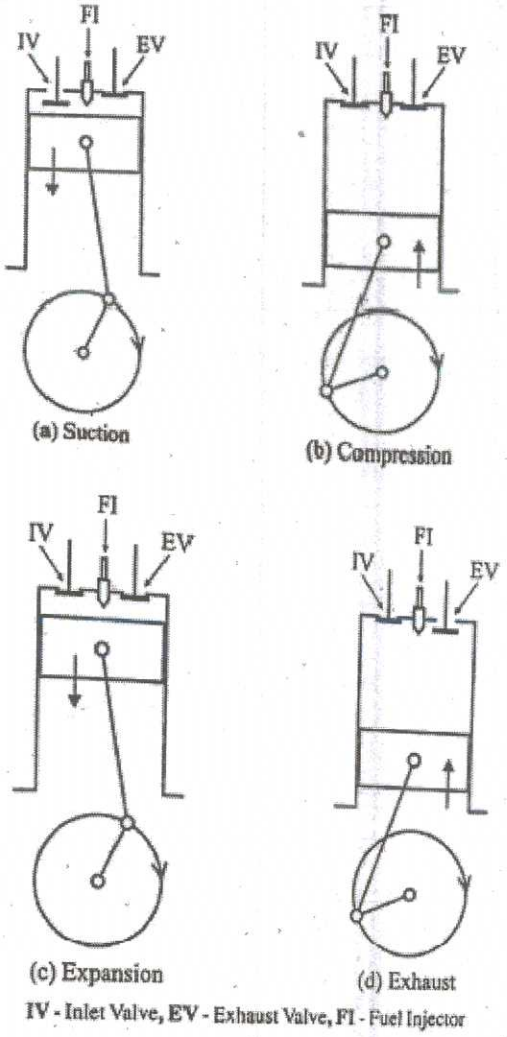
9 | 9

The high pressure superheated steam from the boiler is supplied to the steam chest.
This steam is first admitted to the cover end of the cylinder

	when the steam admission port (a) is uncovered by the D-slide valve, while the steam is exhausted through the steam port (b) at the crank end and exhaust port. Now, the steam admitted on the cover end, exerts pressure on the surface of the piston and pushes it to the crank of the cylinder. At the end of this stroke, fresh steam from the steam chest is again admitted by the D-slide valve to the crank end of the cylinder while the exhaust steam on the cover end is exhausted through the steam port 'a' and exhaust port. Now the steam at the crank end pushes the piston back to its original position ie; towards left hand side/cover end of the cylinder. The D-Slide valve gets to and fro motion from the eccentric fitted to the crankshaft. Thus, two working strokes are completed and the crankshaft turns by one revolution, ie; the engine is double acting. The operations are repeated.	4		
VI.(b)		1 X 6	6	6

FIRE TUBE BOILER	WATER TUBE BOILER
1.Hot gases flow through the tubes which are surrounded with water	1.Water circulates through the tubes and hot gases around them
2.Free circulation of water	2.Forced circulation of water
3.Steam pressure is limited to 20 to 30 bar	3.Works even at super critical pressures and temperatures
4.Usually used for heating purpose only	4.Used for power generation & heating purpose
5. Rate of steam production is less	5. Rate of steam production is high
6. Overall efficiency up to 85%	6. Overall efficiency up to 92%
7. Construction is difficult	7. Construction is simple
8. Various parts are not accessible for cleaning,repairing and inspection	8. Parts are more accessible.
9. Chances of explosion is less	9. Chances of explosion is more
10. Requires less skill for efficient Working	10.Requires more skill and careful attention
11. They are internally fired boilers	11.They are externally fired boilers

	UNIT III			
VII.(a)	In a four stroke diesel engine, one power stroke is obtained by two complete revolution of the crank shaft. The entire process of a diesel engine cycle is completed by 4 strokes, explained below		9	9



IV - Inlet Valve, EV - Exhaust Valve, FI - Fuel Injector

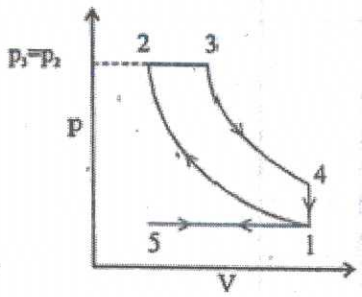
3

i) Suction stroke : During this stroke, the piston moves downwards and the inlet valve is opened. The air is sucked into the cylinder though the inlet valve. This is represented by 5-1 in the pV diagram. Exhaust valve remains dosed during this stroke.

ii) Compression stroke: During this stroke, the piston moves upward. Both the inlet valve and exhaust valve remains closed during this process. The air present aside the cylinder is compressed by the upward movement of the piston. This is represented by 1-2 in the pV diagram. The temperature and pressure of the air increases rapidly during this process.

4

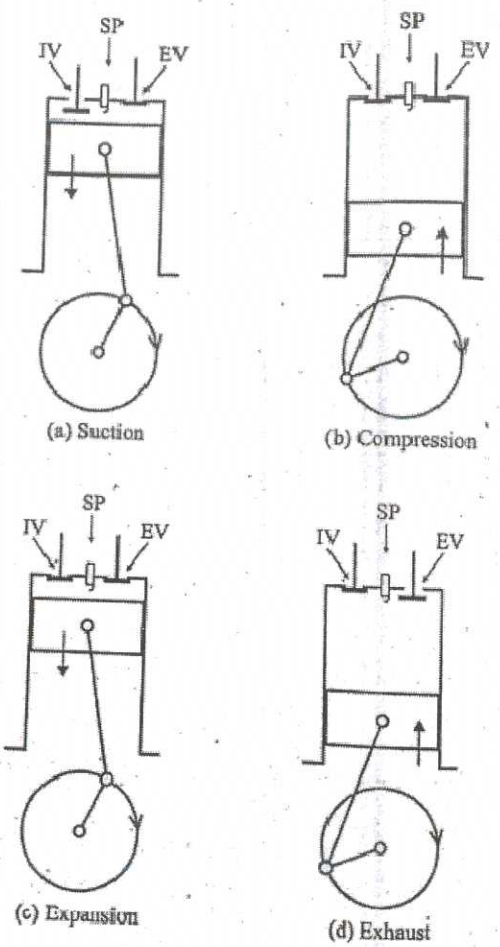
iii) Expansion stroke or power stroke: At the end of compression stroke, the temperature of air inside the cylinder is such that it exceeds the ignition temperature of the fuel. At this stage, fuel is sprayed into the cylinder by the fuel injector and the fuel starts burning.

	This combustion is a constant pressure process and is represented by 2-3 in pV diagram. The pressure of the gas increases instantaneously and the gas starts expanding by moving the piston downwards. Hence work is done on the piston. This stroke is also known as power stroke because the power is obtained during this stroke. The inlet valve and the exhaust valve remain closed during this stroke. This is represented by 3-4 in pV diagram. iv) Exhaust stroke: At the end of expansion stroke, the exhaust valve opens instantaneously and inlet valve remains closed. The piston starts moving upwards and the gas escapes the cylinder through the exhaust valve. This is represented by 1-5 in pV diagram. By completing this stroke, one cycle has finished and the process continues  		2		
VII.(b)	Advantages of Internal Combustion Engine 1) Simplicity in design 2) The overall size of the engine is small 3) The overall efficiency of the engine is higher 4) Low cost of operation 5) Possible to develop low power engines with reasonable thermal efficiency and cost 6) Avoid the use of boilers turbines etc. Disadvantages of Internal Combustion Engines 1) Vibration caused by reciprocating components are very high 2) It is not possible to use variety of fuels 3) Only liquid or gaseous fuels of given specification can be effectively used 4) Fuels are relatively expensive		1X6	6	6
VIII.(a)	The various strokes of four stroke petrol engine are explained below i) Suction stroke: The inlet valve is opened and air-fuel mixture is sucked into the cylinder during the downward movement of the piston. The exhaust valve remains closed during this stroke. This is represented by 5- 1 in pV diagram ii) Compression stroke: The air-fuel mixture is		4	9	9

compressed by the upward motion of the piston. The inlet valve and exhaust valve remains closed during this stroke. This is represented by 1-2 in pV diagram

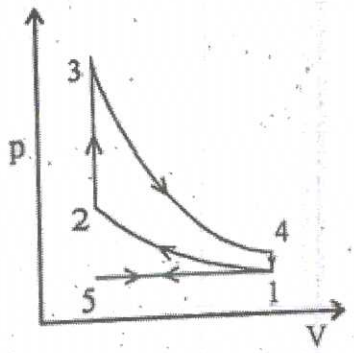
iii) Expansion stroke or power stroke: At the end of compression stroke, spark plug initiates a spark and it ignites the air-fuel mixture. The combustion takes place at constant volume (2-3 in pV diagram). The burnt gases drive the piston downwards, which is known as or stroke. Thus work is done on the piston. The inlet valve and exhaust must valve remain closed during this stroke. This is represented by 3-4 in the pV diagram.

iv) Exhaust stroke: Exhaust valve is opened and inlet valve remains closed during this stroke. The piston moves upwards and the exhaust gas is completely drained out of cylinder through exhaust valve. This is represented by 1-5 in pV diagram. One cycle is completed and the process repeats.



IV - Inlet Valve, EV - Exhaust Valve, SP - Spark Plug

3



2

VIII.(b)

Four stroke cycle engine	Two stroke cycle engine
1. One power stroke is obtained in every two revolutions of the crank shaft. Thus crank torque is non uniform	1. Onc power stroke is obtained in every revolution of the crank shaft. Thus crank torque is more uniform
2. Heavy fly wheel is required due to non uniform torque	2. Lighter fly wheel is required
3. Valves are present	3. Ports are present instead of valves
4. More efficient, because burnt gases are completely removed during exhaust stroke	4. Less efficient because some amount of burnt gases are always present in the cylinder and it mixes with fresh charge.
5. Heavy weight and design is complicated	5. Light weight and simple design
6. For the same size, four stroke engine develops one half of power developed by two stroke engine	6. For the same size, two stroke engine develops twice the power developed by four stroke engine
7. Thermal efficiency is higher	7. Thermal efficiency is lower
8. Lesser rate of wear and tear	8. More rate of wear and tear
9. Engine will run in one direction only	9. Engine will run in both directions due to lack of valves
10. Used in cars, buses, aeroplanes, power generators, tractors etc. where efficiency is important.	10.Used in lawn movers, scooters, motor cycles. hand sprayers, mopeds etc. where low cost, compactness and light weight are important.

1X6 | 6 | 6

UNIT IV

IX.(a)

Water collected in the earth's surface possesses potential energy. As the water falls through a certain height, its potential energy is converted into kinetic energy and this kinetic energy is converted to mechanical energy while the water is flowing through hydraulic turbine. This mechanical energy is utilized to run an electric generator which is coupled to the turbine shaft. Following are the essential elements of a hydro electric power plant.

4 | 9 | 9

1. Catchment area: Catchment area is the whole area behind the dam, from where the water is collected in a river across which

the dam has been constructed.
2. Reservoir: The main purpose of the reservoir is to store water during rainy season and supply the same during dry season.
3. Dam: It is a construction across the river to develop a reservoir of the desired capacity to store water and builds up a head for power generation.
4. Penstocks: They are passages or pipes through which water is conveyed to die turbine.
5. Surge tank: The surge tank is a small reservoir in which water level rises or falls to reduce the pressure variations in a penstock. It is used to avoid the effect of water hammer in the penstock.
6. Draft tube: It is a diverging passage connecting the turbine outlet with the tail race
7. Tail race: It is a passage for discharging the water leaving the turbine into the river/canal.
8. Power house: The power house is a building in which turbines, generators and controlling equipment are housed, and electric power is generated.
9. Power transmission systems: It consists of step-up transformers, switch gear mechanisms. Outgoing connections etc.
10. Spill ways It is used to discharge the water during flood period without passing Through the power house.

Water available from the catchment area is collected in the reservoir behind the dam. The power house is located at a lower level, so that maximum possible head is available for the supply water. The power house provided with water turbines are coupled to electric generators for the production of electricity. Water from the reservoir is supplied to the turbines through penstock. Gates and valves control the rate of water flow entering the turbine. A storage reservoir known as surge tank is fitted to the penstock at a point near to the turbine. It is provided to avoid the effect of water hammer in the penstock. The turbines convert the kinetic energy of flowing water into mechanical energy. The mechanical energy developed by the turbine is utilized for running the electric generator. The water after doing work on the turbine passes through the draft tube to the tail race. Transformers and transmission lines are provided for the efficient distribution of electric power generated.

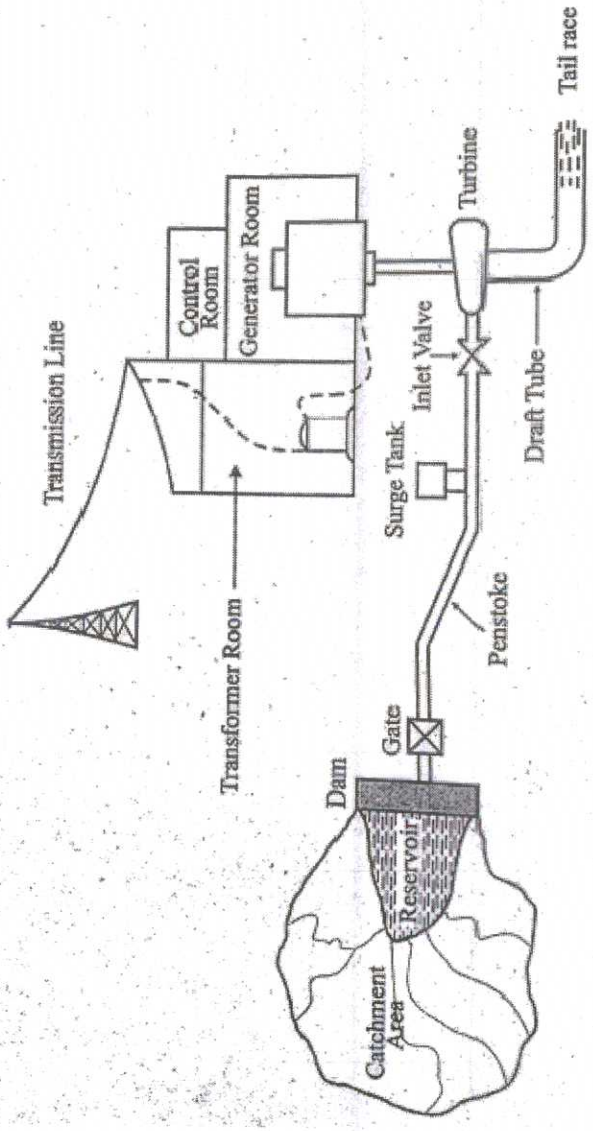


Fig5

IX.(b) Advantages

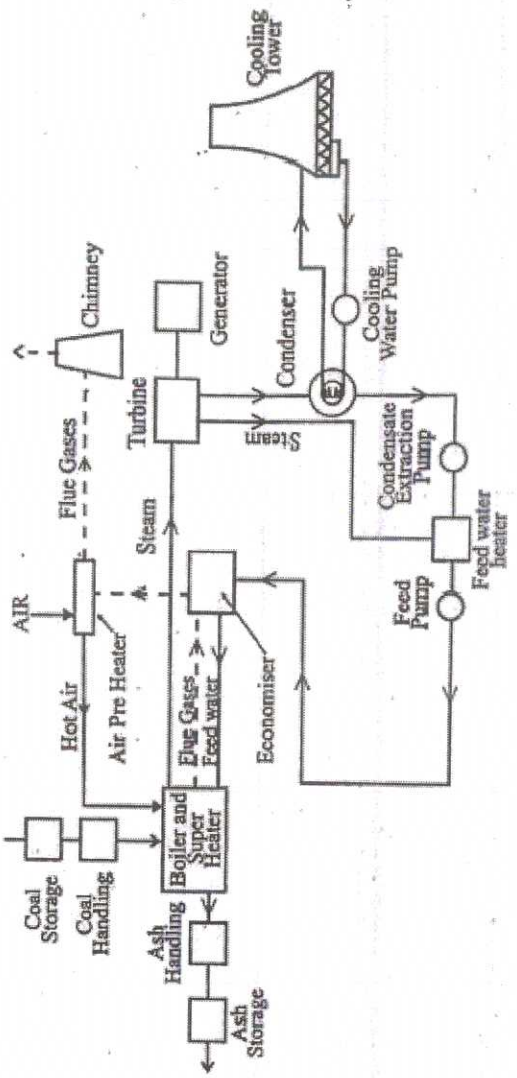
1) Solar energy is a renewable source of energy and is infinite 2) It is ecofriendly and will not cause any pollution 3) It is available in remote areas also 4) Low power devices can be efficiently run using solar power

Disadvantages

1) Solar energy is available only during day time 2) The intensity of solar energy is very low and its extraction is very costly 3) Large areas of land is required for the proper utilisation of solar energy 4) Power output from the solar power plant is limited and will not match the power output from a conventional power plant

1X6 | 6 | 6

X.(a)	Steam power plant is a conventional energy power plant which converts the chemical energy in fossil fuels (coal, oil, gas) in to mechanical or electrical energy through the expansion of steam in a suitable prime mover such as steam turbines or reciprocating engines. Water is converted into steam in a boiler by burning fuel in the furnace, which is conveyed to the prime movers through pipe lines. The prime mover is coupled to the generator for producing electricity. Steam power plants are also called as thermal power plants. Different equipment or components used in a steam power plant are 1. High pressure boiler 2. Coal handling and ash handling systems 3. Pumping systems 4. Cooling towers 5. Condenser 6. Superheater, Economiser, Air preheater, Feed