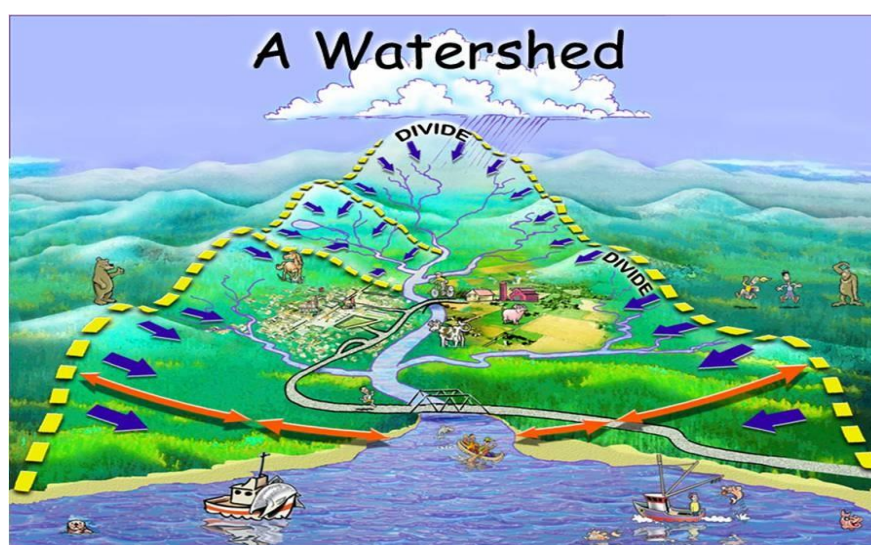


Five Days Training Course on
**TOOLS & TECHNIQUES FOR HYDROLOGICAL
INVESTIGATIONS**

(4 – 8th November, 2019 at NIH, Roorkee)

A BRIEF REPORT



Compiled by:
Dr. Santosh M. Pingale, Scientist-C
Sh. Rajeev Gupta, PRA



NATIONAL INSTITUTE OF HYDROLOGY
ROORKEE- 247667 (UTTARAKHAND)

Training Course Organisers

Director	Dr. Sharad Kumar Jain
Division	Hydrological Investigations Division
Divisional Head	Dr. Sudhir Kumar, Scientist-G
Course Coordinator	Dr. Santosh M. Pingale, Scientist-C

INTRODUCTION

Water, which covers approximately 70% of the Earth's surface, sustains plant and animal life, plays a key role in the formation of weather, and helps to shape the surface of the planet through erosion and other processes. India is one of the fastest growing economies in the World. The developmental activities are putting a lot of pressure on all the natural resources of the country. Water is no exception. There is a competition for utilization of water for power, irrigation, municipal, industrial, recreation, aesthetic and other uses. The overall impact is apparent in water conflicts. Accurate and reliable hydrological database is required for development of management plans. Further, changing LULC and climatic conditions are affecting both the quality and quantity of water. Hydrological Investigations are fundamental for assessing water resources and understanding the hydrological processes. Because the hydrologic cycle is so diverse, hydrologic measurement and analysis methods span many disciplines: including soils, oceanography, atmospheric science, geology, geophysics and limnology, and so on. Apart from the conventional techniques, now many new and advanced techniques and instruments are available for hydrological investigations worldwide. It is high time that the engineers, scientists, and professionals working in the field of water resources and hydrology start adopting these techniques to improve their capabilities. Among the latest techniques, application of environmental isotopes and remote sensing has increased dramatically. Isotope techniques can be used to measure groundwater recharge, pattern of sedimentation in water bodies, track pollution in groundwater, leakage and seepage from water bodies, measurement of hydrogeological parameters, origin and age of groundwater, surface water-groundwater interaction. Remote sensing and GIS techniques have become the backbone of all the hydrological investigations in the last 2-3 decades. These techniques are being widely used for mapping earth features from airborne sensors.

OBJECTIVES

To impart knowledge to the professionals (engineers, scientists, policymakers & academicians) of various governments, private organizations actively working in water resources and agencies concerned with hydrological investigations, water resources planning and management about:

- latest tools and techniques for hydrological investigations for sustainable water resources planning and management.
- developing strategies and action plans for water resources planning & management using the latest tools & techniques.

INAUGURATION

The five days training course was organised from 4 to 8th November, 2019 at NIH Roorkee. The inauguration function of the training course was organised on 4th November, 2019 at 9.30 AM. Dr. Sudhir Kumar, Sc-G & Head, HI division was the chief guest. The function was presided over by Dr. Santosh M. Pingale, Scientist-C & Course

Coordinator, HI Division, formally welcomed all the participants and briefly informed about the training course and its objectives.



PARTICIPATION

The course was intended for professionals (engineers, scientists, policymakers & academicians) of various governments, private organizations actively working in water resources and agencies concerned with hydrological investigations, water resources planning and management. Masters students and research scholars were encouraged to attend this course.

A total of 34 candidates attended the training course. It mostly included research scholars, consultants, and academicians. The participants belonged to different organizations of different scientific streams from India, Nepal, and Ethiopia. Participants from India were included from Delhi, Jharkhand, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Tamilnadu, Uttarakhand, and Uttar Pradesh. One participant was also included from Ghana (who is currently visiting research scholar in IIT, Roorkee) who deposited the fees on-line, however, did not eventually join the course. A list of participant is given in Annexure-I.



COURSE FEES

The training course was mostly funded from the Plan Grant of NIH. However, to support the expenses, some nominal course fee was kept as:

Govt. Employee	= Rs. 5,000/-
NGO's and PSUs	= Rs. 8,000/-
PG Students/Research Scholar	= Rs. 3,000/-

COURSE CONTENT AND FACULTY

The Training Course consisted of lectures by subject experts from the Indian Institute of Technology, Roorkee and National Institute of Hydrology, Roorkee. Efforts were made to cover the various theoretical and some practical aspects. Case studies carried out by both Institutes were included. A tutorial on streamflow modelling using Fuzzy Logic, Adaptive Neuro-Fuzzy Interference System (ANFIS) and Rainfall-Runoff Modelling Tool (RRMT) were included. The hands-on GIS and Remote Sensing as well as water and sediment yield estimation using Soil and Water Assessment Tool (SWAT) were conducted. Visit to Isotope Hydrology Laboratory, Meteorological Observatory, Soil Water Laboratory and Water Quality Laboratory and hands on in Water Quality Laboratory were organized. Most of the faculty of the training course were the senior scientist and Professor of the NIH and IIT Roorkee who have carried out studies on hydrological and geophysical investigations, hydrological modelling, groundwater modelling and water quality analysis for water resources planning and management over last 20-30 years.

The various lecture topics covered in the training course and the corresponding faculty are given in Annexure-II.

SCHEDULE

The duration of the training course was five days. The training courses included 16 lectures, 3 laboratory hands on sessions, 4 laboratory visits, 4 tutorial sessions, and one software demo session. A field visit to Hydraulic Structures on Ganga Canal, Pashulok Barrage, Rishikesh and River Ganga, Haridwar was also arranged on day 3rd. The detailed schedule of the training course is given at Annexure-II.

VIDEO SESSIONS

To make the training course interesting and informative, some video sessions related to water resources were added in between some lectures.

LECTURE MATERIAL

The lecture material/presentations were provided to the participants as softcopies in the pen drive.

FIELD VISIT

As mentioned above, a full day field visit to Pashulok Barrage, Rishikesh and River Ganga, Haridwar was organised on 6th November, 2019. During the field visit, the participants were provided field training on water quality sampling, depth water sampling, sediment core sampling, measurement of water level in hand pumps, isotope sample collection techniques at modelling Station, Bahadrabad, Pashulok Barrage, Rishikesh and Haridwar. Also, hydraulic structures like Aqueduct, Super Passage and Level Crossing showed on the way during field visit. Dr. S.M. Pingale, Sc-C, Sh. Rajeev

Gupta, PRA and Sh. Satya Prakash, MTS (T) HID provided the field training to the participants.



