Fuel and Combustion Technology - Web course

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Chemical Engineering

COURSE OUTLINE

Fuels and combustion technology course is required at various Indian universities and IITs as a part of the degree courses. This course is also useful to post graduate students, researchers, teachers and technical personnel. It may become a useful guide to industry. The course introduces basic knowledge about solid, liquid and gaseous fuels, their origin, classification, preparation procedure and characterization in terms of physico-chemical properties. In Solid fossil fuels coal is the main fuel which is focused here. Coal mining, cleaning and its combustion processes are the main feature of discussion in the section of Solid fuel. In Liquid fuel section, petroleum is the liquid fuel which is elaborated in terms of exploration, evaluation, distillation and secondary processing. Different important gaseous fuels are included in Gaseous fuel section. Emphasis is given to combustion of various fuels in the light of thermodynamics and various combustion appliances are discussed in Combustion technology section. Requisite mathematical examples with their step-wise solutions are also included in the course. Where ever required, concepts are illustrated with schematic and block diagrams.

Pre-requisites:

Operations management

Coordinators:

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SESSION PLAN:

Module No.	Topic	No of Sessions
1	INTRODUCTION	6
2	SOLID FOSSIL FUEL(COAL)	9
3	LIQUID FOSSIL FUEL(PETROLEUM)	10
4	GASEOUS FUELS	6
5	COMBUSTION TECHNOLOGY	9
	TOTAL HOURS	**40**

LECTURE PLAN:

Module	Learning units	Total Hours
1	1.1 History of Fuels 1.1.1 History of solid fuel 1.1.2 History of liquid fuels and gaseous fuels 1.2 Production, present scenario and consumption	2

	pattern of fuels 1.3 Fundamental definitions, properties and various measurements 1.3.1 Definitions and properties of solid fuels 1.3.2 Definitions and properties of liquid and gaseous fuels 1.3.3 Various measurement techniques	1 3
2	2.1 Coal classification, composition and basis 2. 2 Coal mining 2.3 Coal preparation and washing 2.4 Combustion of coal and coke making 2.4.1 Action of heat on different coal samples 2.4.2 Different types of coal combustion techniques 2.4.3 Coal tar distillation 2.5 Coal liquefaction 2.5.1 Direct liquefaction 2.5.2 Indirect liquefaction 2.6 Coal gasification	1 1 1 3 2 1
3	3.1 Exploration of crude petroleum 3.2 Evaluation of crude 3.3 Distillation 3.3.1 Atmospheric distillation 3.3.2 Vacuum distillation 3.4 Secondary processing 3.4.1 Cracking 3.4.1.1 Thermal cracking, Visbreaking 3.4.1.2 Coking 3.4.1.3 Catalytic cracking 3.4.3 Reforming of naphtha 3.4.4 Hydrotreatment, dewaxing, deasphalting 3.5 Refinery equipments	1 1 2 3 1 1 1
4	4.1 Natural gas and LPG 4.3 Producer gas 4.4 Water gas 4.4 Hydrogen 4.5 Acetylene 4.6 Other fuel gases	1 1 1 1 1 1
5	5.1 Fundamentals of thermochemistry 5.2 Combustion air calculation 5.3 Calculation of calorific value of fuels 5.4 Adiabatic flame temperature calculation 5.5 Mechanism and kinetics of combustion 5.6 Flame properties 5.7 Combustion burners 5.8 Combustion furnaces 5.9 Internal combustion engines	1 1 1 1 1 1 1 1 1
Total hours		**40**

References:

- Modern Petroleum Technology, Vol 1, Upstream, Ed. by Richard A. Dave, IP, 6th ed., John Wiley & Sons. Ltd.
- Modern Petroleum Technology, Vol 2, Downstream, Ed. by Alan G. Lucas, IP, 6th ed., John Wiley & Sons. Ltd.
- Combustion, Irvin Glassman, 2nd ed., Academic Press.
- Modern Petroleum Refining Processes, B.K. Bhaskar Rao, 4th ed., Oxford & IBH Publishing Co. Pvt. Ltd.
- Report on the project “Coal Combustion Study”, sponsored by Tata Tron and Steel Company Ltd., Jamshedpur.
- Fuels Combustion and Furnaces, John Griswold, Mc-Graw Hill Book Company Inc.
- Fuels and Combustion, Samir Sarkar, 3rd. ed Universities Press.
- Petroleum Refinery Engineering, W.L. Nelson, 4th ed. Mc-Graw Hill Book Company.