
Explain with neat sketch construction and working of constant volume gas turbine.

Constant volume gas turbine Working:- Air from surrounding atmosphere is drawn in compressor and is compressed to a pressure of about 3 kN/m2 . The compressed air is then admitted to the combustion chamber through the inlet valve. When inlet valve is closed, the fuel oil is admitted by means of a separate fuel pump into combustion chamber containing compressed air. The mixture (of air and fuel oil) is then ignited by an electric spark, the pressure rising to about 12 kN/m2 , whilst the volume remains constant. Thus combustion takes place at constant volume.

A single cylinder reciprocating compressor has a bore of 120 mm and a stroke of 150 mm...

$$\frac{P_2}{P_1} = \left(\frac{T_2}{T_1}\right)^{n/n-1}$$

$$P_2 = 1.2\left(\frac{488}{293}\right)^{\frac{1.3}{1.3-1}}$$

$$P_2 = 10.92 \text{ bar}$$

$$\text{Pressure Ratio} = \frac{P_2}{P_1} = 9.1$$

$$V_s = \frac{\pi}{4} d^2 l \times N$$

$$= \frac{\pi}{4} \times (0.12)^2 \times 0.15 \times \frac{1200}{60}$$

$$V_1 = 2.036 \text{ m}^3/\text{min}$$

$$\text{I.P.} = \frac{n}{n-1} P_1 V_1 \left(\left(\frac{P_2}{P_1}\right)^{n-1/n} - 1\right)$$

$$= \frac{1.3}{1.3-1} \times 1.2 \times 10^5 \times \frac{2.036}{60}\left[(9.1)^{\frac{1.3-1}{1.3}} - 1\right]$$

$$= 11.68 \text{ KW}$$

Shaft power when mech efficiency 80%.

$$\text{Shaft Power} = \frac{\text{I.P.}}{\eta_{mech}} = \frac{11.68}{0.8}$$

$$= 14.6 \text{ KW}$$

$$P_1 V_1 = m R T_1$$

$$m = \frac{P_1 V_1}{R T_1} = \frac{1.2 \times 10^5 \times 2.036}{287 \times 293}$$

$$= 2.9054 \text{ kg/min}$$

Explain with neat sketch construction and working of ice

plant.

Working of Ice plant: The main cycle used for ice plant is vapor compression cycle with ammonia as the refrigerant in primary circuit and brine solution in secondary circuit. Brine solution takes heat from water in secondary circuit and delivers the heat to ammonia in primary circuit. Thus, the indirect method of cooling is used in ice plant. In secondary circuit brine is cooled in evaporator and then it is circulated around the can which contains water. The heat is extracted from the water in the can and is given to the brine.

List the additives of lubricant used in S.I engine and state their advantages.

Additives (any six) (1) Detergents – To keep engine parts, such as piston and piston rings, clean & free from deposits. (2) Dispersants – To suspend & disperse material that could form varnishes, sludge etc that clog the engine. (3) Anti – wear – To give added strength & prevent wear of heavily loaded surfaces such as crank shaft rods & main bearings. (4) Corrosion inhibitors – To fight the rust wear caused by acids moisture. Protect vital steel & iron parts from rust & corrosion.

Define – (i) Indicated power, (ii) Mechanical efficiency, (iii) BSFC

i) Indicated Power (ip) is defined as the power developed by combustion of fuel in the cylinder of engine. It is always more than

brake power. ii) Mechanical efficiency : ηm : It is a measure of mechanical perfection of the engine or its ability to transmit power developed in the engine cylinder to the crank shaft . It is defined as the ratio of brake power to indicated power of the engine

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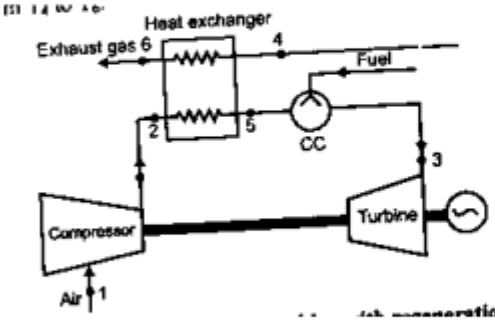
State different methods for improving thermal efficiency of gas turbine and explain any one.

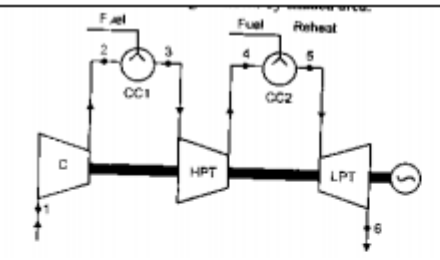
Methods to improve thermal efficiency of gas turbine [blurred] of any one – 2 marks)

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.

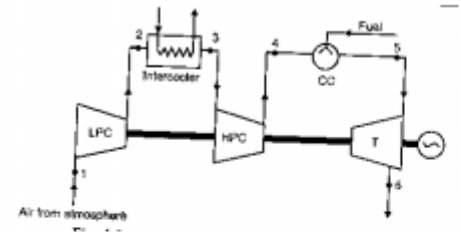


(b) Increasing the value of maximum cycle temp.

(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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