WINTER-16 EXAMINATION

Model Answer Subject Code **17554**

WINTER – 16 EXAMINATIONS

Subject Code: **17554** **Model Answer** Page No: ____/ N

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and Communication Skills)
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

WINTER-16 EXAMINATION

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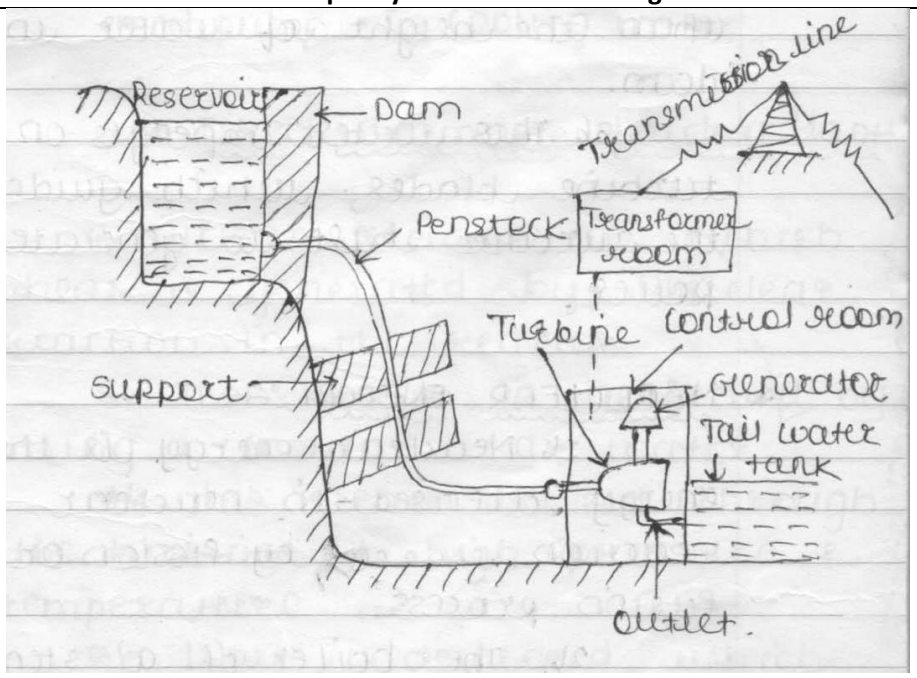
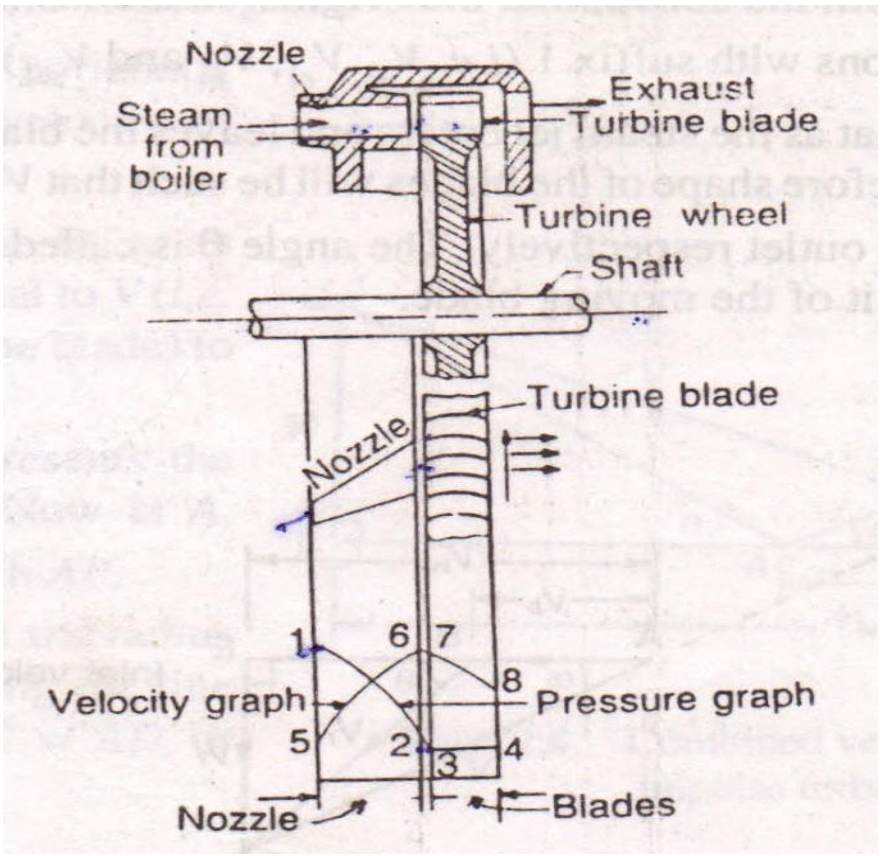
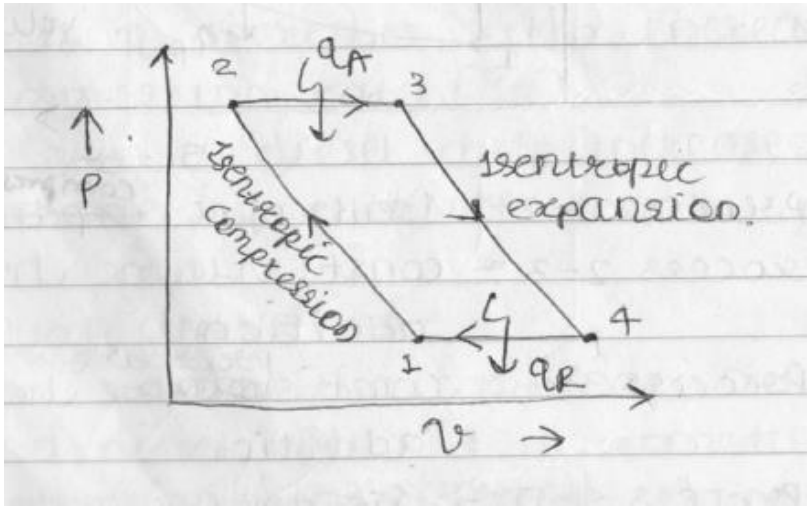
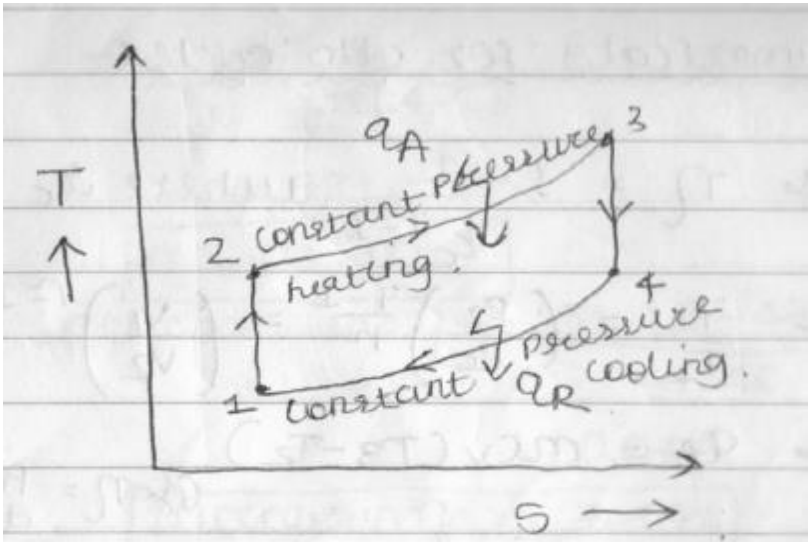
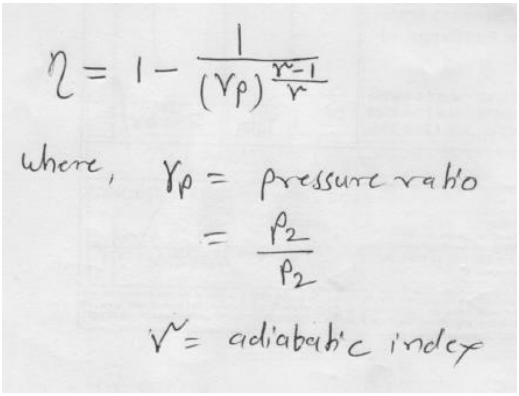
`Q	MODEL ANSWER . NO.	MARKS	TOTAL MARKS
1.	**Attempt any FIVE of the following:**		**20**
a)	 HYDRO-ELECTRIC POWER PLANT fig.shows a general lay-out of a hydro-electric power plant which consists of: (i)A dam constructed across a river to store water. (ii)Pipes of large diameters called penstocks, which carry water under pressure from the storage reservoir to the turbines. These pipes are made of steel or reinforced concrete. (iii)Turbines having different types of vanes fitted to the wheels. (iv)Tail race, which is a channel which carries water away from the turbines after the water has worked on the turbines. The surface of water in the tail race is also known as tail race.	2m(dia.) 2m(expl.)	4m
b)	Zeroth law of thermodynamic: Ths law states"when two system are each in thermal equilibrium separately with a third system,then two systems are also in themal equilibrium in each other." This law is on the basis for temperature measurement ,as the numbers can be placed on the thermometer and everytime a body has equality of temp. with the thermometer,we can say that the body has the temp.we	3m	4m

