**Benha University Shoubra Faculty of Engineering**

**Energy & Sustainable Energy Engineering**

**Fuel & Advanced Combustion Sheet No. (5)**

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1. The compression ratio of a single cylinder engine operating on diesel cycle is 15. Engine speed is 1000 r.p.m, cylinder diameter is 10 cm, fuel calorific value is 40000 kj/kg cycle maximum temp is 2500 ºC the pressure and temperature at the start of the cycle are 1 bar and 40 ºC .find engine fuel consumption (S/D=1.2).
2. The volumetric analysis of the dry exhaust gases in the manifold of four cylinder four stroke spark ignition engine as follow:-

CO2 11%, CO 6% , H2 2% , N2 81%

For this engine the relative efficiency 40% , brake power 16.2 kW, volumetric efficiency 75% at 1 bar and 300 K ,lower calorific value of the hydrocarbon fuel used 43000 kJ/kg ,mean piston speed 8m/sec. and compression ratio 5.7 .Calculate the cylinder diameter of this engine.

1. The diameter and stroke of four cylinder four stroke S.I. Engine are 75mm and 64mm respectively. If the volumetric efficiency of this engine is 80% at 1 bar and 300 K. The brake specific fuel consumption 374 grm. /kW hour at mean piston speed equals 5.3m/sec. If the dry volumetric analysis of the exhaust as follow:-

CO2  9.8%, O2 0.2%, CO 7.6%, N2  82.4%

Calculate the brake power produced assuming a hydrocarbon fuel used in this engine.

1. Four strokes, four cylinders S.I. Engine generated 29.5 kW at 2400 rpm. The air fuel ratio used 14.8 ,the compression ratio of the engine 5, mean piston speed 9.5 m/sec., lower calorific value of the fuel used 43500 kJ/kg ,relative efficiency 50% ,volumetric efficiency 77% (1bar,300 K),mechanical eff. 84%. Calculate the diameter and stroke of engine cylinder.
2. Four stroke, four cylinder compression ignition engine with diameter and stroke 127mm and 158 mm respectively working with compression ratio 15 and 1000 rpm. If the cut in this engine at 5% from the stroke and engine uses 50% excess air over the correct ratio. The fuel used (C.V=42700 kJ/kg.)consists of 85% C and 14%H2

It’s required to calculate the brake power, relative efficiency, if b.s.f.c=245grm/kWh and volumetric ɳ=72% at 1bar and 0oC .

1. The diameter and stroke of four stroke compression ignition engine are 265mm and 380mm. The engine running at 260rpm with compression ratio13.9 and the fuel injection stopped at 5.2% of expansion stroke. It is required to calculate indicated mean effective pressure and indicated power for this engine by assuming the combustion takes place at constant pressure and the compression and expansion strokes were completed according to the law PV1.3=C and the pressure and temperature at the beginning of compression stroke 1bar and 300K.
2. 4 cylinder, 4 stroke petrol engine operating on Otto cycle develops 34kW brake power at 2000 r.p.m . The compression ratio is 7. the pressure and temperature at the end of suction process are 1 bar and 60 OC, cycle maximum pressure is 60 bar, relative efficiency is 60%,mech efficiency is 85% and brake sp. Fuel consumption is 0.35 Kg/kW.hr

Calculate:-

a) The air fuel ratio used

b) Cylinder dimension if (S/D=1.25)

1. A 4 Stroke petrol engine operating on Otto cycle has following data:

Indicated power=40KW Engine speed=1800 r.p.m

Mech. Efficiency=85% Cycle relative efficiency=55%

Air fuel ratio = 15 Fuel calorific value= 40000 KJ/Kg

Brake specific fuel consumption =0.4 kg/kW.hr

Pressure and temperature at the start of compression=1 bar, 50ºC

Find the cycle maximum pressure and temperature.

1. A 4-cylinder 4 stroke petrol engine 7.5 cm bore, 8.75 cm stroke operates on Otto cycle and has a compression ratio of 6, relative efficiency of 55% .calculate the indicated thermal efficiency. When running at 2400 r.p.m. the engine develops a brake mean effective pressure, of 7 bar and uses 9 kg of fuel per hour having 44000 kJ/ kg. Calculate the brake thermal efficiency, mechanical efficiency and the specific fuel consumption.