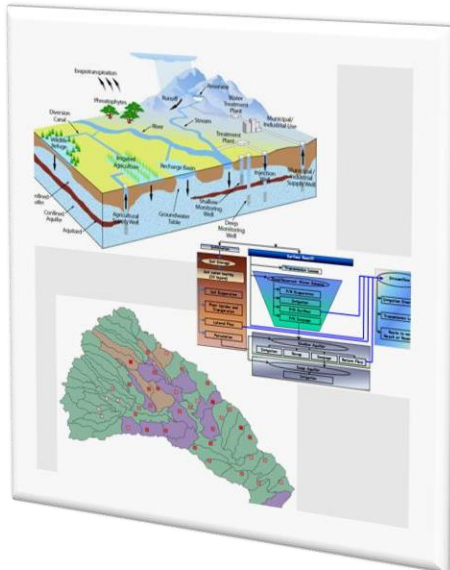


Training Course

On

HYDROLOGICAL MODELING: HEC-HMS, HEC-RAS AND MACHINE LEARNING (HyMHECMaL 2025)

March 24-28, 2025



Organized by

**NATIONAL INSTITUTE OF HYDROLOGY
ROORKEE-247667**

BACKGROUND

Water is the most essential natural resource for life and is likely to become a critical scarce resource in the coming decades due to continuous increase in population and the impacts of anthropogenic as well as climate changes. Therefore, it is important to manage our Water resources in a judicious and sustainable manner.

Hydrological modeling is required for an accurate assessment of the catchment response essential for optimum planning, development, operation and management of water resources. Modelling methods have been widely used over 50 years for a variety of hydrological processes. The development of models has gone hand-in-hand with developments in computing power. While event-based models originated in the 1930s and could be used with hand calculation, the first hydrological models for continuous simulation of rainfall-runoff processes emerged in the 1960s, when computing power was sufficient to represent all the land-phase processes in a simplified, 'conceptual' way. Later, in the 1970s and '80s, increases in power enabled 'physically-based' hydrological models to be developed, solving a coupled set of partial differential equations to represent overland, in-stream and subsurface flow and transport processes, together with evaporation from land and water surfaces. And currently, global climate models are able to represent the global hydrological cycle with simplified physics-based models.

Hydrological modeling tools such as HEC-HMS, HEC-RAS, and modern machine learning techniques play a pivotal role in understanding and managing complex water systems. HEC-HMS (Hydrologic Engineering Center - Hydrologic Modeling System) is widely used for simulating rainfall-runoff processes in dendritic watersheds, making it indispensable for flood forecasting, water availability studies, and climate change impact assessments. HEC-RAS (Hydrologic Engineering Center - River Analysis System) is a powerful tool for modeling water flow through natural and constructed channels, offering capabilities for 1D and 2D hydraulic computations, floodplain mapping, dam break analysis, and sediment transport studies. Complementing these tools, machine learning techniques such as Artificial Neural

Networks (ANN), Random Forests, and Long Short-Term Memory (LSTM) models enable data-driven analysis of hydrological processes, improving predictions of rainfall-runoff relationships, groundwater levels, and climate change impacts. This course provides participants with a comprehensive understanding of these methodologies, combining theory with hands-on training to address real-world challenges in water resource management.

COURSE CONTENTS

The specialized training course on "Hydrological Modeling: HEC-HMS, HEC-RAS and Machine Learning" will consist of lectures by Scientists and Professors with wide range of experience in the subject. Lectures will be followed by extensive hands-on sessions covering fifty percent of the total training period in virtual mode. The course material would not only be useful for the participants but also serve as a reference for practicing hydrologists and engineers. It is proposed to keep a two-way interaction throughout the training course so that there is a good sharing of field experiences, problems and their analysis/modelling solutions. Following topics shall be covered in this course:

- ◆ Water Resources Management Challenges
- ◆ Basics of Hydrological Modeling
- ◆ Hydro-meteorological Data: Requirements, Sources, and Downloading Techniques
- ◆ Evapotranspiration in Hydrological Modeling
- ◆ HEC-HMS: Overview and Applications, Data Preparation for HEC-HMS, Model Setup and Configuration
- ◆ Hands-on Exercises: Simulation, Optimization, and Result Analysis
- ◆ HEC-RAS: Overview and Applications, Data Preparation and Boundary Condition Setup, Model Setup for 1D and 2D Simulations
- ◆ Hands-on Exercises: 1D and 2D Analysis
- ◆ Introduction to Artificial Neural Networks (ANN)
- ◆ Recent Developments in Machine Learning: Random Forest and LSTM
- ◆ Hands-on: ANN, Random Forest, LSTM
- ◆ Climate Change Impact Assessment: Tools and Techniques

DATES AND VENUE

The training course will be held at **National Institute of Hydrology, Roorkee in a physical mode** during March 24-28, 2025.

PARTICIPATION

The course is intended for engineers, scientists and officers working in water resources/ irrigation and other related departments of Central/State Govt and those who are in academic profession. Post graduate and research scholars are encouraged to attend the course. Representatives of NGO's and other civil society groups can also participate. We expect participants to have keen interest in the analysis of hydro-meteorological and climate data as well as their use in modelling of various hydrological processes.

ABOUT NATIONAL INSTITUTE OF HYDROLOGY (NIH)

National Institute of Hydrology (NIH) is a premier Research and Development organization under the Department of Water Resources, River Development and Ganga Rejuvenation, Ministry of Jal Shakti, Government of India. It was established as an autonomous society in 1978 with its headquarters at Roorkee, Uttarakhand. The main objectives of NIH are to undertake, aid, promote and coordinate systematic and scientific work in all aspects of hydrology and water resources management. The Institute was declared a Science and Technology (S&T) organization in 1987.

The Institute is an ISO 9001:2008 Certificated organization. Over the years, the Institute has grown as a centre of excellence for pursuing research activities in hydrology and water resources with emphasis on technology transfer and demand driven, user-defined, strategic research. The research in the Institute has been carried out under six scientific divisions at the headquarters at Roorkee, five Regional Centres located at Belgaum, Jammu, Kakinada, Bhopal and Jodhpur and two Centres for Flood Management Studies at Guwahati and

Patna. The institute has well equipped laboratories like Remote Sensing Lab, Nuclear Hydrology Lab, and Water Quality Laboratories with state of the art equipment. The institute pursues capacity development by way of organizing specialized training courses. For more information about NIH, please visit www.nihroorkee.gov.in

REGISTRATION

The registration fee per participant is as follows:

NGO's and PSUs = INR 12,000/-
Govt. Employee = INR 11,000/-
PG Students/Research Scholar = INR 9,000/-

The fee includes a registration kit, working lunch, session teas, field visit, and certificate.

It is intended to register only a limited number of participants (25) for this training program on a first-come, first-served basis after the registration fees have been paid. **The participants will have to arrange TA/DA or any other expenditure from their parent organization/institute. The participants must carry laptops for hands-on. The Guest House facility of NIH Roorkee can be availed on a payment basis at nominal charges.** The interested participants are required to fill in the registration form online **latest by 28th Feb 2025 (along with registration Fee)**. An Institute/University identity card should be uploaded while submitting the application. If needed, the intending participants may contact the course coordinators for further information.

Fee Payment Details:

Account Name: NIH PROJECT
Account No: 4044 0001 0017 4852
Bank: PUNJAB NATIONAL BANK (PNB)
Branch: IIT ROORKEE
IFSC code: PUNB0404400
MICR Code: 247024103



Registration Link with QR code

<https://forms.gle/p5uth6wQQi5zoMJT8>

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All correspondence related to the course should be made with the course coordinator(s).