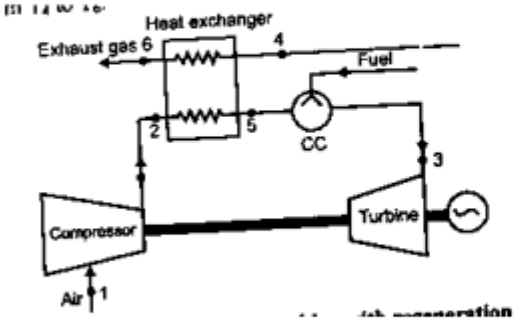
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State different methods for improving thermal efficiency of gas turbine and explain any one.

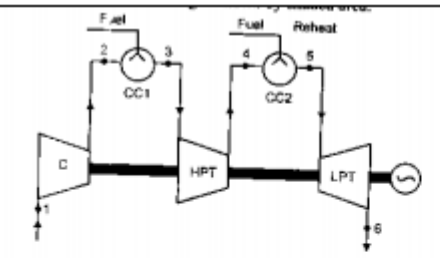
Methods to improve thermal efficiency of gas turbine [illegible]
of any one – 2 marks)

1) Regeneration – This is done by preheating the compressed air before entering to the combustion chamber with the turbine exhaust in a heat exchanger, thus saving fuel consumption.



2) Improving turbine output: this can be done by

(a) Reheating : The whole expansion in the turbine is achieved in two or more stages &reheating is done after each stage.

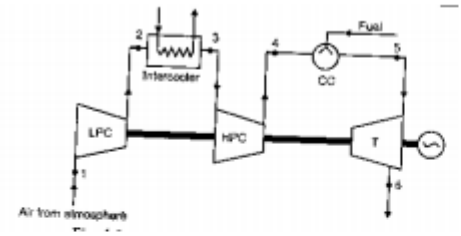


(b) Increasing the value of maximum cycle temp.

(c) Improving turbine efficiency by improving design.

3. Reducing compressor input: By

(a) Intercooling : Compressor work is reduced by intercooling the air between the compressor stages.



(b)By lowering inlet temp to compressor

(c) By increasing compressor efficiency

(d) Water injection at inlet to compressor

State the norms of Bharat stage III and IV

Bharat stage III and IV norms :

Petrol Emission Norms (All figures in g/km) Emission Norm CO HC NOx HC+NOx PM BS-III 2.30 0.20 0.15 --- --- BS-IV 1.00 0.10 0.08 --- --- Diesel Emission Norms (All figures in g/km) Emission Norm CO HC NOx HC+NOx PM BS-III 0.64 --- 0.50 0.56 0.05 BS-IV 0.50 --- 0.25 0.30 0.025

Explain battery ignition in S.I. engine.

Battery Ignition system : It consists of a battery of 6 or 12 volts, ignition switch, induction coil, condenser, distributor and a circuit breaker. One terminal of battery is ground to the frame of the engine and other is connected through the ignition switch to one primary terminal of the ignition coil . The other terminal is connected to one end of contact points of the circuit breaker. To start with the ignition switch is made on and the engine is cranked. The contacts touch, the current flows from battery through the switch.

Explain the process of combustion in diesel engine.

Combustion in CI Engines :The combustion in CI engines is taking place in following stages as shown in figure 1. Ignition delay period: During this period, some fuel has been admitted but not yet ignited. The delay period is a sort of preparatory phase. It is counted from the start of injection to the point where P-ɵ curve separates from air compression curve. 2. Rapid or uncontrolled combustion : In this stage , the pressure rises rapid because during the delay period the fuel droplets have time to spray and have fresh air around them.

What is scavenging in I.C. engine ? State its types.

Scavenging :

In two stroke engines , at the end of expansion stroke, combustion chamber is full of products of combustion. This is due to elimination of

exhaust stroke like in four stroke engine. Scavenging is the process of clearing the cylinder after the expansion stroke. This is done short duration of time available between end of expansion and start of charging process. Types of scavenging : 1. Uniflow scavenging process 2. Cross scavenging process 3. Loop or reverse scavenging process

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Name four sensors used in I.C. engine and explain working of any one.

Sensor used in IC engines (Explanation of any one)

A sensor is an input device that provides variable information on an engine function. Examples of sensors include the airflow sensor (AFS), crank angle sensor (CAS), throttle potentiometer sensor (TPS) etc, and these provide data on load, rpm, temperature, throttle opening etc. This data is signaled to the ECM, which then analyses the results and computes an output signal. The output signal is used to actuate an n output device.

