



# Indian Institute of Technology Delhi

TEQIP-III Sponsored Short-Term Course

## MULTISCALE MODELLING AND SIMULATION

IIT Delhi Campus, New Delhi 7<sup>th</sup> – 11<sup>th</sup> December 2020



### About IIT Delhi

IIT Delhi is one of the oldest technological institutes in India. The institute has nearly 35 academic units that impart knowledge on Engineering, Science, Design, Social Science, among others. IIT Delhi has been instrumental in providing solutions to technological and societal problems through its academic and research activities. IIT Delhi has been consistently placed among top academic universities around the globe, and as per the recent QS University ranking, the institute stands at 61<sup>st</sup> in the list of Engineering and Technology domain. Recently, IIT Delhi has been elevated to the status of “Institution of Eminence” by Govt. of India.

### Scope of the Course

A plethora of physical processes have multiple scales embedded into the physics of the problem. It is virtually impossible to capture the transport processes over all these scales explicitly and simultaneously. Multiscale modelling approaches, in that respect, provide with more viable approaches for linking the transport phenomena occurring over the disparate length scales, by employing some suitable upscaling techniques.

The aim of this course is to introduce the multiscale modelling techniques through a guided series of lectures and hands-on lab sessions. The course will include lecture sessions on the basics of the multiscale modelling approach followed by live demo sessions where the participants can learn to implement some of the multiscale problems introduced during the lectures.

### Learning Outcomes

- Significance of multiscale modelling
- Theoretical and computational description of transport at various scales.
- Computational techniques for the numerical solution of problems at each scale.
- Principles of bridging the gaps between the scale for solving particular problems using homogenization-based upscaling technique.
- Demo activities, mathematical simulations and computational tools to provide a practical understanding of multiscale simulation.

### Course Contents

*Lectures:* Introduction to Multiscale modelling; Introduction to models at different length scales: Microscale simulation, Mesoscale simulation; Homogenization based upscaling technique to bridge different scales; multiscale modelling of diffusion equation; multiscale modelling of pressure-driven fluid flow in porous medium; Introduction to electrokinetic transport; multiscale modelling of electrokinetic transport in porous media.

*Demo session:* Models at different scales; Getting started with ANSYS FLUENT; Using UDF's in ANSYS FLUENT; Multiscale modelling of diffusion equation; Multiscale

modelling of fluid flow in porous media, Lattice Boltzmann Method, Molecular Dynamics Method.

### Course Coordinator

Prof. Debabrata Dasgupta, Department of Mechanical Engineering, IIT Delhi

### Course Faculty



**Prof. Debabrata Dasgupta**  
Dept of Mechanical Engg  
IIT Delhi  
New Delhi – 110016  
Ph: 011-2659 1034

[debabrata@mech.iitd.ac.in](mailto:debabrata@mech.iitd.ac.in)



**Prof. Subhra Datta**  
Dept of Mechanical Engg  
IIT Delhi  
New Delhi – 110016  
Ph: 011-2659 1054  
[subhra.datta@mech.iitd.ac.in](mailto:subhra.datta@mech.iitd.ac.in)



**Prof. Bahni Ray**  
Dept of Mechanical Engg  
IIT Delhi  
New Delhi – 110016  
Ph: 011-2659 6393

[bray@mech.iitd.ac.in](mailto:bray@mech.iitd.ac.in)

### Target Audience

The course is designed for faculty members at TEQIP-III institutes.

Participants (students, faculty members and industry employees) from non-TEQIP-III institutions are also welcome to register by paying fees.

### Registration

No registration fee for TEQIP-III participants. However, a refundable security deposit of ₹2,000, for completion of registration process is mandatory.

For the non-TEQIP-III participants' mandatory registration fee for participation as follows:

- INR 5,000/- + GST – Research Scholars
- INR 10,000/- + GST – Faculty
- INR 30,000/- + GST – Industry participants

Fee is payable online (via net banking) to the IIT Delhi CEP Account. Account Details here,

Account holder: **IITD CEP Account**

Account number: **36819334799**

Name of the Bank: **SBI, IIT Delhi**

IFS Code: **SBIN0001077**

SWIFT Code: **SBININBB547**

MICR Code: **110002156**

IITD PAN no.: **AAATI0393L**

GSTN: **07AAATI0393L1ZI**

### Important Dates

Deadline for registration: 31-October-2020

Confirmation of registration: 06-November-2020

Deadline for payment: 14-November-2020

# Registration Form

Please send a signed/sealed copy of this form as a PDF to [debabrata.dasgupta.iitd@gmail.com](mailto:debabrata.dasgupta.iitd@gmail.com)

## MULTISCALE MODELLING AND SIMULATION

(7th – 11th December 2020)

(Please fill the form using block letters)

**Name of applicant:** \_\_\_\_\_

**Designation:** \_\_\_\_\_

**Department:** \_\_\_\_\_

**Institute/Organization:** \_\_\_\_\_

**Address:** \_\_\_\_\_

AFFIX YOUR  
RECENT  
PASSPORT  
SIZE  
PHOTOGRAPH

**E-mail ID:** \_\_\_\_\_ **Mobile number:** \_\_\_\_\_

**Place:** \_\_\_\_\_

**Date:** \_\_\_\_\_

\_\_\_\_\_  
**Signature of applicant**(with date)

Dr./Prof./Ms/Mr \_\_\_\_\_ is faculty member / employee / research scholar of my organisation/institute and is permitted to attend the course on “**Multiscale Modelling and Simulation**” at IIT Delhi from 7th – 11th December 2020.

\_\_\_\_\_  
**Signature of Head** (with date & official seal)