

Course Overview

Name of the Course:	Biomass to Biorefinery: Process Integration
Name of Instructor:	Dr. Anand Chakinala & Dr. Abhishek Sharma
Session:	Jan 2021
Language of Instruction:	English
Number of Contact Hours:	36
Credit Awarded:	03

Objective of course:	<ul style="list-style-type: none"> • Understand biomass characterization and conversion processes to useful products and in particular thermochemical routes such as gasification, combustion, and pyrolysis. • Choose a conversion process for biomass and be able to design a complete biomass conversion route, using the engineering approach making proper assumptions and basic research. • Carrying out mass and Energy balances over different conversion steps and the whole biomass conversion route. • Evaluate the conversion processes and routes using performance indicators like energy efficiency, fossil energy ratio (FER), land area/utility requirements and carbon emissions. • Determine the main dimensions of a biomass conversion reactor, by applying thermodynamics, heat and mass transfer and chemistry • Form their own opinion, based on facts and research, about the sustainability of the use of biomass for energy applications • Evaluate the chain analysis of the selected biomass conversion route considering the environmental impacts of bio-refineries.
-----------------------------	--

Syllabus

Introduction; Biomass Characterization; Conversion processes: biochemical and thermochemical; Thermo-chemical methods: Combustion, Gasification, Pyrolysis; Material and Energy Balances: process calculations and synthesis; Process Modelling and Simulation: Fundamentals, Case Studies; Process Development: Reactor, Separator and Heat Exchanger Design; Techno-economic Analysis: Overall plant design strategies, Case Studies.

Organization of the Course:

Total contact hrs 36		
1st week:	18 hrs (classes)	2 hrs (self-study/project) (Mid term exam/assessment/discussion)
2nd week:	18 hrs (classes)	2 hrs (End term exam)

Mode of lectures: online lecture/online videos/case study/ discussion/ workshop/ hands-on

Course Plan:

Lecture no.	Topic	Lecture mode	Instructor
L: 1- 6	Introduction and Biomass Characterization	Online	Dr. Anand Chakinala
L: 7–12	Conversion Processes: Biochemical and Thermochemical; Thermo-chemical methods: Combustion, Gasification, Pyrolysis	Online	Dr. Anand Chakinala
L: 13 – 18	Material and Energy Balances: Process calculations and synthesis	Online	Dr. Anand Chakinala
L: 19 – 24	Process Modelling and Simulation: Fundamentals, Case Studies	Online	Dr. Abhishek Sharma
L: 25 - 30	Process Development: Reactor, Separator and Heat Exchanger Design	Online	Dr. Abhishek Sharma
L:31-36	Techno-economic Analysis: Overall plant design strategies, Case Studies	Online	Dr. Abhishek Sharma

Course Instructor:
Dr. Anand G. Chakinala



Dr. Anand Gupta Chakinala is an Associate Professor of Chemical Engineering, School of Civil and Chemical Engineering (SCCE). He has a rich and versatile, research, industrial and teaching experience of several years. He started his career as a research assistant at the University of Abertay Dundee on an EPSRC funded project on Industrial Wastewater treatment using Advanced Fenton Process which led to several publications for which he was also awarded the MPhil by the University. He worked as a Research Engineer at Brownell Ltd., London jointly with the University of Reading on the development of novel continuous moisture removal technologies for large storage containers. After PhD at the University of Twente on Supercritical Water Gasification of Biomass he worked as Process Engineer at Veolia Water Solutions – Oil & Gas Division at Ede, The Netherlands where he worked on several international projects particularly related to produced water treatment. He later worked as an Oxo Process Development Engineer at ExxonMobil Chemical Europe Inc., at Brussels, Belgium. His areas of research interest includes Catalysis, reaction engineering, process plant design, industrial/produced water treatment and biofuels.

Course Instructor:
Dr. Abhishek Sharma



Dr. Abhishek Sharma is currently working as Professor in Department of Chemical Engineering in Manipal University Jaipur (MUJ). He is also holding Dr. Ramdas Pai Research Chair position in the Organization. He has over 13 years of experience in field of Process Engineering with research interests in waste valorization, alternate energy, and multi-scale processes. He has worked in Process Design and Development Department in Engineers India Limited after completing his Bachelor's in Chemical Engg. from Malaviya National Institute of Technology, Jaipur. He has achieved his PhD from Curtin University, Australia and worked for Australia-India Strategic Research Funding and Australia Research Council Projects. He has published several journal articles with conference and invited talks. He has provided consultancy to Industries such as Saint Gobain and Price Waterhouse Coopers. He has established the



Chemical Engineering Department in MUJ as Founder Head and initiated MoU/NDAs with Universities/R&Ds/Industries to work collaboratively in certain areas of interest. He is a Life Member of IChE and Associate Member of IChemE.