MULTIPHASE FLOWS

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INTENDED AUDIENCE : Under Graduate and Post Graduate students, professional practitioner in the discipline of Chemical Engineering, Petroleum Engineering, Mechanical Engineering and Energy.

INDUSTRIES APPLICABLE TO : IOCL, BPCL, OIL, HPCL, ONGC

COURSE OUTLINE :
Multiphase flow reactors are critically important many industries like, chemical, petroleum, petrochemicals, food, pharmaceuticals etc. The performances of these reactors largely depend on the interactions of different phases involved. In this course basic of Multiphase flow along with different flow regime map and pressure drop, and volume fraction calculation will be covered. Further, the interaction between different phases at different scales will be discussed. Modelling methods used for multiphase flow reactors will be covered. Finally, different type of multiphase flow reactors will be introduced and their functioning, advantage and disadvantages and challenges along with future direction of research will be discussed.

ABOUT INSTRUCTOR :
Prof. Rajesh Kumar Upadhyay is serving as Associate Professor in the Department of Chemical Engineering at Indian Institute of Technology Guwahati. He has joined IIT Guwahati as an Assistant Professor in July 2010 after completing his PhD from IIT Delhi. During his PhD, he has worked on development of Radioactive particle tracking technique and implementation of the same on different multiphase flow reactors like gas-liquid, gas-solids and gas-liquid-solids system. He has taught Multiphase Flow in IIT Guwahati as an elective course to UG, PG and PhD students for four consecutive years.

COURSE PLAN :

Week - 1 Multiphase flow introduction, Fundamental definitions and terminology used

Week - 2 Flow-pattern map for fluid-fluid (gas-liquid and liquid-liquid) and flow regime map for fluid-solids flows

Week - 3 Pressure drop and Volume fraction calculation for Homogeneous regimes: Using momentum balance equation from equation of motion and empirical correlations

Week - 4 Pressure drop and Volume fraction calculation for Segregated/Separated regimes: Using equation of motion and empirical correlations.

Week - 5 Multiphase Interactions: Drag, lift, virtual mass force, Basset force, one way, two way, three-way and four-way coupling and mathematical formulation of the same.

Week - 6 Modelling Methods for Multiphase Flows: Mixture Model, Euler-Euler Model and Euler-Lagrangian Model

Week - 7 Measurement Techniques used in Multiphase Flows

Week - 8 Multiphase Reactors: Bubble Column, Packed Bed ,Fluidized Bed