

## Emerging and Sustainable Technologies

### Complementing Conventional Water/Wastewater Treatments (ESTCWT-2023)

#### Overview

Potable water is one of the most precious natural resources on earth. In today's world, the future of a country depends on its ability to harness limited water sources to the best of its ability while conserving, treating, and reusing as much water as possible to meet the high demands exerted by the ever-growing population and increasing industrial development. The present standards of living and life-styles coupled with the emergence of more complex pollutants in our water bodies warrant a higher level of treatment using conventional as well as the latest treatment technologies.

This proposed course will be helpful to professionals at regulating agencies that are responsible for river management and water quality, students who are getting ready to enter the professional field of water and environmental engineering, educators who teach courses focused on a sub-section of overlapping areas of water/wastewater and water resources engineering. Researchers who are investigating new ways to purify water and treat wastewater with emerging technologies will get an in-depth exposure of conventional and latest technologies that are being employed in an efficient manner in this area.

The course is focused on engineering design principles dealing with the sustainable withdrawal of water from rivers, estimation of water demand, and treatment of water for potable use following conventional as well as energy-efficient emerging treatment technologies. Additionally, it will cover the quantity, characteristics, treatment, and environmentally sustainable disposal of wastewater to receiving water bodies. Additional focus will be on the protection of fresh groundwater resources from salt encroachment and this course is designed to help participants with an in-depth understanding of various processes being used in water and wastewater treatment facilities and help them understand the design of each processing unit. The first half of the course addresses water treatment. The subject matter of this course follows the flow of water from intake structures through unit processes of coagulation, flocculation, sedimentation, filtration (including MF and UF), and disinfection. The topics of wastewater follow a similar pattern and provide comprehensive knowledge to the participants. Participants will also gain in-depth knowledge of the latest and emerging separation and treatment technologies. This course also focuses on groundwater contamination and comprehensive discussion on required remediation techniques.

The foreign faculty of the course- Dr. Sanjay Tewari of Missouri University of Science & Technology, Rolla, USA (with a joint appointment with Missouri State University, Springfield, MO) will deliver the contents of this course. Dr. Tewari is an active member of multiple international technical committees focused on water, wastewater, desalination and water reuse. He has demonstrated his technical knowledge, experience, and ability in teaching, consultancy, research, and training in the field of water treatment/reuse, sustainable management of water resources, and emerging energy-efficient treatment technologies. The course is planned and offered as per the norms set by GIAN and Motilal Nehru National Institute of Technology Allahabad, Prayagraj (India).

#### Course Objectives

This short course will provide participants a seamless in-depth understanding of technical, practical, and professional challenges that relate to planning and design of water withdrawal from natural sources in a sustainable manner, its treatment, supply, collection of used water, and treatment before it is being released back to a receiving water body. Participants will also have an opportunity to explore the fundamentals and challenges of emerging energy-efficient technologies in this area. After successful completion of this short course, participants will be able to:

- Analyze problems associated with variations in water demand/use and its impact on wastewater. Participants will also be able to analyze the data from a pilot-scale study to design coagulation/flocculation tanks;
- Develop energy-efficient designs for various units involved in water and wastewater treatments.
- Use knowledge gained from this course in the sustainable operation of treatment units and better management of water resources. Participants will also be able to protect groundwater from possible saltwater intrusion or contaminations if needed design and employ suitable remediation treatment.