water heater Working of steam power plant Coal stored is transported using conveyer belts into coal preparation centre, where it is pulverised into powder form. This coal is fed into the furnace along with pre-heated air and is ignited. The burning takes place, and the heat generated is used for the conversion of water into steam. The steam generated is further heated in superheaters. The dry, high pressure and high temperature steam is then fed to the steam turbine. In steam turbine, the steam is expanded and the thermal energy of steam is convened into mechanical energy of the turbine shaft, which is utilised to rotate a generator and produce electrical energy. After doing the useful work in the steam turbine the exhaust steam flows in to a condenser where it is condensed to water. The coolant water circulated through the condenser gets heated up and is further cooled in a cooling tower for recirculation. The condensed steam (condensate) is used as the feed water for the next cycle. The condensate (feed water) is heated in a feed water heater with the help of steam taken from the steam turbine. The feed pump forces the feed water under pressure to the economiser. In the economiser, the feed water is further heated up by the hot flue gases leaving the boiler. The hot feed water from the economiser enters the boiler; thus one cycle of operations is completed, the processes are repeated. For the purpose of combustion, air is required, and the efficiency of combustion increases if the air supplied is hot. This is achieved with the help of air preheater. Hot flue gases enters the air preheater and the atmospheric air is heated. The ash resulting from the combustion of coal is collected in the ash pit of the	4	9	9

	furnace and is removed mechanically. Fly ash in the flue i gases are separated using ash precipitators, before the flue gas is exhausted through the chimney.  	Fig 5		
X.(b)	Advantages 1) Renewable source of energy 2). Ecofriendly and inexhaustible 3) Requires smaller area for construction of the power plant 4) Operation cost is low compared to conventional power plant Disadvantages 1) Tidal power plant affects the marine life and interrupt the natural movement of species. 2) Initial cost is higher 3) Tidal power plant can only be constructed in few ocean shores and it depends on the availability of tides 4) The power generation is not continuous and it depends on the occurrence of tides.	1X6	6	6