

“Integrated Modelling of Subsurface Flow and Solute Transport in Porous Media – Challenges and Opportunities” Training Workshop

..... January 02 - 14, 2017 @ IIT Roorkee.....

Overview

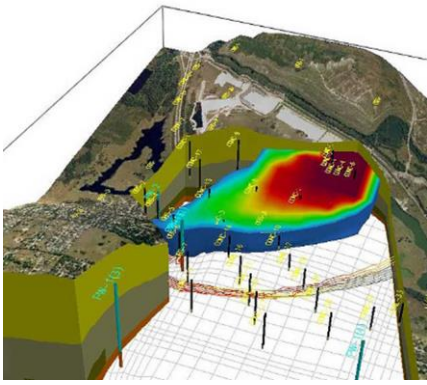
Increased extraction of the natural resources, without replenishment, and increased disposal of waste products, without proper treatment, could potentially result in detrimental impact on the surrounding environment. If unchecked this drastic impact on our environment could be potentially very harmful for future generations to come. It is, however, possible to reduce the impact of natural resource exploitation on surrounding environment by developing a sound understanding of the interactions of the natural resources through proper modelling/experimentations of subsurface flow and transport, and create guidelines/workflows/best-practices for appropriate remediation measures. The tools and technologies available for modelling flow and transport in porous medium have rapidly evolved in the last decade alone. Thanks to these advances in the technology, it is now possible to model subsurface flow and transport process rapidly and more accurately. But there is always a danger or pitfalls if the tools and technology are used incorrectly, sometimes blindly, or without a proper understanding how the tools/technology works. Unfortunately, advent of these tools have also results in increased focus, both in academia and industry, on using these tools rather than trying to understand the basic physics behind flow and transport modelling for appropriate use of these tools and technology. As a result a gap has been created between the use and the development of accurate tools and technology for modelling subsurface flows. This course is aimed at bridging this gap.

This course discusses the subsurface flow and solute transport processes in a porous media setting. The emphasis of the course is on integrated modelling of flow and transport processes and on numerical modelling aspects of the flow in porous media. The course will cover basics of flow and transport in subsurface porous medium. The course will give an in-depth knowledge of the numerical modelling of different subsurface flow and solute transport regimes through lecture and hand on exercises. The course will cover a variety of case studies and examples for different types of porous media flows. The course will also give its participants flavor of how to develop numerical tools for modelling flows and solute transport in porous medium. An exposure to state of the art tools available for modelling subsurface flows will also be provided during the course. The specific objectives of this course are to:

1. Develop a sound understanding of the fundamental of physical principles involved in modelling of flow and solute transport in porous medium.
2. Understand the challenges and opportunities, which exist in modelling subsurface flows and how integrated modelling could help in mitigating these challenges and opportunities in a better way.
3. Develop capabilities to correctly evaluate the results obtained using flow and solute transport modelling tools/technologies and also build capabilities to develop such tools on your own.

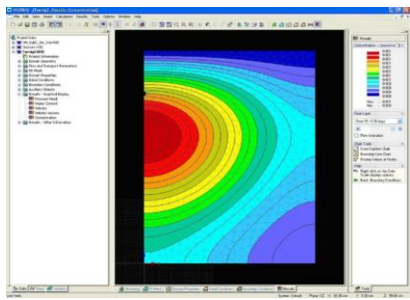
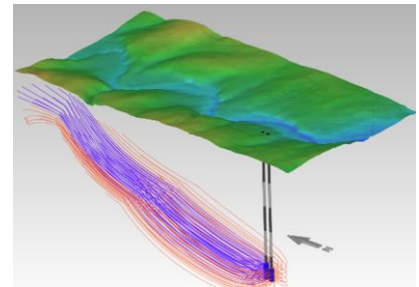
Modules	A: Duration : Jan 02 - Jan 14, 2017 B: Venue : Department of Hydrology, Indian Institute of Technology Roorkee Number of participants for the course will be limited.
You Should Attend If...	<ul style="list-style-type: none"> ▪ you are a student or faculty from academic institution dealing water related topics; ▪ you are a civil/agriculture engineer/geologist/environmentalist interested in water quantity and quality issues in subsurface systems; interested in modelling of moisture flow and solute transport. ▪ you are a person from industry/research organization and interested in learning about Subsurface flow and groundwater contamination modelling.
Fees	<p>The participation fees for taking the course is as follows: Participants from abroad : US \$400 Industry : ₹ 10000 Academic Institutions/Research Organizations: ₹ 5000 Research scholar/student: ₹3000</p> <p>The above fee include all instructional materials, computer use for tutorials and assignments, Laboratory equipment usage charges, free internet facility.</p> <p>The participants will be provided with accommodation on payment and availability basis. Total No of seats: 30</p>

Course module



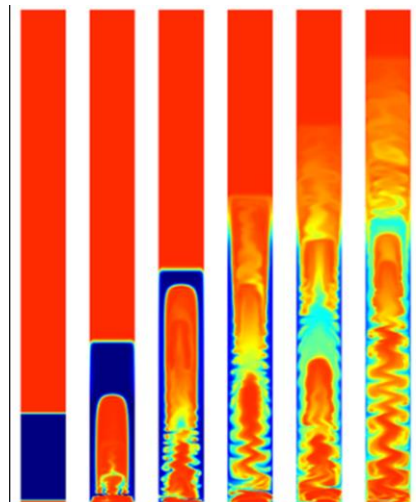
- Introduction to flow through porous medium; characterization of different types of porous medium and pollutants
- Introduction to hydrogeology; reservoir geology; main parameters controlling flow and transport in porous medium
- Equations governing basics of single phase-flow and solute transport in porous medium; review and derivations.