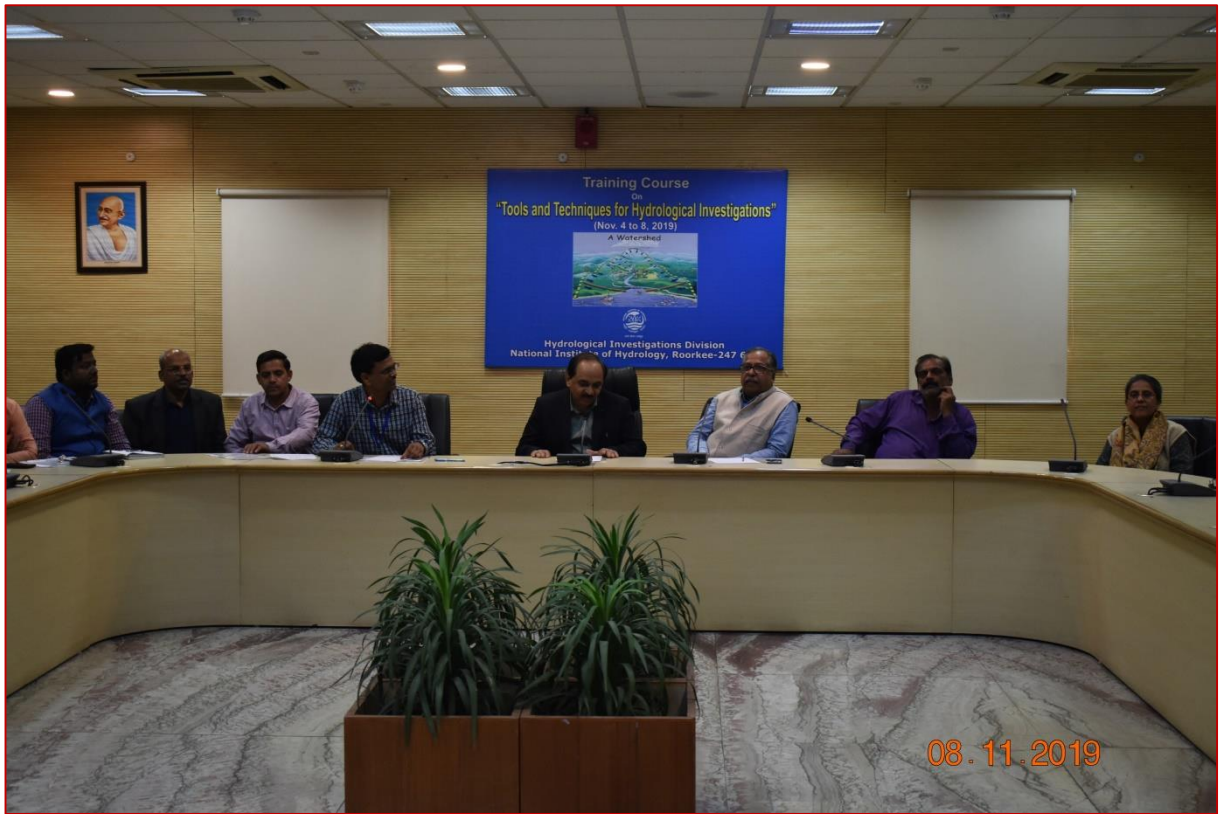


FEEDBACK FROM PARTICIPANTS

The organisation and management of the training course was highly appreciated by the participants. However, some of the participants expressed the need for more practical sessions, longer course duration, and to include more modelling contents, etc. A sample of the feedback received from the participant is enclosed in Annexure III.

VALEDICTORY FUNCTION & CERTIFICATE DISTRIBUTION

The valedictory function of the training course was held on 8th Nov., 2019 at 4.30 PM. In view of the 2nd International Conference on Sustainable Water Management organized by the Water Resource Department, Govt. of Maharashtra during November 6-8th, 2019, Director was on official tour to Pune. So, function was presided by Director-In charge Dr. Rakesh Kumar, Sc-G & Head, Surface Water Division. The Course Coordinator, Dr. S.M. Pingale, Sc-C, HID presented a brief report of the five days training course. During the valedictory function certificates were distributed to the participants by Dr. Rakesh Kumar, Director-Incharge. A sample of the certificate is enclosed in Annexure-IV.