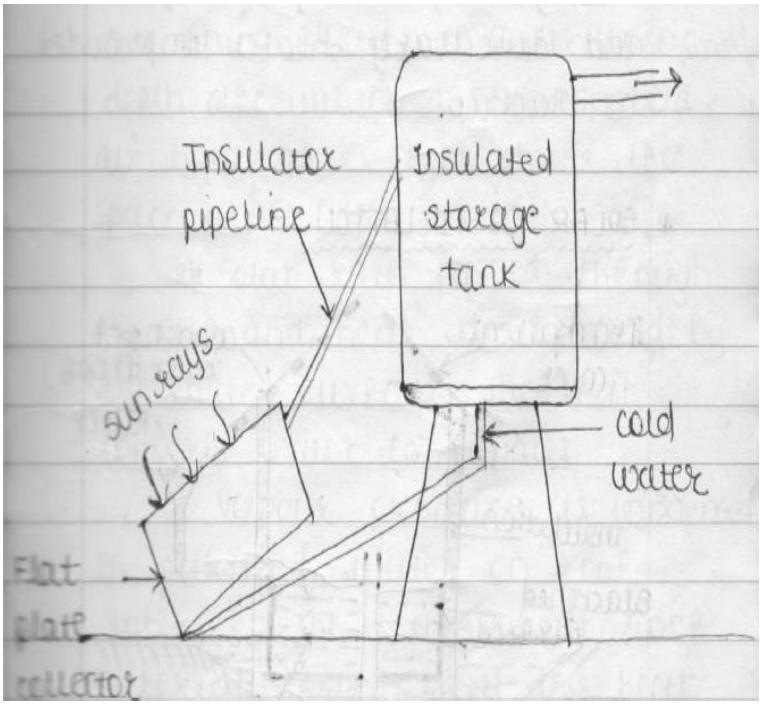
<table>
<tr><td></td><td colspan="4">read on the thermometer.

