COURSE: EN 310 (IC ENGINE & COMBUSTION LAB)

EXPERIMENT-3

Objective:
To measure flame speed.

Theory:
In premixed flames, the fuel and oxidizer are homogeneously mixed before entering the reaction zone. Premixed flames have two fundamental properties namely adiabatic flame temperature and laminar flame velocity. Laminar flame velocity is the velocity with which a plane flame front moves normal to its surface through the un-burnt combustible gas.

Schematic Layout of Set Up:

Assumptions:
1. Composition of LPG: 50% Butane; 50% Propane.
2. Flame front is parallel to area cross-section of pipe.

Calculations:
Data Given:
Densities@25ºC and 1 bar: Butane: 2.44 kg/m^3, Propane: 1.83 kg/m^3, Air: 1.184 kg/m^3
Molecular weight: N=14, C=12, H=1, O=16

Data Calculated:
Density of LPG = _____ kg/m^3
1 mol LPG = _____ gm of LPG

Chemical Equations For Combustion Of LPG:

$$\left(0.5\times C_3H_8 + 0.5\times C_4H_{10}\right) + a\left(O_2 + 3.76N_2\right) = bCO_2 + cH_2O + dN_2$$

Balance the equation and find the values of a, b, c and d

$$\left(0.5\times C_3H_8 + 0.5\times C_4H_{10}\right) + \_\_\left(O_2 + 3.76N_2\right) = \_\_CO_2 + \_\_H_2O + \_\_N_2$$

Stoichiometric Air-Fuel ratio of LPG = Mass of air/Mass of fuel= _____
Observation Table:

Sr. No.	Flow meter reading (cm)		Length traveled by flame (m)	Time taken by flame to travel the length (sec)				Average Flame Speed*, m/s
	LPG	Air		T_1	T_2	T_3	$T_{avg.}$	
1								
2								
3								
4								

*Average Speed= Length traveled by flame/ Time taken by flame to travel the length

Results:

Sr. No.	Volume flow rate# (m^3/s)		Mass flow rate (kg/s)		Actual air fuel ratio	Equivalence ratio*	Flame Velocity, m/s
	LPG	Air	LPG	Air			
1							
2							
3							
4							

Use flow meter calibration chart available with lab TA

* Equivalence ratio = Stoichiometric Air-Fuel ratio / Actual Air-Fuel ratio

Sample Calculation:

Graphs:

1. Air fuel ratio Vs Average flame velocity
2. Equivalence ratio Vs Average flame velocity

CONCLUSIONS: