

Course Overview

This short course will focus on computational simulations of fluid dynamics, mass transfer and chemical reactions in biological systems including the cardiovascular system, thrombus formation and lysis and drug transport in solid tumors. The ability to model such flows is crucial in understanding disease mechanisms and planning clinical interventions, such as thrombolysis or chemotherapy.

Modern medical imaging techniques provide patient-specific data that allow realistic modelling of these biological systems. Computational tools are now integral to diagnosis, surgical planning and predicting treatment outcomes. This course will demonstrate cutting-edge research applications in haemodynamics, thrombosis, thrombolysis and nanoparticle-based drug delivery using multi-scale and multi-physics models.

Course Content

Day 1 - Fundamentals of Biofluid Mechanics and Biotransport

- Intro to governing equations for biological fluids
- Rheology of blood, tissue permeability, compliance
- Clinical case-based examples
- Q&A and discussion

Day 2 - Computational Haemodynamics

- Model formulation, boundary conditions, validation
- Patient-specific modelling using imaging data
- Case studies: Aorta dissections, aneurysms
- Q&A and discussion

Day 3 - Multiscale Modelling of Thrombosis and Thrombolysis

- Blood clot formation and lysis modelling
- Integration with pharmacological therapies
- Case studies and research examples
- Q&A and discussion

Day 4 - Nanoparticle Transport in Solid Tumours

- Multiphysics models of drug delivery
- Radiotherapy enhancement
- Thermosensitive carriers
- Case examples
- Q&A and discussion

Day 5 - Emerging Challenges and Lab

- Future directions and technical challenges
- CFD simulations using ANSYS Fluent
- Exam & feedback session

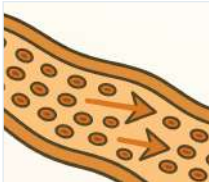
Course Objective

Understand the fundamentals of biofluid mechanics and mass transport.

- Learn to build physiologically relevant models of blood flow and drug transport.
- Evaluate model assumptions, limitations and validation strategies.
- Apply multiscale and multiphysics modelling techniques to real-world clinical problems.
- Explore emerging challenges and interdisciplinary research opportunities.

Keywords

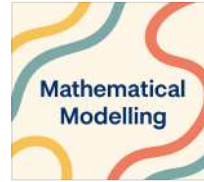
Hemodynamics



Thrombus



Modelling



Aneurysm



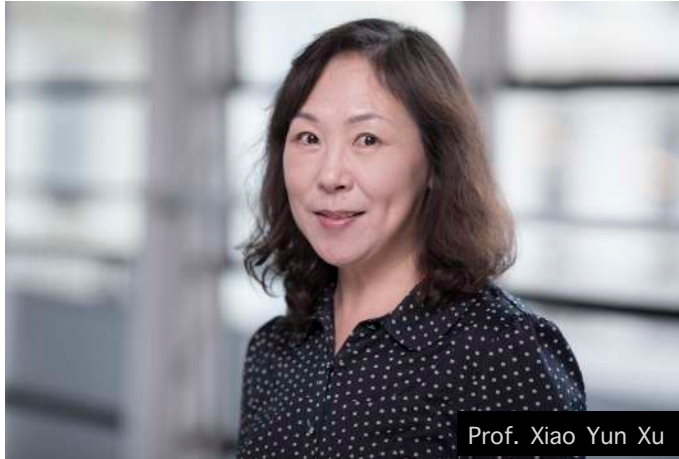
Drug Delivery



CFD Simulations



Teaching Faculty



Prof. Xiao Yun Xu

Prof. Xiao Yun Xu is a Professor of Biofluid Mechanics in the Department of Chemical Engineering at Imperial College London. With a Ph.D. in Mechanical Engineering from City University London, her research focuses on computational modeling of cardiovascular flows, thrombolysis and drug transport in biological systems.



Prof. Dhinakaran

Prof. Dhinakaran is an expert in Computational Fluid Dynamics and Heat Transfer. He is currently a Professor in the Department of Mechanical Engineering at IIT Indore. His research interests include Biofluid Mechanics and Bioheat Transfer.

About the Courses

- ★ Includes 2–3 hours of lectures daily for 5 days.
- ★ Includes a 2-hour lab demonstration at the end.
- ★ Includes an examination on the last day.
- ★ Course Grade sheet and participation certificate will be awarded on the last day of the course.

About Indore

Indore is located in Madhya Pradesh and is well connected to several tourist destinations such as Ujjain, Omkareshwar, Maheshwar, Mandu and others.



Maheshwar (Indore)

Examination & Certificate

- ★ An examination will be conducted on the last day.
- ★ A grade sheet and a certificate of participation will be provided.

Accommodation & Travel

- ★ IIT Indore is well-connected by rail, road and air.
- ★ **Nearest railway station:** Indore Junction
- ★ **Nearest airport:** Devi Ahilyabai Holkar Airport, Indore.
- ★ Accommodation will be arranged for registered participants on a first-come-first-served basis on the campus either in the Guest House or in the Hostel on payment basis.

About IIT INDORE

IIT Indore, established in 2009, is a premier engineering institute in Madhya Pradesh, ranked 14th in the NIRF 2023 Engineering category. Known for academic excellence, innovation and leadership development, its 500-acre campus fosters cutting-edge research and entrepreneurship.

Who should attend?

- ★ Students (B.Tech/M.Sc/M.Tech/Ph.D) and Faculty from Academic institutions.
- ★ Researchers and Engineers from Biomedical, Pharmaceutical and Healthcare industries.
- ★ Government R&D Professionals interested in Biomedical simulations.

Registration Fee

Who?	Fees
Students	Rs. 1,000
Faculty members (Pvt. Institutions)	Rs. 3,000
Faculty members (Govt. Institutions)	Rs. 10,000
Industry/R&D Organisation	Rs. 30,000
Foreign Participants	USD 500

Fee concession may be granted, if requested.

How to Register?

Email the course coordinator for registration

Contact Person: Prof. Dhinakaran Shanmugam

Email: sdhina@iiti.ac.in

Mobile/Whatsapp: [+91-9111-74-9191](tel:+91-9111-74-9191)

