Combustion

Swayam Prabha Course Code – M60

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PROFESSOR'S NAME	Prof. S.R. Chakravarthy
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COURSE OUTLINE	Review of thermodynamics. Chemical kinetics. Mass transfer definitions: Fick's law. Equations of conservation of species mass, momentum, and energy; multi component diffusion equation. Schvab-Zel'dovich formulation. Rankine-Hugoniot relations. Laminar premixed flames: Flame speed, flammability limits, flame stabilization, ignition and quenching. Laminar diffusion flames: Burke-Schumann problem and droplet burning. Partially premixed flames. Introduction to turbulent flames: premixed and diffusion flames. Solid Propellant Combustion. Spray combustion. Detonations: ZND model. Combustion instabilities.

COURSE DETAILS

S. No	Module ID/ Lecture ID	Lecture Title/Topic
1.	Module1_L1	Introduction
2.	Module1_L2	Chemical Reactions, Heats of Reaction and Formation
3.	Module1_L3	Sensible Enthalpy and Adiabatic Flame Temperature
4.	Module1_L4	Dissociation of Products, Role of Pressure
5.	Module1_L5	Numerical Calculation of Adiabatic Flame

		Temperature, Chemical Kinetics - I
6.	**Module2_L6**	Chemical Kinetics - II
7.	**Module2_L7**	Equilibrium Reactions, Global Kinetics, Order of Reaction
8.	**Module2_L8**	Reduced Chemistry, Steady State Approximation
9.	**Module2_L9**	Steady State Approximation, Partial Equilibrium Approximation
10.	**Module2_L10**	Partial Equilibrium Approximation, Chemical Explosions
11.	**Module2_L11**	Combining Chemical and Thermal Processes - I
12.	**Module2_L12**	Combining Chemical and Thermal Processes - II
13.	**Module2_L13**	Combining Chemical and Thermal Processes - III
14.	**Module2_L14**	Combining Chemical and Thermal Processes - IV
15.	**Module3_L15**	Mass and Molar Diffusion, Fick's Law
16.	**Module4_L16**	Conservation Equations for Multi-Component Mixtures
17.	**Module4_L17**	Multi-Component Diffusion Equation
18.	**Module4_L18**	Multi-Component Momentum Equation
19.	**Module4_L19**	Energy Equation
20.	**Module4_L20**	One Dimensional Steady Flow
21.	**Module5_L21**	chvab-Zeldovich Formulation - I
22.	**Module5_L22**	Schvab-Zeldovich Formulation - II
23.	**Module6_L23**	Rankine-Hugoniot Relations - I
24.	**Module6_L24**	Rankine-Hugoniot Relations - II
25.	**Module6_L25**	Rankine-Hugoniot Relations - III
26.	**Module6_L26**	Velocity, Temperature and Entropy Variation along Hugoniot Curve
27.	**Module7_L27**	Laminar Premixed Flames
28.	**Module7_L28**	Laminar Premixed Flames - Corrections

29.	**Module7_L29**	Laminar Premixed Flames - Rigorous Analysis - I
30.	**Module7_L30**	Laminar Premixed Flames - Rigorous Analysis - II
31.	**Module7_L31**	Flame Speed Dependencies, G-Equation
32.	**Module7_L32**	Bunsen Burner - I
33.	**Module7_L33**	Bunsen Burner - II
34.	**Module7_L34**	Flame Stabilisation - I
35.	**Module7_L35**	Flame Stabilisation - II
36.	**Module7_L36**	Ignition
37.	**Module8_L37**	Burke-Schumann Problem - I
38.	**Module8_L38**	Burke-Schumann Problem - II
39.	**Module8_L39**	Burke-Schumann Problem - III
40.	**Module9_L40**	Flame Structure
41.	**Module9_L41**	Mixture Fraction Formulation - I
42.	**Module9_L42**	Mixture Fraction Formulation - II
43.	**Module10_L43**	Droplet Burning - I
44.	**Module10_L44**	Droplet Burning - II
45.	**Module10_L45**	Spray Combustion - I
46.	**Module10_L46**	pray Combustion - II
47.	**Module11_L47**	Turbulent Combustion - I
48.	**Module11_L48**	Turbulent Combustion - II
49.	**Module12_L49**	Combustion Instabilities
50.	**Module13_L50**	Detonations
51.	**Module13_L51**	Detonation Wave - ZND Structure

List of reference material/ books:

K. K. Kuo, Principles of Combustion, Second Edition.

Name and contact details of two referees for the course: