$$\Rightarrow 22 = \frac{\text{air taken in kg/h}}{1.783 \text{ kg/h}}$$

$$\Rightarrow \text{air taken in kg/h} = 22 \times 1.783 \text{ kg/h}$$
$$= 39.226 \text{ kg/h}$$
$$= 39.23 \text{ kg/h}$$

10) A four cylinder, two stroke cycle petrol engine develops 30 kW brake power at 2500 rpm. The mean effective pressure on each piston is 8 bar and the mechanical efficiency is 80%. Calculate the diameter and stroke of each cylinder if the stroke to bore ratio is 1.5. Also calculate the brake specific fuel consumption of the engine, if brake thermal efficiency is 28%. The calorific value of the fuel is 44100 KJ/

Given:

$n = 4$
Two stroke cycle petrol engine
Brake power = 30 kW
$N = 2500$ rpm
Mean effective Pressure (P_m) = 8 bar = 8×10^5 N/m^2
Mechanical Efficiency = 80% = 0.8 (η_{mech})
Stroke to Bore Ratio = 1.5
Brake thermal efficiency (η_{th}) = 28% = 0.28
Calorific value of the fuel = 44100 KJ/kg

To find:

Diameter and stroke of each cylinder
Brake specific fuel consumption of the engine.

Soln:

$$\frac{\text{Stroke}}{\text{Bore}} = 1.5$$

$$\Rightarrow \text{Stroke} = 1.5 \times \text{Bore}$$

$\Rightarrow L = 1.5D$

$$\eta_{mech} = \frac{B.P}{I.P}$$

$$80\% = \frac{30}{I.P}$$

$$I.P = \frac{30}{80\%}$$

$$= \frac{30}{\frac{80}{100}} = \frac{30}{0.8}$$

$\Rightarrow I.P = 37.5\ KW$

$$I.P = \frac{P_m L A N n}{60}$$

$$\Rightarrow 37.5 \times 10^3 = \frac{8 \times 10^5 \times 1.5D \times \pi/4 (D)^2 \times 2500 \times 4}{60}$$

$$\Rightarrow D^3 = \frac{37.5 \times 10^3 \times 60}{8 \times 10^5 \times 1.5 \times \pi/4 \times 2500 \times 4}$$

$\Rightarrow D^3 = 2.387324146 \times 10^{-4}\ m^3$

$\Rightarrow D = \sqrt[3]{2.387324146 \times 10^{-4}}$

$= 0.062035025\ m = 62.03\ mm$

$= 62\ mm$

$L = 1.5 \times D$

$= 1.5 \times 62\ mm$

$= 93\ mm$

$$\eta_{6th} = \frac{3600 \times B.P}{mf \times C}$$

$$\Rightarrow 0.28 = \frac{3600 \times 30}{mf \times 44100}$$

$\Rightarrow 0.28 \times m_f \times 44100 = 3600 \times 30$

$\Rightarrow m_f = \frac{3600 \times 30}{44100 \times 0.28}$

$= 8.746 \text{ kg/h}$

Brake specific fuel consumption

$(BSFC) = \frac{m.f}{BP}$

$\Rightarrow BSFC = \frac{8.746}{30}$

$\Rightarrow BSFC = 0.29 \text{ kg/B.P/hr}$

$\therefore$ Diameter = 62 mm
Length = 93 mm
BSFC = 0.29 kg/B.P/hr.

5) A constant speed four stroke cycle compression-ignition engine has a bore of 100 mm, stroke 150 mm and runs at 450 rpm. The following data refer to a test on this engine:

Brake wheel diameter = 600 mm
Band thickness = 5 mm
Load on band = 210 N
Spring balance reading = 30 N
Area of indicator diagram = 62.5 mm
Spring scale = 1.1 bar per mm.
Specific fuel consumption = 0.3 kg/b.p/h
Calorific value of ~~wheel~~ fuel = 42,000 kJ/kg.

Calculate:
1. Mechanical efficiency
2. Indicated thermal efficiency