
1- A four-cylinder SI engine with a compression ratio $r_c = 10$ operates on an air-standard Otto cycle at 3000 RPM using ethyl alcohol(C_2H_6O) as fuel. Conditions in the cylinders at the start of the compression stroke are 60°C and 101 kPa. and piston pore is 200 mm and stroke 250 mm. and volumetric efficiency is 89 % and mechanical efficiency is 80 %, Write the balanced stoichiometric chemical equation for this fuel.
Calculate:
(a) AF if the engine operates at an equivalence ratio ¢ = 1.10.
(b) Peak temperature in cycle of part (a). [C]
(c) Peak pressure in cycle of part (a). [kPa]
(d)Thermal power if QHV=44KJ/kg
(h) indicate power.
(f) mechanical power

2- Isooctane(C_8H_{18}) is burned with air in an engine at an equivalence ratio of 0.8333. and piston pore is 300 mm and stroke 250 mm. and volumetric efficiency is 89 % and mechanical efficiency is 80 %, Assuming complete combustion, write the balanced chemical reaction equation.
Calculate:
(a) Air-fuel ratio.
(b) How much excess air is used [%]
(c) and if this engine develops 180 Hp and (mass flow rate of air) =1L/sec

3- Find out the speed at which a four-cylinder engine using natural gas can develop a brake power of 50 kW working under following conditions. Air-gas ratio 9: 1, calorific value of the fuel= 34 MJ/m 3 , Compression ratio 9:1, volumetric efficiency = 70%, indicated thermal efficiency = 35% and the mechanical efficiency = 80% and the total volume of the engine is 2 liters.

4-A four-stroke, four-cylinder diesel engine running at 2000 rpm develops 60 kW. Brake thermal efficiency is 30% and calorific value of fuel (CV) is 42 MJ/kg. Engine has a bore of 120 mm and stroke of 100 mm. Take air density = 1.15 kg/m^3, air-fuel ratio = 15:1 and mechanical efficiency = 0.8.
Calculate
(i) fuel consumption (kg/s);
(ii) air consumption (m3 /s); (iii) indicated thermal efficiency;
(iv) volumetric efficiency; (v) brake mean effective pressure and (vi) mean piston speed

5- A single-cylinder, four-stroke hydrogen fueled spark-ignition engine delivers a brake power of 20 kW at 6000 rpm. The air gas ratio is 8:1 and the calorific value of fuel is 11000 kJ/m 3. The compression ratio is 8: 1. If volumetric efficiency is 70%, indicated thermal efficiency is 33% and the mechanical efficiency is 90%, calculate the cubic capacity of the engine.

6- The indicated thermal efficiency of four-stroke engine is 32% and its. mechanical efficiency is 78%. the fuel consumption rate is 20 kg/h running at a fixed speed. The brake mean pressure developed is 6 bar and the mean piston speed is 12 m/s. Assuming it to be a single cylinder square engine, calculate the crank radius and the speed of the engine. Take CV = 42000 kJ/kg.

7- An engine used for pumping water develops a brake power of 3.68 kW. Its indicated thermal efficiency is 30%, mechanical efficiency is 80%, calorific value of the fuel is 42,000 kJ /kg and its specific gravity = 0.875.
Calculate
(i} the fuel consumption of the engine in (a) kg/h (b) liters/h
(ii) indicated specific fuel consumption and (iii) brake specific fuel consumption.