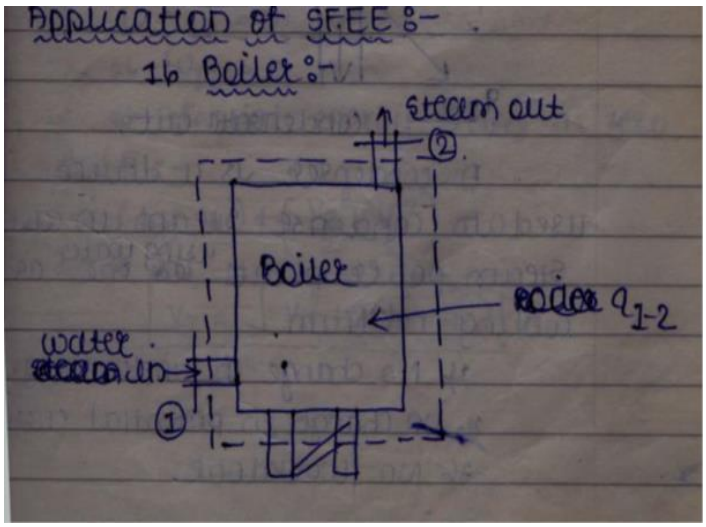
Eg.If a body A, be in thermal equilibrium with two other bodies, B and C, then B and C are in thermal equilibrium with one another.</td><td>1m</td><td></td></tr>
<tr><td>c)</td><td colspan="4"><table>
<tr><td>Sr. No.</td><td>Fire tube boiler</td><td>Water tube boiler</td></tr>
<tr><td>1</td><td>The hot gases from the furnace pass through the tubes which are surrounded by water</td><td>The water circulates inside the tubes which are surrounded by hot zg ases from the furnace</td></tr>
<tr><td>2</td><td>It can generate steam only upto 24.5 bar.</td><td>It generates steam at a higher pressure upto 165 bar.</td></tr>
<tr><td>3</td><td>The rate of generation of steam is low, i.e. upto 9 tonnes per hour.</td><td>The rate of generation of steam is high, i.e. upto 450 tonnes per hour.</td></tr>
<tr><td>4</td><td>The floor area required is more, i.e. about 8 m^2 per tonne per hour of steam generation.</td><td>For a given power, the floor area required for the generation of steam is less, i.e. about 5 m2 per tonne per hour of steam generation.</td></tr>
<tr><td>5</td><td>Its overall efficiency is only 75%.</td><td>Overall efficiency with economiser is upto 90%.</td></tr>
<tr><td>6</td><td>The transportation and erection is difficult.</td><td>It can be transported and erected easily as its various parts can be separated.</td></tr>
<tr><td>7</td><td>It can also cope reasonably with sudden increase in load but for it shorter period.</td><td>It is preferred for widely fluctuating loads.</td></tr>
<tr><td>8</td><td>The water does not circulate in a definite direction.</td><td>The direction of water circulation is well defined.</td></tr>
<tr><td>9</td><td>The operating cost is less.</td><td>The operating cost is high.</td></tr>
<tr><td>10</td><td>The bursting chances are less.</td><td>The bursting chances are more.</td></tr>
<tr><td>11</td><td>The bursting produces greater risk to the damage of the property</td><td>The bursting does not produce any destruction to the whole boiler.</td></tr>
</table></td><td>1m for each(any four)</td><td>4m</td></tr>
</table>

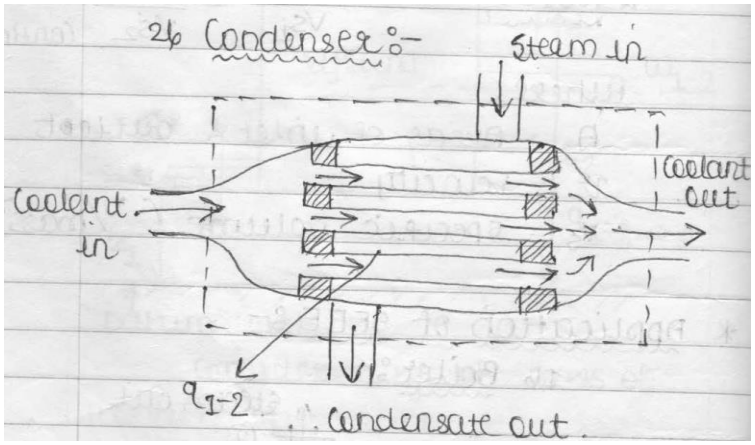
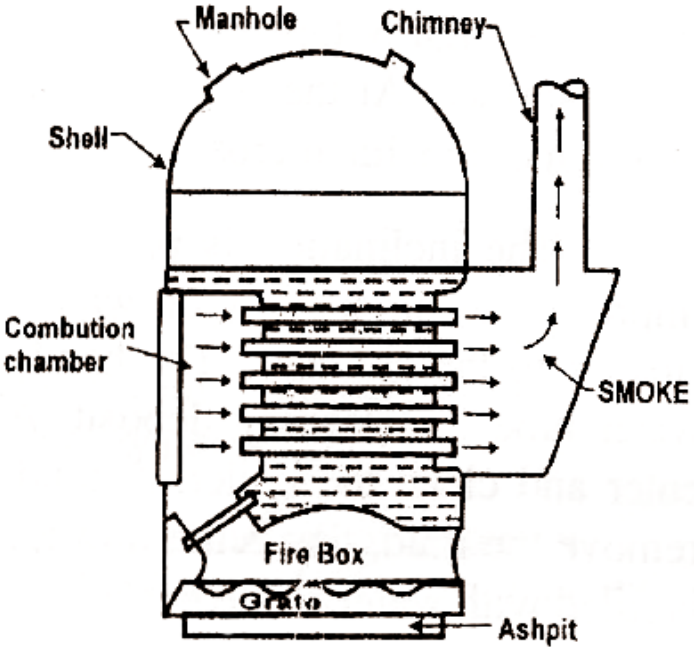
	12	It is not suitable for large plants.	It is used for large power plants		
d)	Impulse Turbine  Pressure and velocity graph of steam in a simple impulse turbine. An impulse turbine, as the name indicates, is a turbine which runs by the impulse of steam jet In this turbine, the steam is first made to flow through a nozzle. Then the steam jet impinges on the turbine blades (which are curved like buckets) and are mounted on the circumference of the wheel. The steam jet after impinging glides over the concave surface of the blades and finally leave the turbine. Note: The action of the jet of steam, impinging on the blades, is said to be an impulse and the rotation rotor is due to the impulsive forces of the steam jets. De-Level ImpulseTurbine A De-Level turbine is the simplest type of impulse steam turbine, and is commonly used. It has the following main components : 1. Nozzle:- It is a circular guide mechanism,which guides the steam to flow	2m(dia.) 2m(expl.)	4m

	at the designed direction and velocity. 2. Runner and blades:- It consists of a circular disc fixed to a horizontal shaft on the periphery of the runner, number of blades are fixed uniformly. The steam jet impinges on the buckets, which move in the direction of the jet. This movement of the blades makes the runner to rotate. 3. Casing:- It is an air-tight metallic case, which contains the turbine runner and blades. It controls the movement of steam and does not permit it to move into the space. Moreover, it is essential to safeguard the runner against any accident.		
e)	Bryton Cycle:   -Process 1-2 :-Isentropic Compressoion	2m(dia.)	4m

	-Process 2-3 :-Constant pressure heat addition (In the C- Chamber) -Process 3-4 :-Isentropic Exampasion(In the gas turbine) -Process 4-1 :-Contant Pressure heat rejection or cooling(In heat exchaner) 	2m(expl.)	
f)	1 According to type of Contact a) Direct type of contact heat exchanger b) Indirect type of contact heat exchanger 2. According to flow of coolant a) Parellel flow heat exchanger b) Counter flow heat exchanger 3 According to construction a) 1.Shell and tube heat exchanger b) 2.Double pipe heat exchanger c) 3.Plate type heat exchanger d) 4.Plate and shell type heat exchanger. 4. According to nature a) Natural type of heat exchanger b) Forced type of heat exchanger. Applications of heat exchanger: a) Dairy industry. b) Food industries. c) Refrigeration and air-conditioning. d) Steam and gas turbine power plants. e) Internal combustion engines. f) Milk chiller of pasteruzing plant	2m(classification) 2m(appl.)	4m

