Spray Theory and Applications

Swayam Prabha Course Code – M57

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DEPARTMENT	Department of Mechanical Engineering
INSTITUTE	Indian Institute of Technology Madras
COURSE OUTLINE	This course covers the theory necessary to understand spray formation and evolution, as well as a host of spray applications. Topics include drop size distributions, breakup of liquid sheets and ligaments, drop formation and breakup, drop motion and the interaction between a spray and its surroundings, drop evaporation, nozzle internal fluid mechanics, external spray characteristics, nozzle performance, and experimental techniques relevant to these subjects. Applications this semester will include: Gas turbine engines Sprays for geo-engineering Internal combustion engine sprays and Use of non-traditional liquids in aero-propulsion and other systems.

COURSE DETAILS

S. No	Module ID/ Lecture ID	Lecture Title/Topic
1.	L1	Introduction to Sprays And Their Applications
2.	L2	Spatial Versus Temporal Sampling
3.	L3	Spatial vs Temporal Sampling Example Problem
4.	L4	Steady vs Unsteady Spray
5.	L5	Statistical Measures on Spray
6.	L6	Discussion on Pdf and Moments
7.	L7	Size Velocity Correlation
8.	L8	Discussion on Interfacial Tension

9.	**L9**	Introduction to Atomizers and Their Design - I
10.	**L10**	Introduction to Atomizers and Their Design - II
11.	**L11**	Simple Measurement Techniques
12.	**L12**	Selection of Atomizers
13.	**L13**	Spray Measurement Characteristics
14.	**L14**	Spray Measurements Techniques
15.	**L15**	Non-Intrusive Spray Measurements Techniques
16.	**L 16**	Non-Intrusive Spray Measurements Techniques.
17.	**L17**	Linear Stability Analysis – Introduction
18.	**L18**	Linear Stability Analysis- Kelvin-Helmhotz Instability - I
19.	**L19**	Linear Stability Analysis- Kelvin-Helmhotz Instability - II
20.	**L20**	Linear Stability Analysis- Kelvin-Helmhotz Instability - III
21.	**L21**	Linear Stability Analysis Procedure
22.	**L22**	Linear Stability Analysis - Cylindrial Jet Instability - I
23.	**L23**	Linear Stability Analysis - Cylindrial Jet Instability - II
24.	**L24**	Linear Stability Analysis - Planar Liquid Sheet Instability - I
25.	**L25**	Linear Stability Analysis - Planar Liquid Sheet Instability - II
26.	**L26**	Design Of Pressure Swirl Atomizer- I
27.	**L27**	Design Of Pressure Swirl Atomizer - II
28.	**L28**	Design Of Pressure Swirl Atomizer - III
29.	**L29**	Design Of Pressure Swirl Atomizer - IV
30.	**L30**	Secondary Atomization-Dimensionless Parameters
31.	**L31**	Secondary Atomization-Modes of Breakup - I
32.	**L32**	Secondary Atomization-Modes of Breakup - II

33.	**L33**	Multiphase Modelling
34.	**L34**	Multiphase Modelling
35.	**L35**	Multiphase Flow Modelling Basics
36.	**L36**	Multiphase Modelling – Selection of Model - I
37.	**L37**	Multiphase Modelling – Selection of Model - II
38.	**L38**	Multiphase Modelling - Governing Equations
39.	**L39**	Droplet Evaporation
40.	**L40**	Droplet Combustion
41.	**L41**	Spray Combustion

List of reference material/ books:

Atomization and Sprays, by A.H. Lefebvre (Hemisphere: New York, 1989. ISBN 0-89116-603-3)

Liquid Atomization, by L. Bayvel and Z. Orzechowski (Taylor and Francis: Washington DC, 1993. ISBN 0-89116-959-8).

Name and contact details of two referees for the course: