



MULTIPHASE MICROFLUIDICS

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PREREQUISITES: A basic course in Fluid Mechanics

INTENDED AUDIENCE:

1. Postgraduate (M Tech and PhD) and final year undergraduate student from chemical, mechanical engineering disciplines.
2. Industry practitioners from chemical micro-processing, electronics cooling and biomedical industry Course is primarily a PG course but can be taken by third/final year students as well.

INDUSTRY SUPPORT: Thermax, General Electric, Syrris, Blacktrace/Dolomite

COURSE LAYOUT:

With the advancement in manufacturing technology in past few decades, the trend towards miniaturization has accelerated in several industries. In chemical process industries, the viability of compact heat exchangers, microreactors for process intensification is being explored because of small diffusion lengths, high interfacial area density and relatively safe operation. Most of these equipments involve multiphase flows and their design requires a fundamental understanding of heat, mass and momentum transport in multiphase flow in microchannels. This course is aimed at introducing the students with the fundamental principles as well as recent developments in the area of multiphase flow at the small scale.

ABOUT INSTRUCTOR:

Prof. Raghvendra Gupta is an Associate Professor in the Department of Chemical Engineering at Indian Institute of Technology Guwahati. He teaches courses related transport processes and fluid mechanics at IIT Guwahati. His research interests are based around understanding complex transport processes in chemical and biological systems using a combination of theoretical, numerical and experimental techniques.

COURSE PLAN:

Week 1: Introduction: Motivation, applications, definitions, size effects

Week 2: Interfacial Phenomena: Capillarity, wetting and dewetting behavior, Contact line dynamics

Week 3: Gas liquid and liquid-liquid flow in microchannels: Flow regimes; pressure drop and phase distribution

Week 4: Transport processes in Taylor Flow in microchannels

Week 5: Bubble and droplet generation; annular and slug-annular flow regimes

Week 6: Gas-solid flow in microchannels; Inertial microfluidics; multiphase microreactors

Week 7: Condensation, evaporation and boiling in microchannels

Week 8: Experimental and computational techniques to study multiphase flow in microchannels