CHEMICAL PROCESS INTENSIFICATION

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PRE-REQUISITES : B.E/M.Sc in Chemical Engineering

INTENDED AUDIENCE : Chemical, mechanical Engineering graduate/ Post graduate/ Research Scholar/ Scientist/ Academician/Industrial R&D

INDUSTRY SUPPORT : Industrial Research and Development Section of Chemical and Mechanical Engineering

COURSE OUTLINE :

This course covers the developments in a number of intensified technologies, with particular emphasis on their application in chemical processes. The course is intended to be a useful resource for practising engineers and chemists alike who are interested in applying intensified reactor and/or separator systems in chemical industries. It will provide a basic knowledge of chemical engineering principles and process intensification for chemists and engineers who may be unfamiliar with these concepts. It will be a valuable tool for chemical engineers who wish to fully apply their background in reaction and separation engineering to the design and implementation of green processing technologies based on process intensification principles. Students on undergraduate and postgraduate degree programmes which cover topics on advanced reactor designs, process intensification, will gain a better understanding of the practical applications in different areas.

ABOUT INSTRUCTOR :

Prof. Subrata Kumar Majumder is a Professor in the Chemical Engineering Department, IIT Guwahati, India. His research interests include multiphase flow and reactor development, hydrodynamics in multiphase flow, mineral processing, process intensifications and micro-nano bubble science and technology and its applications. He is a Fellow of the International Society for Research and Development, 8A Kapteinsvigein, London, UK. He is also a recipient of various honours and awards like: Editor, Journal of Chemical Engineering Research Studies, Guest editor, American Journal of Fluid Dynamics, published by Scientific & Academic Publishing Co., CA, 91731, USA, Editorial board member of Scientific Journal of Materials Science, IIME Award on beneficiation from Indian Institute of Mineral Engineers (IIME), Editorial board Member of the Journal of Science and Technology, Scientific and Academic Publishing, USA, Advisory board member of Excelling Tech Publishers (ETP), London, UK. He is a life member of Indian Institute of Chemical Engineers, Indian Institute of Mineral Engineers, member of Institute of Engineers (India), Member of Asia-Pacific Chemical, Biological & Environmental Engineering Society (PCBEE), senior member of International Association of Engineers (IAE), Japan. He authored four books, five book chapters, and has more than 80 publications in several reputed international journals. Presently he is working in the field of Microbubble science and technology and its applications in mineral beneficiation, food processing and arsenic, ammonia and dye removal and process intensifications by developing ejector-induced gas aided extraction process.

COURSE PLAN :

Week 1: Introduction on Process Intensification:

History, Philosophy and Concept, Principle Features, Strategies and domain based techniques **Week**

Week 2: Mechanism involved in the process intensification

Intensification by fluid flow process, Mechanism of Intensification by mixing, Intensification in Reactive system

Week 3: Role of Process intensification in sustainable development

Problems leading to sustainable development, Concept, Issues and Challenges, Strategies in process design

Week 4: Design Techniques for Process Intensifications

Scales and stages of process intensification, Methods and Tools for Achieving sustainable design, Multi-level Computer aided tools

Week 5: Stochastic Optimization for Process Intensification

Introduction on Stochastic Optimization, Optimization Algorithms, Applications of Optimization Algorithms

Week 6: Process intensification by cavitation

Introduction and Mechanism of Cavitation-based PI, Cavitational Reactor Configurations and activity, Parametric effects on cavitation

Week 7: Process Intensification by monolith reactor

Introduction of monolith reactor, Preparation of monolithic catalyst, Application of monolithic catalyst, Hydrodynamics, transport of monolithic reactor

Week 8: Interfacial area based PI

Overview of interfacial area based processes, Ejector induced downflow system for PI, Hydrodynamics and transport in downflow system,

Week 9: Process intensification in distillation

Introduction and Principles, Types of Intensified Distillation Units, Design of membrane-assisted distillation

Week 10:Process intensification in extraction

Introduction and Principles, Supercritical extraction for process intensification,

Week 11: Process intensification by membrane

Introduction to membrane and its principles, Membrane engineering in process intensification

Week 12: Micro Process Technology in process intensification

Introduction to microprocess technology, Process Intensification by Microreactors, Hydrodynamics and transport in microchannel based microreactor