08.11.2019



08.11.2019



08.11.2019



08.11.2019



08.11.2019

FINANCIAL ASPECTS

The total expenditure incurred on the training course was **Rs. 1,52,655/- (Rs. One Lakh Fifty Two Thousand Six Hundred Fifty Five Only)**. A brief break up of the expenditure is presented in the following Table 1:

Table 1 Total expenditure incurred.

SN	Item	Amount (Rs)
1.	Registration kits including bag, folders, pen, and pads	25808
2.	Hospitality including inaugural tea, valedictory tea, working lunch on 4 days and, sessions tea for 4 days	52069
3.	Mementos for faculty	8095
4.	Honorarium to faculty	21000
5.	Printing charges (banner, Group Photos, certificates and badges etc)	4264
6.	Field visit including BUS charges	18100
7.	Pen Drive for soft copies of lectures/presentations	18408
8.	Others & Miscellaneous expenses (stationery items, etc)	4911
TOTAL (Rs. One Lakh Fifty Two Thousand Six Hundred Fifty Five Only)		152655

No arrangement for picking up the participants on arrival and departure was made.

Funds Received

As per the approval obtained from the competent authority, the training course was to be financed from Plan Budget of NIH with some financial support through registration fees. Accordingly, an amount of Rs. 1,40,000/- (Rs. One Lakh Forty Thousand) was raised through registration fees of the training course.

Annexure-I

LIST OF PARTICIPANTS

S.N.	NAME	DESIGNATION	ORGANIZATION	CONTACT NO.	E-MAIL ID
1	Ms. AKHTAR JAHAN	Research Scholar	Earth Science Dept., IIT Roorkee	9451574715	jahanakhtar94@gmail.com
2	Ms. ANITA	Research Scholar	GBPUA&T, Pantnagar	9149207274	kohlianita52@gmail.com
3	Ms. ANURADHA	Research Scholar	University of Jammu, J&K	9599465894	anuradha080551990@gmail.com
4	Ms. ANUVA CHOWDHURY	Coordinator-Policy & Impact	Partners in Prosperity (PNP), Delhi	9830633368	anuva@pnpindia.org.in
5	Mr. AYANO HIRBO GELEBO	Research Scholar	IIT Roorkee	9997366810	ayanohirbo@gmail.com
6	Ms. AYUSHI TRIVEDI	Research Scholar	Jawaharlal Nehru Krishi Vishwa Vidyalyaya, Jabalpur	8989423769	ayushikhandwa@gmail.com
7	Mr. BHAGWAT SARAN	Research Scholar	GBPUA&T, Pantnagar	9760004342	saran.bhagwat007@gmail.com
8	Mr. DEBELA KASSAYE WANDIMAGEGN	M.Tech. Scholar	IIT Roorkee	7253928259	debelakassaye@gmail.com
9	Dr. MUKUND GANGADHAR SHINDE	Professor	Mahatma Phule Krishi Vidyapeeth, Rahuri	9403605979	mgshinde18@gmail.com
10	Dr. PRAVINCHANDRA GANGADHAR GAIKWAD	Associate Professor	Sardar Patel College of Engineering, Mumbai	9527310772	pvgiitr@gmail.com
11	Dr. VAIBHAV SOMNATH MALUNJKAR	Research Associate	MPKV Rahuri	9959193388	vaibhav.ss.malunjar@gmail.com
12	Mr. GUNANIDHI POKHREL	Hydrogeologist	ICIMOD, Nepal	+977-9813011432	pokhrel.gunanidhi@gmail.com
13	Mr. JAIDEEP PURUSHOTTAM YADAV	Research Scholar	D.Y. Patil Institute of Engineering & Technology, Pune	9552511057	jaideepyadav84@gmail.com
14	Mr. JAYESH MUKHERJEE	Research Scholar	Jawaharlal Nehru University, New Delhi	8981898905	jayesh26_ssf@jnu.ac.in
15	Mr. JOACHIM AYIWE ABUNGBA	Research Scholar	IIT Roorkee	9997372328	joachimayiwe@yahoo.com