<b>Dates</b>	22-27 May 2023	
<b>Location</b>	The course will be conducted via OFFLINE mode at Motilal Nehru National Institute of Technology (MNNIT) Allahabad, Prayagraj-211004, U.P. (India).	
<b>Course Schedule</b>	22 <sup>nd</sup> May 2023 (Monday)	<p><b>Inauguration: 9.00 AM to 9.30 AM</b></p> <p><b>Lecture Module 1 &amp; 2: 10:00 AM to 11:00 AM (1 hr)</b> Topic: General water supply design considerations, Water intake structures and pumps.</p> <p><b>Lecture Module 3 &amp; 4: 11:15 to 12:15 PM (1 hr)</b> Topic: Coagulation and flocculation fundamentals, Fundamentals of sedimentation.</p> <p><b>Hands-on Session/Tutorial 1: 3.30 to 4.30 PM (1 hr)</b> Topic: Pump curves.</p>
	23 <sup>rd</sup> May 2023 (Tuesday)	<p><b>Lecture Module 5 &amp; 6: 9:00 AM to 10:00 AM (1 hr)</b> <b>Topic:</b> Sedimentation modeling, Fundamentals of conventional filtration and selection of filtration media.</p> <p><b>Lecture Module 7 &amp; 8: 10:15 AM to 11:15 AM (1 hr)</b> <b>Topic:</b> Emerging use of micro/nanofiltration, Disinfection and fluoridation.</p> <p><b>Lecture Module 9: 11:30 AM to 12:30 PM (1 hr)</b> <b>Topic:</b> Fundamentals of Capacitive Deionization (CDI).</p> <p><b>Hands-on Session/Tutorial 2: 3.00 PM to 4.00 PM (1 hr)</b> <b>Topic:</b> Discrete settling.</p>
	24 <sup>th</sup> May 2023 (Wednesday)	<p><b>Lecture Module 10 &amp; 11: 9:00 AM to 10:00 AM (1 hr)</b> <b>Topic:</b> Modifications of CDI electrodes for specific contaminants and enhanced yield, Electro-kinetic barriers against seawater intrusion.</p> <p><b>Lecture Module 12 &amp; 13: 10:15 AM to 11:15 AM (1 hr)</b> <b>Topic:</b> Electro-coagulation and its applications in wastewater treatment, Reverse osmosis and inland concentrate management.</p> <p><b>Lecture Module 14: 11:30 AM to 12:00 Noon (0.5 hr)</b> <b>Topic:</b> Advanced reduction processes – a new class of contaminant treatment.</p> <p><b>Lecture Module 15 &amp; 16: 12.15 PM to 1:15 PM (1hr)</b> <b>Topic:</b> Microbial treatment- fundamentals and selection of suspended vs. attached growth process, Design of an activated sludge process (Part - I).</p> <p><b>Hands-on Session/Tutorial 3: 2.30 to 3.30 PM (1 hr)</b> <b>Topic:</b> Fundamentals of mass balance concept in the context of environmental and water resources engineering.</p>
	25 <sup>th</sup> May 2023 (Thursday)	<p><b>Lecture Module 17 &amp; 18: 9:00 AM to 10:00 AM (1 hr)</b> <b>Topic:</b> Design of an activated sludge process (Part - II), Design and operation of attached growth treatment units.</p> <p><b>Lecture Module 19 &amp; 20: 10:15 AM to 11:15 AM (1 hr)</b> <b>Topic:</b> Residuals management and sludge digesters, Bio-filters.</p> <p><b>Lecture Module 21: 11:30 AM to 12:00 Noon (0.5 hr)</b> <b>Topic:</b> Point-of-use ceramic/clay filters.</p> <p><b>Hands-on Session/Tutorial 4 &amp; 5: 2.00 PM to 4.00 PM (2 hrs)</b> <b>Topic:</b> Design and operational/cost-cutting analysis of a suspended-growth secondary treatment unit.</p>
	26 <sup>th</sup> May 2023 (Friday)	<p><b>Lecture Module 22 &amp; 23: 9:00 AM to 10:00 AM (1 hr)</b> <b>Topic:</b> Bio-swales, Groundwater and dense non-aqueous phase liquids.</p> <p><b>Lecture Module 24: 10:15 AM to 11:15 AM (1 hr)</b> <b>Topic:</b> Groundwater remediation and wastewater treatment using zero-valent iron.</p> <p><b>Site Visit/Hands-on Session/Tutorial 6-8: 1.30 PM to 4.30 PM (3 hrs)</b> <b>Topic:</b> Site visit to a water and wastewater treatment plants and interactive session.</p>
	27 <sup>th</sup> May 2023 (Saturday)	<p><b>9.30 AM-12 Noon:</b> Evaluation of Learning Outcomes (Examination/Test, Feedback) &amp; Certificate distribution.</p>
<b>Who should attend?</b>	<ul style="list-style-type: none"> <li>• Anyone with a degree in Civil, Environmental, Chemical or relevant branches of Engineering and Science.</li> <li>• Students at all levels (B.Tech./B.Eng./B.Sc./M.Sc./MTech./Ph.D.) and faculty members/academic staff from universities and institutions.</li> </ul>	



- Engineers, Scientists and Professionals working in companies, industries and R&D institutions.

### Course Fee

**One-Time GIAN Registration:** Please visit <http://www.gian.iitkgp.ac.in/GREGN/> and register by paying Rs. 500/- (those who have already been paid, need not pay again).

The participation fees for attending the course is as follows:

<b>Participants from abroad:</b>	US\$ 200 + 18% GST
<b>Industry/ Research Organizations:</b>	Rs. 5000 + 18% GST
<b>Academic Institutions (Faculty members):</b>	Rs. 3000 + 18% GST
<b>Academic Institutions (Students/Research scholars):</b>	Rs. 1000 + 18% GST

- The course will be offered via OFFLINE mode.
- No hardcopy of the learning materials would be provided to the participants.
- Minimum 90% attendance necessary to be eligible for certificate of participation/attendance.
- Appearing for evaluations/examinations during the course is necessary for certificate of grades in the course.

### Bank Details

**Account Name:** SNFCE MNNIT Allahabad.  
**Account No.:** 10424975574.  
**Bank Name:** State Bank of India (SBI).  
**Branch:** MNNIT Allahabad, Prayagraj-211004, Uttar Pradesh, India.  
**IFSC Code:** SBIN0002580.  
**Last Date of Registration:** 7<sup>th</sup> May 2023.

### International Expert



#### Dr. Sanjay Tewari, Missouri University of Science & Technology, USA

Dr. Sanjay Tewari is currently serving as an Associate Professor in the Department of Civil, Architectural and Environmental Engineering in the Missouri University of Science & Technology (joint appointment with Missouri State University). Dr. Tewari has more than 10 years of experience of high-quality teaching undergraduate and graduate courses at multiple universities (Texas A&M University, Louisiana Tech University, Missouri State University, and Missouri University of Science & Technology) in various capacities. Dr. Tewari has earned multiple awards for his teaching, research, and involvement with students.

As an active researcher, Dr. Tewari has more than fifteen years of experience in his primary research interests of water quality, wastewater treatment, bio-filters, and electrochemical processes such as capacitive deionization and electro-coagulation. In addition to his primary research interests, Dr. Tewari also has applied his knowledge to many overlapping areas - environmental engineering, water resources engineering, sustainable and resilient infrastructure, and utilization of spatial data and geological/soil properties to estimate the adverse environmental conditions leading to corrosion of buried metal pipelines/culverts.

Dr. Tewari led multiple externally funded research projects and supervised multiple graduate students (Ph.D. and MS). The total amount of his externally funded recent research is about half a million US dollars. Many of his research projects are sponsored by multiple state and national research agencies. Some of his research findings and outcomes have been adopted by the Louisiana State Department of Transportation and Development for implementation in the field.

Dr. Tewari is involved in various scholarly activities of engineering education. His recent efforts have been focused on making engineering education more interactive and hands-on. Dr. Tewari was recently (summer of 2019) invited to Southwest University in Chongqing, China to deliver an advanced and condensed course on advances in water and wastewater treatment and engineering. He has been actively publishing and presenting his research at the national and international levels. He is actively serving as a review board member of multiple international journals and serves the engineering community by reviewing numerous journal manuscripts and conference articles.

Dr. Tewari is involved with various technical and professional societies. He is an active contributing member of multiple technical committees such as national ASCE Committees on Water Pollution Engineering; Water Desalination and Reuse; Sub-committee on Development of Guidelines on Concentrate Management in Inland



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Desalination Projects; Technical Sub-committee on Development of Pre-Standard on Case Studies for Concentrate; and a four-person Blue Ribbon Panel for Land Subsidence and Managed Aquifer Recharge Committee. In addition to ASCE, he is equally active with the American Society for Engineering Education (ASEE). He was an Executive Member of the Ocean and Marine Engineering Division; a member of the Board of Directors Committee on P12 Engineering Education where he represented the Environmental Engineering Division. Locally, he is one of the directors of the Ozark Chapter of Missouri Society of Professional Engineers.

#### Host Faculty:



**Dr. R. C. Vaishya** is a Professor in the Department of Civil Engineering, Motilal Nehru National Institute of Technology Allahabad (India). He obtained his B.Tech. (Civil Engg.) in 1987 from Awadh University Faizabad; M.E. (Environmental Engg.) in 1989 from the MNNIT Allahabad and Ph.D. (2002) from IIT Bombay. His major research specialization areas are Water and Wastewater Treatment and Air Pollution Control and Monitoring. His research interest mainly lie in the areas of removal of groundwater contaminants like arsenic and fluoride and other heavy metals by adsorption and filtration processes. He has published more than 130 research papers in international and national journals, seminars and conference. He is having more than 29 years of experience in teaching and research field. He has expertise in providing sustainable solutions of problems like water and solid waste management with minimum resource applications. Prof. Vaishya also served as the Head of Civil Engg. Department from 2019-21.



**Dr. Akshoy Ranjan Paul** is an Associate Professor in the Department of Applied Mechanics, Motilal Nehru National Institute of Technology Allahabad (India). Dr. Paul has over 20 years of teaching and research experience and is actively involved in research in the areas of fluid mechanics, turbomachinery, CFD and green energy. He obtained his Ph.D. in Aerodynamics in 2013 from MNNIT Allahabad. Dr. Paul has published over 200 research papers, 4 textbooks and delivered several invited talks in India and abroad on a variety of technical and motivational topics. Dr. Paul is presently working in several research projects sponsored by various government agencies as an investigator.

#### Contact:

Principal Course Coordinator	Course Coordinator	Local Coordinator, GIAN
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