Engine Performance Calculations

1. Engine specifications

A single cylinder, 4-stroke SI engine has a stroke volume of 400 cm^3. The cylinder bore (D) is equal to the stroke (S) of the engine (S = D).

    i.   For a compression ratio of $\varepsilon = 10$ calculate values of D and S.

    ii.   Calculate compression volume (V_c) and clearance distance (x_c) .

    iii.   Calculate mean piston speed for an engine speed of n = 3000 [r.p.m.] .

    iv.   If combustion is completed at 45 ^{o}CA at n = 3000 [r.p.m.] calculate piston speed at that instant.
          Take connecting rod length as, l = 165 [mm] .

    v.   For the above conditions calculate distance of the piston from cylinder head in [mm] and total cylinder volume at that instant. Make assumptions for spark advance angle etc and obtain flame speed for those conditions. <u>Indicate your assumptions and</u> **discuss** <u>your results.</u>

2. Engine performance

Engine torque value is measured as 60 [Nm], at 2600 [r.p.m.] using a dynamometer.
Take mechanical efficiency as $\eta_m = 0.80$.

    i.   Calculate engine effective power and indicated power.

    ii.   Calculate mean effective pressure.

    iii.   Calculate frictional losses.

    iv.   Calculate power output.

3. Volumetric efficiency

Air/fuel ratio is given as , A/F = 14.6 and combustion efficiency is , $\eta_{comb} = 0.96$.
Calculate fuel flow rate , air flow rate, volumetric efficiency, and thermal efficiency.
Take air entering the cylinder at pressure and temperature values of 83 [kPa] and 52 ^{o}C respectively.
Lower heating value of the fuel is $Q_{hv} = 44000$ [kJ/kg].
Discuss <u>parameters effecting volumetric efficiency</u> and effect of volumetric efficiency on engine performance.

For any values not given above, make your own assumptions.