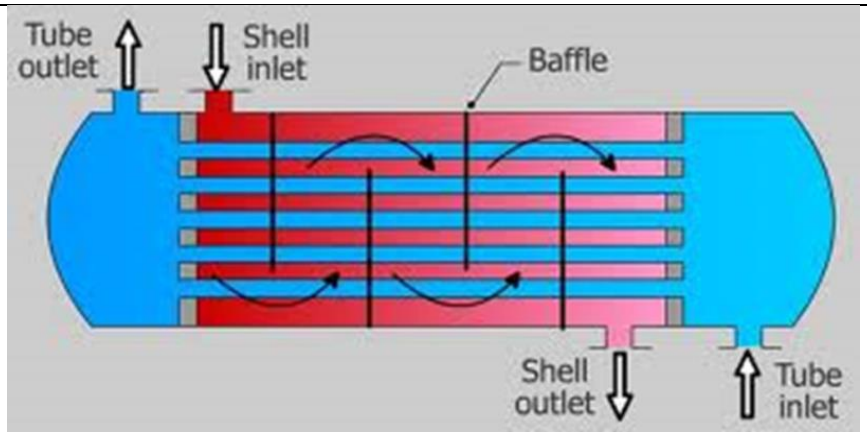
g)	Difference between point function and path function: Path Function: Their magnitudes depend on the path followed during a process as well as the end states; Work (W), heat (Q), Pressure, volume, enthalpy, internal energy are path functions; When the two properties locate a point on graph (coordinates axes) then those properties are known as point function Point Function: They depend on the state only, and not on how a system reaches that state.; All properties are point functions; Those properties, which cannot be located on graph by a point but are given by area or show on the graph	**2M each(any two)**	**4M**
2.	**Attempt any FOUR of the following:**		**16**
a)	Solar water Heater :  1). It Consist of a a)Tittled flat plate collector b) Hightly insulated storage tank c)Insulated pipe line joining water tabk and flate plate collector. 2).The bottom of a storage tank atleast a foot higher than the top of the collector and therefore no auxillary energy is required for circulation of water. To provide heationg during long clouldy atmosphere and auxillary	2m(dia.) 2m(expl.)	4m

	heater is provide as backup.		
b)	SFEE: $h_1+V_1^2/2+gZ_1+q_{12}= h_2+V_2^2/2+gZ_2+W_{12}$ where, h_1,h_2= enthalpy inlet,outlet v_1,v_2=velocity, inlet,outlet z_1,z_2=Height above datum inlet,outlet, q_{12}=Height transfer W_{12}=work transfer For boiler  It is a device which supplies heat to water and generates steam. 1) No change in kinetic energy 2) No change in potential energy 3) No work done. SFEE q12=h2-h1	1m $1\ ^1/_2$m	4m

	For Condenser  A condenser is device used to condense steam in case of steam power plant using water as cooling medium. 1) No change in kinetic energy 2) No change in potential energy 3) No work done. SFEE -q12=h2-h1 q12=h1-h2	1 $^1/_2$m	
c)	Cochran boiler:  Cochran Boiler (Elevation)	**4m**	**4m**

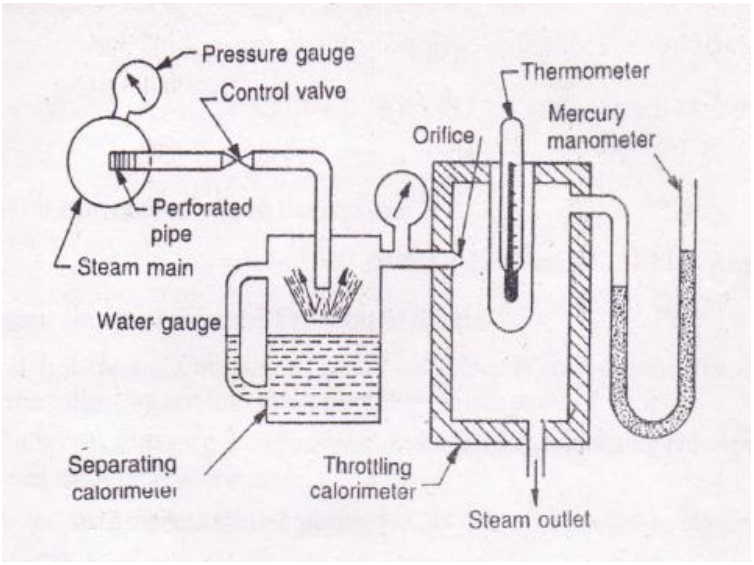
<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>d)</td><td>Classification of steam condenser
A)Jet Consender or Mixing type
1.Parallel flow
2.Counter flow or low level
3.Barometric or high level ejector
B)Surface condesor or Non mixing type
1.Down flow
2.Central flow
3.Regerrative
4.Evaprative
1.Primary fuction of condense:
The primary function is to maintain a low pressure(below atomsheric) so as to obtain maximum possible energy from steam and thus to secure a high efficiency.
2.Secondary function:
It is use to supply pure feed water to hot well,from where iti is pumped back to the boiler.</td><td>2m(class.)

2m (funct.)</td><td>4m</td></tr>
<tr><td>e)</td><td>
<table>
<tr><td>Sr no</td><td>Two Stroke</td><td>Four Stroke</td></tr>
<tr><td>1</td><td>The two-stroke engine completes one cycle of events for every revolution of the crankshaft</td><td>completes one cycle of events with the two revolutions required for the four-stroke engine cycle.</td></tr>
<tr><td>2</td><td>Theoratical power developed is more</td><td>Theoratical power developed is less</td></tr>
<tr><td>3</td><td>There are fewer working parts in a two-stroke engine</td><td>There are more working parts in four-stroke engine.</td></tr>
<tr><td>4</td><td>Cheap to manufacture</td><td>Expensive to manufacture.</td></tr>
<tr><td>5</td><td>Maintenance is less</td><td>Maintenance is more.</td></tr>
<tr><td>6</td><td>Self lubrication by mixing with fuel.</td><td>Separate lubrication is required.</td></tr>
<tr><td>7</td><td>Need of Scavenging</td><td>No need of scavenging.</td></tr>
<tr><td>8</td><td>Operation is smooth.</td><td>Operation is not much smooth.</td></tr>
<tr><td>9</td><td>More Pollution</td><td>Less pollution.</td></tr>
<tr><td>10</td><td>Light in weight</td><td>Heavier than two stroke.</td></tr>
</table>
</td><td>4m(any four)</td><td>4m</td></tr>
</table>

<table>
<tr><td>f)</td><td> 

Working:-
A shell and tube heat exchanger is a class of heat exchanger designs. It is the most common type of heat exchanger in oil refineries and other large chemical processes, and is suited for higher-pressure applications. As its name implies, this type of heat exchanger consists of a shell (a large pressure vessel) with a bundle of tubes inside it. One fluid runs through the tubes, and another fluid flows over the tubes (through the shell) to transfer heat between the two fluids. The set of tubes is called a tube bundle, and may be composed of several types of tubes: plain, longitudinally finned, etc.
Two fluids, of different starting temperatures, flow through the heat exchanger. One flows through the tubes (the tube side) and the other flows outside the tubes but inside the shell (the shell side). Heat is transferred from one fluid to the other through the tube walls, either from tube side to shell side or vice versa. The fluids can be either liquids or gases on either the shell or the tube side. In order to transfer heat efficiently, a large heat transfer area should be used, leading to the use of many tubes. In this way, waste heat can be put to use. This is an efficient way to conserve energy.</td><td>2m(dia.)

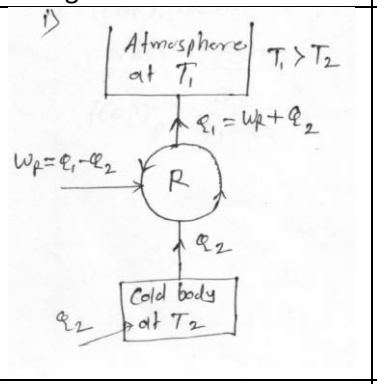
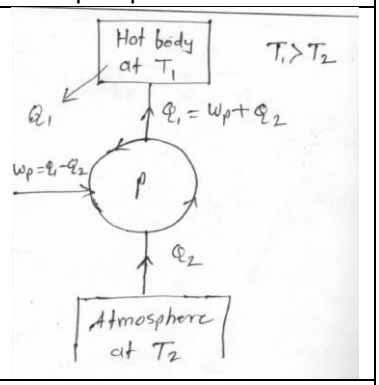
2m(expl.)</td><td>4m</td></tr>
<tr><td>3.</td><td>Attempt any FOUR of the following:</td><td></td><td>16</td></tr>
<tr><td>a)</td><td>
<table>
<tr><td>Open System</td><td>Closed system</td></tr>
<tr><td>1.Mass of the system does not remains constant.</td><td>1.Mass of the system remains constant.</td></tr>
<tr><td>2.Mass and energy tranferes across control volume</td><td>2.Only energy tranferes across sytem boudries.</td></tr>
<tr><td>3.It can be explain with concept of control volume and control surface.</td><td>3.It can be explain with concept of the concept of boundries.</td></tr>
</table>
</td><td>2m(any two)</td><td>4m</td></tr>
</table>

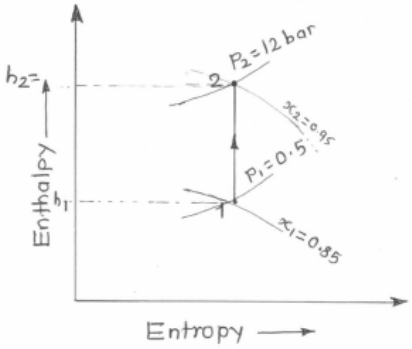
b)	Combined Separating and Throttling Caloriineter A very successful method of measuring the dryness fraction of steam is by a combined separating and throttling-calorimeter as shown in Fig.  In this calorimeter, the wet steam is first collected in a perforated collecting pipe and then passed through a separating calorimeter. A part of water is removed by the separating calorimeter owing to quick change of direction of flow. The resulting semi-dry steam is throttled into a throttling calorimeter. This method ensures that the steam will be superheated after throttling. This instrumentis well insulated to prevent any loss of heat. Let X1 = Dryness fraction of steam considering separating calorimeter, and X2 = Dryness fraction of steam entering the throttling calorimeter. Now the actual dryness fraction of steam in the steam main, X = X1 * X2	**2m(dai.)** **2m(expl.)**	**4m**
c)	Sources of Air into the Condenser The following are the main sources through which the air may en r into the condenser: 1.The dissolved air in the feed water enters into the boiler, whicfri rn enters into the condenser with the exhaust steam. . 2. The air leaks into the condenser, through various joints, due to high vacuum pressure in the condenser. 3. In case of jet condensers, dissolved air with the injection water enters into the condenser	4m	4m
d)	Supercharging: it is the process of increasing the mass, or in other words of the air-fuel mixture induced into the engine cylinder. This is usually done with the help of compressor or blower known as supercharger.	**2m**	4m

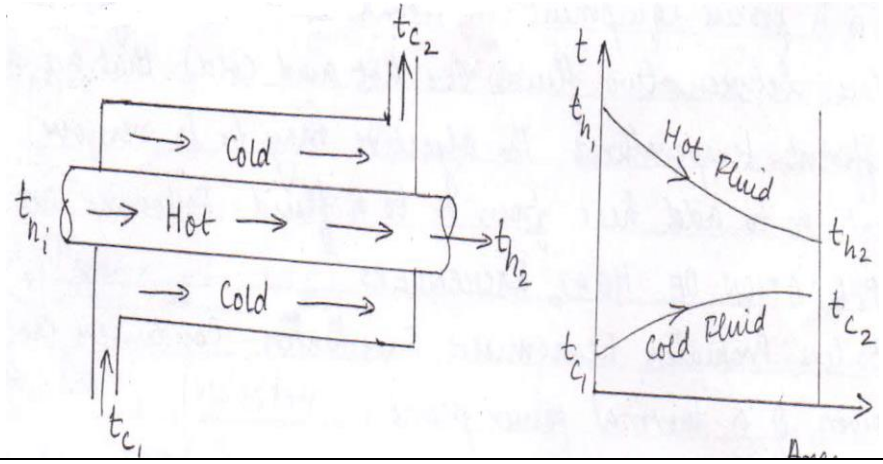
	Necessity:- The main objective of supercharging is to reduce mass of engine per brake power and to increase the power output of an engine when greater power is required	**2m**	
e)	**Solution: (a) Given data:** P = 10 bar, v = 0.185 m^3/kg **Procedure:** From steam table corresponding to pressure of 10 bar, v_g = 0.1943 m^3/kg As $v < v_g$, the steam is wet We have, $v = x \cdot v_g$ $\therefore$ $0.185 = x \times 0.1943$ $\therefore$ $x = \mathbf{0.9521}$ **(b)Given data:** P= 12 bar, T = 200°C **Procedure:** From steam table corresponding to pressure of 12 bar, T_{sat} = 188°C As, $T > T_{sat}$, therefore steam is superheated $\therefore$ Degree of superheat = $T - T_{sat}$ = 200 − 188 = **12°C**	**2m** **2m**	4m
f)	Vacuum Efficiency: Vacuum efficiency is the ratio of actual vacuum at inlet to condenser to the maximum or ideal vacuum which can be obtained in a perfect condensing plant n_v=Actual vacuum/Ideal vacuum Actual vacuum = barometric pressure- Actual pressure Ideal vacuum =Barometric pressure- Ideal pressure (or pressure corresponding to temperature of condenser) Condenser efficiency: Condenser efficiency is defined as ratio of temperature rise of cooling water to the difference in vacuum temperature and inlet cooling water. n_c =Temperature rise of cooling water/Vacuum temperature inlet cooling water temperature $=t_o-t_i/t_v-t_i$ Where t_o = outlet temperature of cooling water t_i= inlet temperature of cooling water t_v =Vacuum temperature or saturation temperature corresponding to condenser pressure	**2m** **2m**	4m

WINTER-16 EXAMINATION

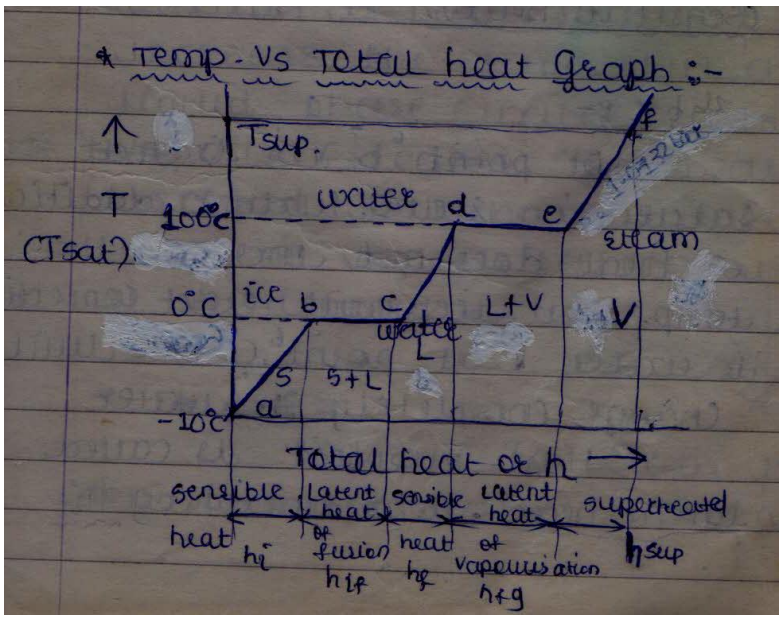
Model Answer Subject Code **17554**

4.	Attempt any FOUR of the following:				16
a)	Sr.No.	Refrigerator	Heat pump	4m	4m
	1				
	2	It is device which maintains the temperature of a cold body(Refrigerated space)at a temperature lower thab temperature of surrounding	It is divice which maintainces the temperature of ahot body(Heated space) at a higher temperature thab the surrounding		
	3	Heat is to be removed from the body at the same rate at which heat is leaking into the body	Heat has to be suppied to the hot body at the same rate at which it is leaking out of the body.		
	4	(cop).(coefficient of performance) $(COP)_R = \frac{Q_2}{Q_1 - Q_2}$	(COP) $(COP)_{H.P.} = \frac{Q_1}{Q_1 - Q_2}$		
b)	**Sr.No**	**Natural draught cooling tower**	**Forced draught cooling tower**	4m(any four)	4m
	1	More installation cost.	Less installation cost.		
	2	Less operating cost.	More operatino cost.		
	3	Low maintenance cost	Hiqh maintenance cost.		
	4	Fan is not required	Fan is required.		
	5	It is preferred for large capacity plants	It is preferred for small capacity plants.		
	6	It requires more space	It requires comparatively less space		

c)	given data :- $m = 5\ ton = 5000\ kg$ $P_1 = 0.5\ bar$ $x_1 = 0.85$ $P_2 = 12\ bar$ from mollier chart, $h_1 = 570.45\ kcal/kg$ $= 570.45 \times 4.186\ kJ/kg$ $= 2387.90\ kJ/kg$ $h_2 = 656\ kcal/kg$ $= 656 \times 4.186\ kJ/kg$ $= 2746.01\ kJ/kg$  work input $= h_2 - h_1$ $= 2746.01 - 2387.90$ $= 358.11\ kJ/kg$ ∴ for 5 ton of steam, work input is, $= 358.11 \times 5000$ $= 17.90 \times 10^5\ kJ/$ **work input $= 17.90 \times 10^5$ kJ**	1m(dia.) 3m(cal.)	4m
d)	Pre-ignition:- The ignition of fuel in an internal-combustion engine before the spark passes through the fuel, resulting from a hot spot in the cylinder or from too great a compression ratio for the fuel. Ignition of the charge in an internal-combustion engine earlier in the cycle than is compatible with proper operation. Scavenging: the process of removing burnt gases from the combustion chamber of the engine cylinder is known as scavenging. Following are the methods of scavenging: 1. Cross flow scavenging: in this the transfer port and exhaust port are situated on opposite sides of engine cylinder 2. Back-flow or loop scavenging: in this method the inlet and outlet ports are situated on same side of engine cylinder 3. Uniflow scavenging: in this method, the fresh charge while entering from one side of the engine cylinder pushes out the gases through exit valves	2m 2m	4m
e)	**Biogas** typically refers to a mixture of different gases produced by the		

	breakdown of organic matter in the absence of oxygen.Bio gas can be produced from raw material such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food wasteJBiogas is a renewable energy source Applications 1) Biogas can be used for electricity production on sewage works, 2) in a gas engine, where the waste heat from the engine is conveniently used for 3) cooking; space heating; water heating etc 4)If compressed, it can replace compressed natural gas for use in vehicles. **Boimass**: It is plant matter created by the process of photosynthesis is called as Biomass It is a solar energy is stored in the from of chemical energy by Photosynthsis. Application: 1) A wood and agricultural products are used for direct burining to obtaine heat and energy. 2) Conventional biomass is converted to ethanol and mythanle to use as fuel in IC engine.	2m 2m	4m
f)	Parallel flow type: The hot and cold fluids flows in the same direction and thus enter the exchanger from the same side. As seen in the figure the temperature difference between hot and cold fluids goes on decreasing from inlet to outlet. This type requires a large area of heat tranfere. 	2m expl. 2m(dia.)	4m
5.	**Attempt any FOUR of the following:**		**16**

a)



2m(dia.)

(i)Sensible heat (a-b):
When heat is added to ice, temperature of ice will increase which can be sensed by a thermometer .Therefore it is called sensible heat. During this only solid phase will exist. It is denoted by h_i

(ii) Latent heat(b-c):
At point b ice is at saturation state, further addition of heat does not increase the temperature .But ice will start converting to water and at point c ice will change completely to water. Heat supplied is called latent heat. It is denoted by h_{if}

2m(expl.)

(iii) Dryness fraction:
It is the ratio of mass of actual dry steam in a quantity of wet steam to the mass of same quantity of wet steam and it is denoted by x
Where x= mass of dry steam vapour /mass of wet steam mixture
x=mg/mg+mf
where mg= mass of actual dry steam
mf = mass of water in suspension
m= mass of wet steam
(iv) Superheated steam:
When stem is further heated at constant pressure. Thus raising its temperature.it is said to be superheated steam.

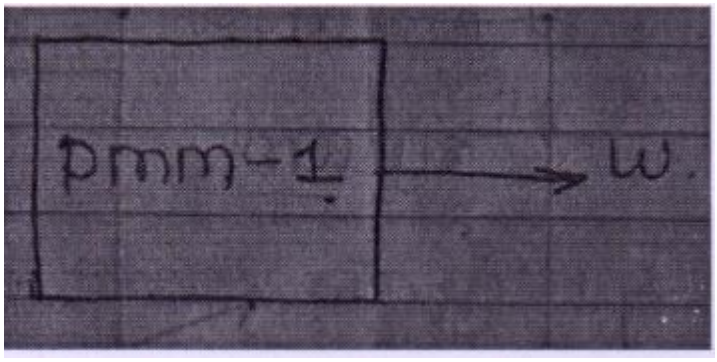
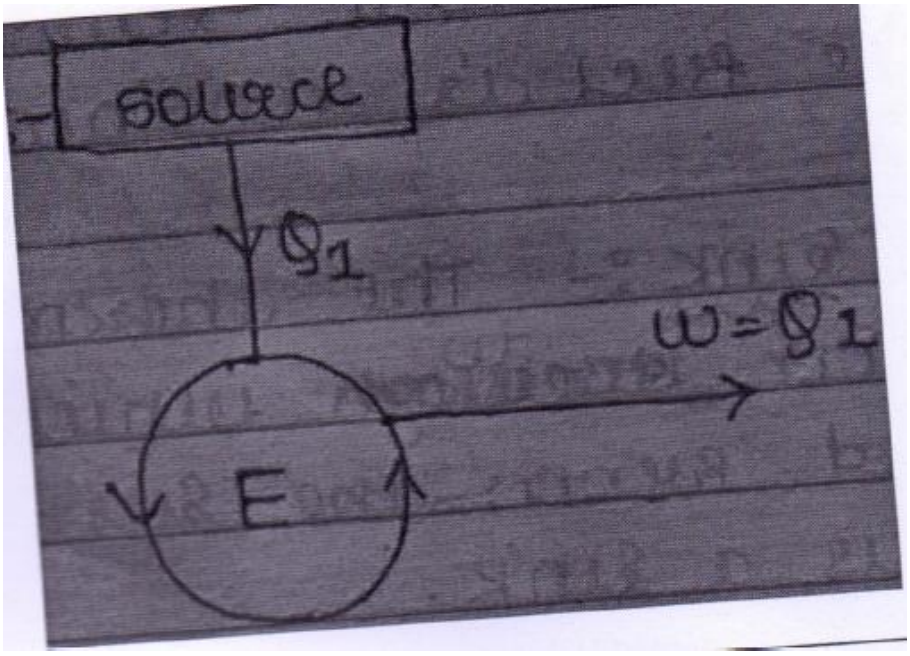
4m

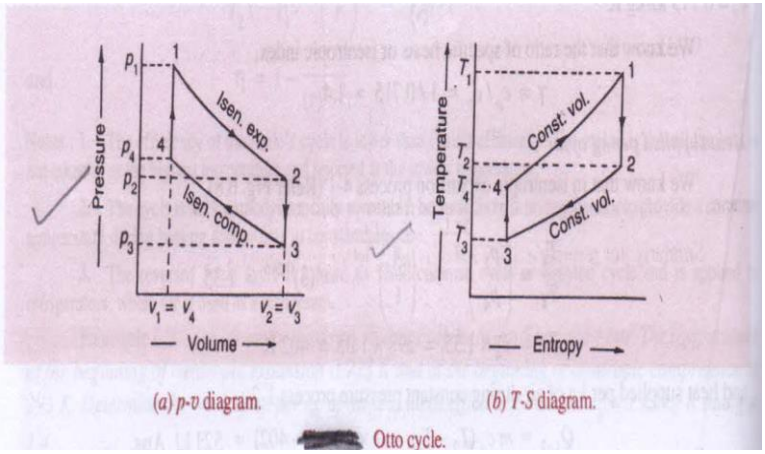
b)

Sr.No.	Jet Condenser	Surface Condenser

4m

	1	The condensing plant is simple toconstruct.	The condensing plant is complicated toconstruct	1m for each (any four	
	2	Less suitable for high capacity plants	More suitable for high capacity plants		
	3	Cooling water and steam are mixed up	Cooling water and steam do not mix up		
	4	Low initial cost.	High initial cost		
	5	Condensate is washed	Condensate is reused.		
	6	Low maintenance cost	High maintenance cost.		
	7	Requires less quantity of cold water	Requires more quantity of cold water		
	8	More power is required for air pump	Less power is required for air pump.		
c)	To improve the properties by addition of chemical of compound called additives The main additives as following: 1) Detergents- dispersant: These additives improve the detergent action of the lubricating oil by keeping the deposit in suspension form ads this additives are oil soluble. E.g.Metalics salts or organic acids 2) Pour point depressors: Lubricant contain paraffin compound and form wax precipitates as they cooled .Wax reduc e fluidity of oil temperature pour depressants are add to lower the pour points of lubrication oil. e.g. polymerized phenols , Easter ,alkylated naphthalene oil 3) Anti-foam agent: This assistive prevent the formation of foam by reducing surface tension, which allow air bubble to separate from oil more rapidly. e.g. Silicon polymers 4) Rust inhibitors: These prevent rusting of ferrous engine parts during storage and from acidic moisture accumulation during cold engine operation e.g. Metal sulphates, fatty acid and amines.			4m	4m
d)	PMM -1 (Perpetual motion machine of first kind)				4M

	A machine which violates the first law of thermodynamics is known as PMM -1.It is a machine which produced a work without consuming an equivalent of energy in any other form. Such machine is impossible to construct  PPM – 2 A heat engine which violates the second law of thermodynamics is known asPerpetual motion machine of second kind. It is 100% efficient machine. It convertswhole of heat energy into mechanical work. It is impossible to obtain in actual practice. 	2M 2m	
e)	Sr.N	Mountings	Accessories	4m(any	4m

	o			four)	
	1	Mountings are safety devices that,control the process of steam generation.	Accessories increase the efficiency of boiler plant.		
	2	These are essential for boiler.	These are auxiliary.		
	3	These are the fittings mounted on the boiler.	These are the integral parts of the boiler.		
	4	Examples are water level indicator, safety valve.	Examples are feed pump, super heater and economizer.		
f)	 Otto Cycle The ideal Otto cycle consists of two constant volume and two reversible adiabatic or isentropic processes as shown on p-v and T-S diagrams in Fig. (a) and (b). Following are the four stages of the ideal cycle: 1.First stage (Reversible adiabatic or isentropic expansion). The air is expanded reversibly and adiabatically from initial temperature T1 to a temperature T2 as shown by the curve 1-2 in Fig.(a) and (b). In this process, no heat is absorbed or rejected by the air. 2.Second stage (Constant volume cooling). The air is cooled at constant volume from temperature T2 to a temperature T3 as shown by the curve 2-3 in Fig. (a) and (b). We know that heat rejected by the air during this process Q2-3=mCv(T1-T2) 3.Third stage (Reversible adiabatic or isentropic compression). The air is compressed reversibly and adiabatically from temperature T3 to a temperature T4 as shown in by the curve 3-4 in Fig. (a) and (b). In this process, no heat is absorbed or rejected by the air. 4. Fourth stage (Constant volume heating). The air is now heated at constant volume from temperature T4 to a temperature T1as shown by the		2m (dia.) 2m(expl.)	4m

	curve 4-1 in Fig. (a) and (b). We know that heat absorbed by the air during this process, Q4-1 = m Cv (T1 - T4) $\eta = 1-\{1 /[(r)^{\Upsilon-1}]\}$		
6.	**Attempt any FOUR of the following:**		**16**
a)	**Kelvin - Planck Statement**. According to Kelvin-Planck "It is impossible to construct an engine working on a cyclic process, whose sole purpose is to convert heat energy from a single thermal reservoir into an equivalent amount of work". **Clausius Statement.** According to Clausius statement "It is impossible for a self acting machine working in a cycLic process, to transfer heat from a body at a lower temperature to a body at a higher temperature without the aid of an external agency".	**2m** **2m**	4m
b)	Boiler is usually a closed vessel made of steel. Its function is to transfer the heat produced by the combustion of fuel (Solid. Liquid or gaseous) to water and ultimately to generate steam. Classification of the steam boiler 1) According to the content in the tube may be classified as: a) Fire tube or smoke tube boiler b) Water tube boiler 2) According to method of circulation of water and steam may be classified as: a) Natural circulation boiler b) Forced circulation boiler 3) According to the number of tubes may be classified as: a) Single tube boiler b) Multitube boiler	1m(def.) 3m(class.)	**4m**
c)	Nozzle: a Steam nozzle is a passage of varying cross-section, which converts heat energy of steam into kinetic energy. The main use of steam nozzle in steam turbine is to produce a jet of steam with high velocity. The smallest section of nozzle is known as throat. Application:- 1.Jet propulsion 2. Turbo-machines 3. Flow measurement 4. Injectors s. Spray painting. 6. Ejector condensers.	1m(def.) 3m(appli.)any three	4m
d)	Detonation:- The land pulsating noise heard within the engine cyiinder known as	2m	4m

	'denotation' (also called knocking or pinking). It is, caused due the propagation of a high speed pressure wave created by the auto-ignition. of end portion of unbumt fuel. The blow of this pressure wave may be of sufficiea strength to break the piston. Thus,the denotation is harmful to the engine aed must be avoided. The following are certain factors which causes denotation 1) The shape of the combustion chamber. 2) The relativeposition of the sparking plugs in case of petrolengines. 3) The chemical nature of the fuel. 4) The initial teinperature and pressure of the fuel. 5) The rate of combustion' of that portion of the fuel which is the first to ignite. This portion of the- fuel in heating up, compresses the remaining unburnt fuel, thus producing the conditions for auto- ignition.	2m	
e)	Dalton'S Law of Partial Pressures It states "The pressure of the mixture of air and steam is equal to the sum of the pressures which each constitutent would exert, if it occupied the same space by itself." Mathematically, pressure in the condenser containing mixture of air and steam, Pc=Pa+Ps Pa = Partial pressure of air, and Ps = Partial pressure of steam. Note: In most of the cases, we are required to find partial pressure of air, therefore Dalton's law may also used as: Pa =Pc-Ps	2m 1m 1m	4m
f)i	Enthalpy:- It is defined as, "sum of internal energy (U) and product of pressure and volume". Mathematically, H = U + PV Unit of enthalpy is kJ / kg . Entropy:- It is defined as, "a thermodynamic property of a working substance, which increases with addition of heat and decreases with removal of heat". Unit of entropy is kJ / kg K.	1m 1m	2m
ii	Intensive Properties:- “The properties,which are dependent of mass, are called as extensive properties”. eg.volume and energy. Extensive Properties:- “The properties,which are independent of mass, are called as intensive	1m 1m	2m

	properties". eg. pressure,temp. and specific volume		