16	Ms. KHALIDA PARVEEN	Research Scholar	University of Jammu, J&K	9602594479	piyushmalaviya@rediffmail.com
17	Mr. MADHAV PRASAD DHAKAL	Hydrological Analyst	ICIMOD, Nepal	+977-9841517663	Madhav.Dhakal@icimod.org
18	Mr. MANISH KHATRI	Consultant Hydrogeologist	M.K. Associates, Jabalpur	9425325422	mkassociates.2014@rediffmail.com
19	Mr. MANISH KUMAR	Research Scholar	GBPUA&T, Pantnagar	9661887794	manishcae2k11@gmail.com
20	Mr. MOHD USMAN KHAN	Research Scholar	Earth Science Dept., IIT Roorkee	8382813509	mkhan@es.iitr.ac.in
21	Ms. NEELAM BUNKAR	Research Scholar	Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur	7252033749	vermaneelam3110@gmail.com
22	Mr. P. MUTHUSAMY	Director & Consulting Geologist	Indogeo Consultancy Pvt Ltd	9786638763	p.muthusamy@indogeo.in
23	Mr. RAJAN SHRESTHA	M.Tech. Scholar	IIT Roorkee	9027255013	001rajmandu@gmail.com
24	Mr. S. SUNDARA MOORTHY	Consultant Geologist	Indogeo Consultancy Pvt. Ltd, Tamilnadu	9791082719	sundargeors@gmail.com
25	Mr. SAIF ALI	Research Scholar	Indraprastha Institute of Information Technology, Delhi	8800510821	saifa@iiitd.ac.in
26	Mr. SATYENDRA SINGH	M.Tech. Scholar	IIT Roorkee	9806405639	ssingh@wr.iitr.ac.in
27	Mr. SHOHRAT ALI	Research Scholar	Central University of Jharkhand	947202020742	shohrat.ali@cuja.ac.in
28	Mr. SOURAV CHOUDHARY	Research Scholar	IIT Roorkee	7845010723	sourav03325@gmail.com
29	Mr. SUBODH HANWAT	Research Scholar	BHU Varanasi	8878978835	subodh.hanwat@bhu.ac.in
30	Mr. SURYAKANT BAJIRAO TARATE	Research Scholar	GBPUA&T, Pantnagar	9922835018	taratesuryakant01@gmail.com
31	Mr. TANVEER ALI DAR	Research Scholar	Earth Science Dept., IIT Roorkee	7006253914	tanvirdar13@gmail.com
32	Mr. VIJAY TEEPARTHI	Scientist-B	NIH Regional Centre, Kakinada	9848465280	vijayt.nihr@gov.in
33	Mr. WALSE PARMESHWAR NARAYAN	M.Tech. Scholar	Savitribai Phule Pune University, Pune, Maharashtra	9960742028	parmeshwarwalse101@gmail.com
34	Mr. WONDIMU TADIWOS	Research Scholar	Hydrology dept., IIT Roorkee	7983323562	wonde721@gmail.com

(Note: Mr. Joachim Ayiwe Abungba at sr no. 15 paid the registration fees but did not eventually join the course)

TRAINING SCHEDULE**DAY 1: 4th November, 2019**

S. No.	TIME	ACTIVITY
1.	9:00 AM to 09:30 AM	REGISTRATION
2.	09:30 AM to 10:00 AM	INAUGURAL FUNCTION & INAUGURAL TEA
3.	10:00 AM to 11:00 AM	Hydrological Investigations and its need by Dr. Sudhir Kumar
4.	11:00 AM to 12:00 PM	Hydrological Modelling by Dr. Rakesh Kumar
5.	12:00 AM to 12:30 PM	SESSION TEA
6.	12:30 PM to 01:30 PM	Hydrological Investigations using Stable and Radio Isotopes by Dr.Sudhir Kumar
7.	01:30 PM to 02:30 PM	LUNCH
8.	02:30 PM to 03:30 PM	LAB VISIT to Isotope Laboratory by Dr. M.S.Rao
9.	03:30 PM to 04:00 PM	SESSION TEA
10.	04:00 PM to 5:00 PM	Introduction of Remote Sensing & GIS by Dr. S.M. Pingale
11.	05:00 PM to 06:00 PM	Demonstration and hands on Image Processing Software by Dr. S.M. Pingale

