

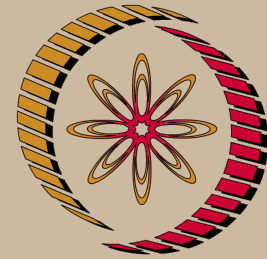
Fuel, furnace and Refractory - Web course

COURSE OUTLINE

- Conventional and newer sources of energy, Characterization of fuels: Analysis and calorific value with problems, Principles of conversion of fuels: Carbonization, Gasification and Hydrogenation, Principles of fuel combustion and Numerical problems.
- Classification of refractories and their service properties, Manufacture of common refractory like silica, alumina, fireclay, dolomite, magnesite.
- Types of furnaces and their role in high temperature applications, Fluid flow in furnaces: macroscopic energy balance and its application to Design of chimney and flow measuring devices
- Heat transfer in furnaces: Conduction, convection and radiation with suitable examples to design refractory lining, and heating of load through flame and convection.
- Flame temperature and heat utilization; concept of available heat and fuel consumption, Principles of waste heat recovery and design of heat exchangers and burners, Heat balance diagrams with illustrations, Fuel economy in industrial furnaces, Oxygen addition to combustion process, Energy efficient operation of furnaces with illustrations, Instrumentation and control in furnaces.
- Concept of carbon credit (carbon-offset) and its relation with energy efficiency.

COURSE DETAIL

Lecture No	Titles
Module – I	Fuels characterization and energy balance



NP-TEL

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<http://nptel.iitm.ac.in>

Metallurgy and Material Science

Pre-requisites:

- Thermodynamics course

Additional Reading:

1. R.Schumann: Met. Engg. Principles.
2. P.Mullinger and B. Jenkins: Industrial and Process furnaces.
3. Butts: Metallurgical Engg. Problems.

Coordinators:

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Lecture 1	Energy Resources and Environment
Lecture 2	Characterization of Fuels: Concepts
Lecture 3	Exercises on fuel characterization
Lecture 4	Production of Secondary Fuels-I : Carbonization
Lecture 5	Materials Balance in Coke-making
Lecture 6	Heat Balance and Clean Development Mechanism
Lecture 7	Production of Secondary Fuels-II: Gasification
Lecture 8	Materials and Heat Balance in Gasification
Module- II	Combustion and heat utilization
Lecture 9	Principles of combustion-I
Lecture 10	Principles of combustion-II
Lecture 11	Materials balance in combustion
Lecture 12	Flame Temperature : Concept
Lecture 13	Flame Temperature Calculations
Lecture 14	Refractory in Furnaces: Properties
Lecture 15	Refractory in Furnaces: Applications

Lecture 16	Furnace: Types and Classification
Lecture 17	Heat Utilization in furnaces
Lecture 18	Energy flow diagrams
Lecture 19	Heat Recovery Concepts
Lecture 20	Exercises on heat recovery
Module-III	Transport phenomena in furnaces
Lecture 21	Fluid Flow-I
Lecture 22	Fluid flow-II Macroscopic Energy BalanceI
Lecture 23	Fluid flow-III Macroscopic Energy Balance exercises
Lecture 24	Fluid flow-IV; Design of flow measuring devices
Lecture 25	Fluid flow-V Exercise on flow measuring design
Lecture 26	Fluid flow-VI Exercises on fluid flow measuring device
Lecture 27	Principles of Burner Design, Types of flame
Lecture 28	Heat transfer-I Conduction Heat transfer
Lecture 29	Heat transfer-II Refractory Design

Lecture 30	Heat transfer-III Convection and Radiation
Lecture 31	Heat transfer-IV Role of refractory surfaces
Module- IV	Heat transfer calculations, miscellaneous topics and carbon credit
Lecture 32	Steady Heat flows in Furnace and Heat Exchanger
Lecture 33	Exercises on Heat Flow in Furnaces and Heat Exchangers-I
Lecture 34	Exercises on Heat Flow in Furnaces and Heat Exchangers-II
Lecture 35	Miscellaneous Topics-I: Atmosphere in Furnaces
Lecture 36	Miscellaneous Topics-II: Temperature measurements
Lecture 37	Miscellaneous Topics-III: Pyrometry
Lecture 38	Miscellaneous topics-IV: Electric Resistance Heating
Lecture 39	Furnace efficiency, Fuel Saving
Lecture 40	Carbon Offset: Concepts and Exercises
Lecture 41	Self evaluations

References:

- As such no text book is available. Lectures will be prepared from different sources.