Define i) Humidity ratio, ii) Specific humidity

Specific humidity : It is defined as the ratio of mass of vapor to the mass of dry air in a given sample of moist air . It is denoted by ω

$$\text{Specific humidity} = \frac{\text{Mass of water vapour in mixture}}{\text{Mass of dry air in mixture}}$$

Compare closed cycle and open cycle gas turbine.

Open cycle and closed cycle gas turbines Any four differences

Sr.no	Factors	Open cycle gas turbine	Closed cycle gas turbine
1.	**Pressure**	Lesser pressure	Higher pressure
2.	**Size of the plant for given output**	Larger size	Reduced size
3.	**Output**	Lesser output	Greater output
4.	**Corrosion of turbine blades**	Corrosion takes place due to contaminated gases	No corrosion since there is indirect heating.
5.	**Working medium**	Loss of working medium	No loss of working medium.
6.	**Filtration of incoming air**	It may cause severe problem.	No filtration of air is required.
7.	**Part load efficiency**	Less part load efficiency	More part load efficiency
8.	**Thermal efficiency**	Less thermal efficiency	More thermal efficiency
9.	**Requirement of cooling water**	No Requirement of cooling water	Larger amount of cooling water required
10.	**Weight of system for given power**	Less	More
11.	**Response to the changing load**	Good response	Poor response
12.	**Fluid friction**	More Fluid friction	Less Fluid friction

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List any four pollutants in exhaust gases of I.C. engine with their effects.

The major air pollutants emitted by petrol & diesel engines are CO2, CO, HC, NOx, SO2, smoke & lead vapour. Effect of CO: Carbon

monoxide combines with hemoglobin forming carboy hemoglobin ,which reduces oxygen carrying capacity of blood. This leads to laziness, exhaustion of body & headache. Prolong exposure can even leads to death. It also affects cardiovascular system, thereby causing heart problem Effect of CO2: Causes respiratory disorder & suffocation.

A four stroke gas engine has a cylinder diameter of 25 cm and stroke 45 cm…

Gas pressure

$= 750 + \frac{136}{13.6} = 760$ mm of Hg

$= \frac{760}{750} = 1.0133$ bar

Let subscript 1 refer to gas condition

& 2 to NTP (1.013 bar, 0°C)

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{1.013 \times 7.5}{290} = \frac{1.013 \times V_2}{273}$$

$V_2 = 7.06 m^3$ in 40 min

Gas supplied/min $= \frac{7.06}{40} = 0.1765 m^3/min$

Heat supplied $= m_f \times C.V.$

$= 0.1765 \times 19 \times 10^3$

$= 3353.5$ KJ/min (100%)

B.P. $= 2\pi NT$

$= 2\pi \left(\frac{8080}{40}\right) \times 90 \times 9.81 \times \frac{1.6}{2}$

$= 896.82$ KJ/min (26.7%)

Heat lost to cooling water $= m C_p (T_2 - T_1)$

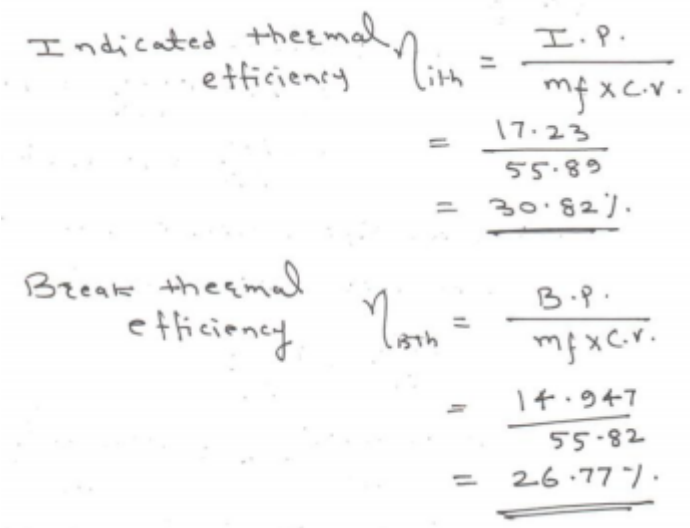
$= \frac{180}{40} \times 4.1868 \times 45$

$= 847.82$ KJ/min (25.28%)

Heat unaccounted

$= 3353.5 - (896.8 + 847.82)$

$= 1608.88$ KJ/min (48%)



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