DAY 2: 5th November, 2019

S. No.	TIME	ACTIVITY
1.	9:00 AM to 10:00 AM	Geophysical Investigations by Prof. Mohammad Israil
2.	10:00 AM to 10:30 AM	SESSION TEA
3.	10:30 AM to 11:30 AM	Conjunctive use of surface water & groundwater by Prof. Deepak Khare
4.	11:30 AM to 12:30 PM	Catchment Area Treatment Measures/Techniques by Prof. Deepak Khare
5.	12:30 PM to 01:30 PM	LAB VISIT to Soil Water Laboratory by Mr. SL Srivastava
6.	01:30 PM to 02:30 PM	LUNCH
7.	02:30 PM to 03:30 PM	Demonstration of GIS software and hands on exercise by Dr. L.N. Thakural
8.	03:30 PM to 04:30 PM	
9.	04:30 PM to 5:00 PM	SESSION TEA
10.	05:00 PM to 06:00 PM	Isotope fingerprinting of precipitation for hydrological studies by Dr. M.S. Rao

DAY 3: 6th November, 2019

S. No.	TIME	ACTIVITY
1.	8:00 AM to 6:00 PM	FIELD VISIT-1 Demonstration of Water and Sediment Sampling for Water Quality & Isotope Analysis by Dr. S.M. Pingale, Sh. Rajiv Gupta and Sh. Satya Prakash FIELD VISIT-2 Aqueduct and different structures visit from Roorkee to Haridwar by Dr. S.M. Pingale, Sh. Rajiv Gupta and Sh. Satya Prakash

DAY 4: 7th November, 2019

S. No.	TIME	ACTIVITY
1.	9:00 AM to 10:00 AM	Groundwater modelling- Concept & modelling framework by Dr. Anupma Sharma
2.	10:00 AM to 10:30 AM	SESSION TEA
3.	10:30 AM to 11:30 AM	Groundwater recharge: Estimation and recharge methods by Dr.Sudhir Kumar
4.	11:30 AM to 12:30 PM	Groundwater modelling-Demonstration by Dr.Anupma Sharma
5.	12:30 PM to 01:30 PM	Water quality: parameters, monitoring techniques, standards and sampling procedures by Dr. Mukesh Sharma
6.	01:30 PM to 02:30 PM	LUNCH
7.	02:30 PM to 03:30 PM	LAB SESSION: Water Quality Tests by Dr. Mukesh Sharma
8.	03:30 PM to 04:00 PM	SESSION TEA
9.	04:00 PM to 5:00 PM	Experimental observations and Hydrological Studies in the Lesser Himalayan Catchments by Er. Manish Nema
10.	05:00 PM to 06:00 PM	Streamflow modelling using RRMT, Fuzzy logic and ANFIS by Dr. S.M. Pingale

DAY 5: 8th November, 2019

S. No.	TIME	ACTIVITY
1.	9:00 AM to 10:00 AM	Visit to Meteorological Observatory, and Instruments for Hydrological Investigation by Dr. Sudhir Kumar
2.	10:00 AM to 10:30 AM	SESSION TEA
3.	10:30 AM to 11:30 AM	SWAT- A tool for basin hydrology and non-point source pollution modelling by Dr. Jaivir Tyagi
4.	11:30 AM to 12:30 PM	SWAT model application for water and sediment yield estimation from watershed by Dr. Vishal Singh
5.	12:30 PM to 01:30 PM	SWAT model application for water and sediment yield estimation from watershed by Dr. Vishal Singh
6.	01:30 PM to 02:30 PM	LUNCH
7.	02:30 PM to 03:30 PM	SWAT model application for water and sediment yield estimation from watershed by Dr. Vishal Singh
8.	03:30 PM to 04:00 PM	SESSION TEA
9.	04:00 PM to 5:00 PM	FEEDBACK AND DISCUSSION
10.	05:00 PM to 06:00 PM	VALEDICTORY FUNCTION AND VALEDICTORY TEA