- Integrated flow modelling approach; integrating geological data, rock properties, flow equations; different integration models
- Need for improved understanding and numerical schemes involved in modelling subsurface flow; types of numerical models;
- Concepts of subsurface system analysis, discretization of governing equations; Simulation and optimization techniques



- Multi-phase flow and solute transport models; Dual porosity and permeability approaches
- Reservoir simulations, Interpretation of data; generating pseudo functions; discretization of multi-phase flow equations
- Matrix solution techniques, convergence criteria; numerical errors; Iterative techniques.

- Introduction to some numerical modelling tools; COMSOL, HYDRUS, MATLAB Tools, Open-source codes; capabilities and limitations of the tools;
- Importance of various initial and boundary conditions and their applications in numerical models; source and sink terms.
- Movement of light and dense non-aqueous phase liquids (NAPL); CO₂ sequestration
- Applied examples of developing numerical models for flow and transport under site specific environmental conditions



International Resource Person



Dr. Mayur Pal is currently Team Lead of Enhanced Oil Recovery Team at Maersk Oil Research and Technology Centre in Qatar. Mayur has more than a decade of industrial experience. Previously he has worked for major companies like Exxon and Shell. Mayur has published over 40 technical articles in international Journals and Conferences. Dr. Mayur Pal has also led a number of joint industry research projects between industry and major universities and institutes like,

University of Texas Austin, Heriott-Watt University, SINTEF Research Institute and Swansea University. He holds a PhD in Applied Reservoir Simulation from Swansea University, UK, Licentiate in Computational Fluid Dynamics from KTH-Stockholm, Masters in Applied Mathematics from KTH-Stockholm, Sweden and Bachelors in Civil Engineering from IIT Roorkee.

National Resource Person

Dr. Brijesh Kumar Yadav is an Associate Professor at Department of Hydrology, IIT Roorkee. He is an awardee of the prestigious Ramanujan Fellow by Government of India and has received many research and consultancy projects from various funding agencies.



Dr. Yadav received his B.E. in Agricultural Engineering from CTAE Udaipur and completed M.Tech. in Civil Engineering (Water Resources) from IIT Delhi. He started his doctoral work at IIT Delhi on "Mathematical Model of Phytoextraction for Contaminated Soils" and moved to UNESCO-IHE (Institute for Water Education) Delft, Netherlands and worked on his PhD research with the Pollution Prevention and Control group in the Environmental Resources Department for two years.

Then he moved to Utrecht University, Netherlands for his postdoctoral work with Environmental Hydrogeology group in Department of Earth Sciences. Subsequently, he worked at University of California, Davis from July-December 2010 on subsurface modeling. From January 2011- June 2012, Dr. Yadav was working as a Ramanujan fellow in Department of Civil Engineering at IIT Delhi before joining the faculty position at IIT Roorkee.

His current research focuses on multiphase flow modelling, soil water flow and solute transport analysis, Nonpoint source pollutant movement through deep and heterogeneous vadose zone, Phytoremediation of heavy metal polluted sites, Bioremediation of hydrocarbon polluted soil and groundwater resources, CO₂ sequestration in subsurface and risk analysis. Dr. Yadav has published more than 15 peer reviewed international journals and made about 30 presentations at various international conferences/workshops.

ABOUT ROORKEE

Roorkee is a part of the State of Uttarakhand and is located at the foothills of Himalayas. Roorkee Railway Station is on the main line of Northern Railways having direct links to Delhi, Mumbai, Calcutta, Amritsar, Jodhpur and Shri Ganga Nagar. The place is also within easy reach by road from Delhi (200 km) and Chandigarh (180 km). It is located on Delhi – Haridwar and Delhi – Dehradun bus routes.



Course Co-ordinator

Dr. Brijesh Kumar Yadav
Associate Professor

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Indian Institute of Technology Roorkee
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brijeshy@gmail.com

**Previous GIAN course
conducted by Co-ordinator**



**REGISTRATION AND
ACCOMODATION REQUEST FORM**
(To reach electronically by 15th Dec., 2016)

**Department of Hydrology, Indian Institute of Technology Roorkee
Roorkee, Uttarakhand**

Once selected, send the following registration form along with required DD to the following:

Dr. Brijesh Kumar Yadav, Department of Hydrology, IIT Roorkee Roorkee – 247 667 (Uttarakhand) Phone: (01332)284755, Fax: (01332) 2273560 Email: gian2016dohiitr@gmail.com, brijeshy@gmail.com	fix passport size photograph
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1. Name of applicant (in block letters): Ms./Mr.
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2. Designation
.....
- 3a. Residential address with pin code

Tel:
Mobile:
- 3b. Official address with pin code

Phone (Off.) Fax: Email:
Fax: Email:
- 3c. Name of the Institute where employed
- 3d. Name of the Department
4. Highest Academic Qualification
5. Branch of Specialization
6. Teaching Experience in Years
7. Needs of Accommodation: Yes/No
Types: AC Single/AC Double/Non-AC Single

Date:

Signature of applicant

Note:

- (i) The selected applications and DD must reach to the coordinator well before starting the course. Scanned copy should be sent by e-mail.
- (ii) Accommodation facilities will be provided inside the IIT Roorkee campus on payment and availability basis.
- (iii) Please come to Roorkee to attend the workshop, only if you have received intimation.