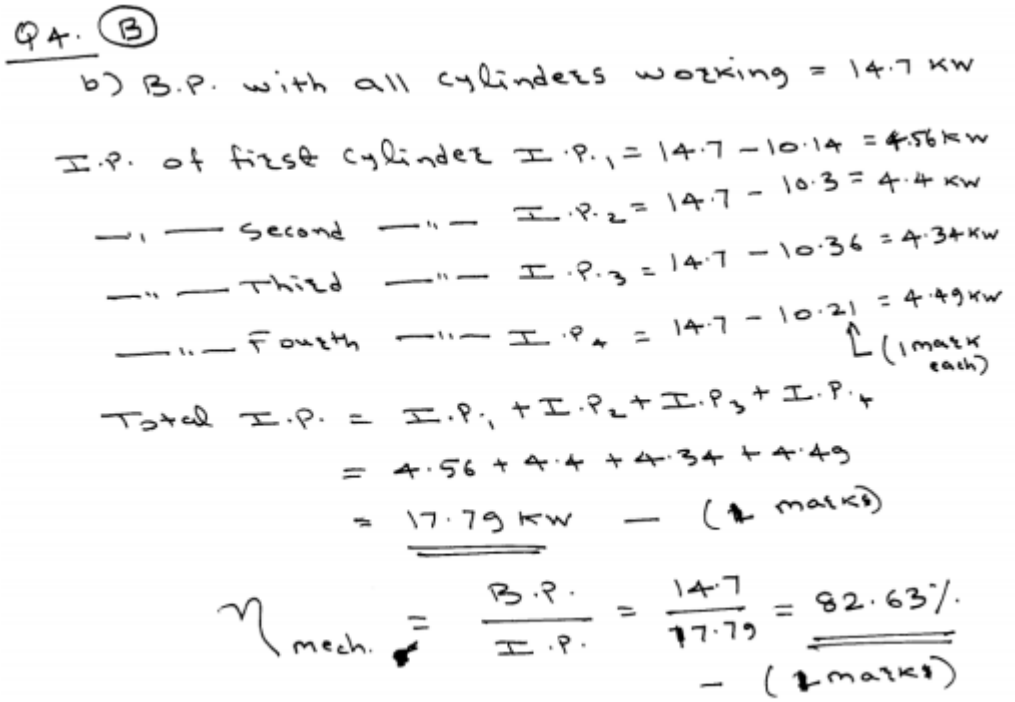
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State any four types of sensors used in I.C. engine.

Following sensors are used in ECU: A permanent magnet inductive signal generator is mounted in close proximity to the flywheel, where it radiates a magnetic field. As the flywheel spins and the pins are rotated in the magnetic field, an alternating (AC) waveform is delivered to the ECM to indicate speed of rotation.

The following data is collected during a trial of four stroke four cylinder petrol engine.



State advantages of closed cycle gas turbine.

Advantages of closed cycle gas turbine:

(i) It has higher thermal efficiency for the same minimum and maximum temperature limits and for the same pressure ratio.

(ii) Since the heating is external, any kind of fuel even solid fuel having low calorific value may be used.

(iii) There is no corrosion due to circulation of combustion product.

(iv) As the system is a closed one there is no loss of the working fluid.

(v) The size of the turbine will be smaller compared to an open cycle gas turbine of the same output.

Define : i) Mechanical efficiency ii) Volumetric efficiency related to I.C. engine.

i) Mechanical Efficiency- It is the ratio of the power available at the engine crankshaft (bp) to the power developed in the engine cylinder (ip).

ii) Volumetric efficiency :- It is the ratio of the actual volume of the charge admitted into the cylinder to the swept volume of the piston .

State effects of pollutants in exhaust gases of petrol engine.

The major air pollutants emitted by petrol 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.

1. This leads to laziness, exhaustion of body & headache. 2. Prolong exposure can even leads to death. 3. It also affects cardiovascular system, thereby causing heart problem

Effect of CO2: Causes respiratory disorder & suffocation.

Following observations were recorded during a trial on single cylinder four stroke oil engine

Q2 (a) Given,

$d = 15\,cm \quad l = 25\,cm \quad p_m = 7.35\,bar \quad N = 400\,r.p.m.$

$T = 225\,N.m \quad m_f = 3\,kg/hr \quad C.V. = 44,200\,kJ/kg$

$$b.p. = 2\pi NT$$
$$= 2\pi \times \frac{400}{60} \times 225$$
$$= \underline{9428.57\,W} = \underline{9.429\,KW} \quad -(2m)$$

$$I.p. = p_m \cdot L \cdot A \cdot \frac{N}{n} \quad n = 2 \text{ for four stroke}$$
$$= 7.35 \times 10^5 \times (0.25) \times \frac{\pi}{4} (0.15)^2 \times \frac{400}{2 \times 60}$$
$$= \underline{10828.12\,W} = \underline{10.828\,KW} \quad -(2m)$$

$$\eta_{mech} = \frac{b.p.}{I.p.} = \frac{9.429}{10.828} = \underline{87\%} \quad -(1m)$$

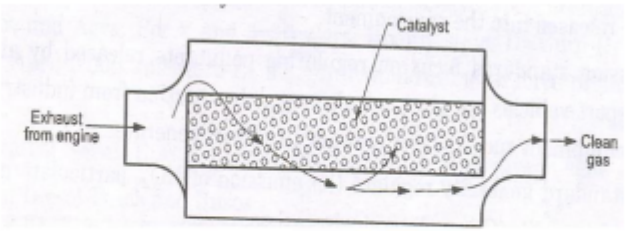
$$\eta_{BTh} = \frac{b.p.}{m_f \times C.V.} = \frac{9.429}{\frac{3}{3600} \times 44,200} \quad -(1m)$$

$$= \underline{25.6\%}$$

$$\eta_{Fith} = B.S.f.c. = \frac{m_f}{b.p.}$$
$$= \frac{3}{9.429}$$
$$= \underline{0.3182\,kg/kw\text{-}hr}$$
$$= \underline{318.2\,gm/kw\text{-}hr} \quad -(2m)$$

Explain with neat sketch working principle of any one type of catalytic converter.

Catalytic converter:



Catalytic converter is a device which converts harmful pollutants to harmless gases. Catalytic converter is used in exhaust emission in control system to convert CO, NO_x, HC and other harmful gases to harmless gases.

A Catalytic converter consists of a cylindrical unit of small size like a small silencer and is installed into the exhaust system of a vehicle. It is placed between the exhaust manifold and the silencer.

Inside the cylindrical tube i.e. converter there is a honey comb structure of a 'ceramic or metal' which is coated with 'alumina base' material and there after a second coating of precious metals 'platinum, palladium or rhodium' or combination of the same. This second coating serves as a catalyst. A catalyst is a substance which causes a chemical reaction intro the gases. When the exhaust gases pass over the converter substance, the toxic gases as CO, HC & NO_x are converted into harmless gases as CO_2, H_2 & N_2.

State different methods of determining frictional power of I.C. engine and explain any one method

Methods to determine the frictional power of I.C. engine are`

1. Willan's line method 2. Morse test 3. Motoring test 4. Difference between i.p. and b.p.

Explanation of any one method

Define :

i) Brake thermal efficiency – It is defined as the ratio of heat

equivalent to brake power per unit time to the heat supplied to the engine per unit time Brake thermal efficiency = B.P./ mf x C.V.

ii) BSFC – It is the mass of fuel required to develop 1 kW brake power for a period of one hour. It is inversely proportional to the brake thermal efficiency. BSFC = Mass of fuel consumed in kg/hr / Brake power in kW

List out different pollutants in exhaust gases of petrol and diesel engine.....

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.

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