SAMPLE OF FEEDBACK RECEIVED

Five Days Training Course on

“TOOLS & TECHNIQUES FOR HYDROLOGICAL INVESTIGATIONS”(4-8th Nov. 2019 at NIH Roorkee)FEED BACK FORM

- PLEASE DO NOT WRITE YOUR NAME OR DO NOT PUT YOUR SIGNATURE ANYWHERE.
- BE CANDID IN GIVING YOUR MARKS/VIEWS. DO NOT HESITATE WHILE RECORDING NEGATIVE COMMENTS MARKS. THIS IS IMPORTANT FOR US TO IMPROVE THE STANDARD OF THE COURSE.

PLEASE MARKS OUT OF 10 IN THE BOX:

(Please give marks out of 10)

Part-1: MANAGEMENT ASPECTS

S.N.	Faculty	Marks out of 10
1	Usefulness of the course in improving your knowledge	08
2	Framing of Training Schedule	09
3	General hospitality	10
4	Standard of lodging (Guest House stay)	10
5	Quality of food served	07
6	Organization of Special Course dinner	10
7	Organization of field visits & Lab sessions	09
8	Organization of Inaugural and Valedictory Function	10
9	Overall organization and management of the course	08
10	Overall stay in NIH Campus	10

Any comments/suggestion (not covered above) which you would like to give for further improvement of the training course?

The behaviour of all the scientist was very good. I never seen such type of good behaviour in any training. All the lectures are very useful for me.
 ⇒ Some improvement, just like focus on hands on is more as compare to class/lecture.

Five Days Training Course on

“TOOLS & TECHNIQUES FOR HYDROLOGICAL INVESTIGATIONS”

(4-8th Nov. 2019 at NIH Roorkee)

FEED BACK FORM

- PLEASE DO NOT WRITE YOUR NAME OR DO NOT PUT YOUR SIGNATURE ANYWHERE.
- BE CANDID IN GIVING YOUR MARKS/VIEWS. DO NOT HESITATE WHILE RECORDING NEGATIVE COMMENTS MARKS. THIS IS IMPORTANT FOR US TO IMPROVE THE STANDARD OF THE COURSE.

PLEASE MARKS OUT OF 10 IN THE BOX:

(Please give marks out of 10)

Part-1: MANAGEMENT ASPECTS

S.N.	Faculty	Marks out of 10
1	Usefulness of the course in improving your knowledge	10
2	Framing of Training Schedule	10
3	General hospitality	10
4	Standard of lodging (Guest House stay)	9
5	Quality of food served	9
6	Organization of Special Course dinner	10
7	Organization of field visits & Lab sessions	9
8	Organization of Inaugural and Valedictory Function	10
9	Overall organization and management of the course	9
10	Overall stay in NIH Campus	9

Any comments/suggestion (not covered above) which you would like to give for further improvement of the training course?

1. It is not possible to learn everything in 5-day course. Hence networking should be developed with trainees by NIH faculties so that when we solve case studies & face difficulties, we should get help from NIH faculties
2. Considering the course content & facilities provided training fee of Rs 5000 is too less.

FORMAT OF CERTIFICATE

Certificate No.: NIH/19-20/T-26/1



**NATIONAL INSTITUTE OF HYDROLOGY
ROORKEE-247667 (INDIA)**

CERTIFICATE

This is to certify that

Ms. Akhtar Jahan, Research Scholar, Earth Science Dept. IIT Roorkee

has participated in the 5- days training course on

“TOOLS & TECHNIQUES FOR HYDROLOGICAL INVESTIGATIONS”

organized by NIH, Roorkee during 4 to 8thNov., 2019.

The participants have been imparted knowledge about the latest tools and techniques for hydrological investigations for sustainable water resources planning and management.

(Santosh M. Pingale)
Scientist-C & Coordinator

(Sudhir Kumar)
Scientist-G & Head

(Sharad Kumar Jain)
Director