

INTERNATIONAL COURSE
Under
GLOBAL INITIATIVE OF ACADEMIC NETWORKS (GIAN)



शिक्षा मंत्रालय
MINISTRY OF
EDUCATION

सत्यमेव जयते

Bioremediation of Hazardous Wastes (BHW)

December 11 to December 22, 2023

Course Coordinator

Prof. Manish Kumar Goyal

**Department of Civil Engineering
Indian Institute of Technology Indore
Indore-453552, Madhya Pradesh, India**

GIAN (An Initiative of the Government of India)

Union Cabinet has approved a program titled Global Initiative of Academic Networks (GIAN) in Higher Education, aimed at tapping the talent pool of scientists and entrepreneurs internationally to encourage their engagement with the institutes of Higher Education in India so as to augment the country's existing academic resources, accelerate the pace of quality reform, and elevate India's scientific and technological capacity to global excellence. GIAN is envisaged to catalyze higher education institutions in the country that will initially include all IITs, IIMs, Central Universities, IISc Bangalore, IISERs, NITs, and IITs. Subsequently, good State Universities, where the spinoff is vast, shall also be covered. GIAN is an evolving scheme that will initially include the participation of foreign faculty in the Institute as Distinguished/ Adjunct/ Visiting faculty/ Professor of Practice. They will be delivering their expertise in short or semester-long courses. In addition, other activities shall also be included in the due course of time.

GIAN is envisaged to achieve the following objectives:

- i. Provide opportunities to our faculty to learn and share knowledge and teaching skills in cutting-edge areas.
- ii. To provide an opportunity for our students to seek knowledge and experience from reputed international faculty.
- iii. To create avenues for possible collaborative research with the international faculty.
- iv. To increase participation and presence of international students in the academic Institutes.
- v. Opportunity for the students at different Institutes/Universities to interact and learn subjects in niche areas through the collaborative learning process.
- vi. Provide opportunities for the technical persons from Indian Industry to improve understanding and update their knowledge in relevant areas.
- vii. To motivate the best international experts in the world to work on problems related to India.

About The Course

Site restoration usually proceeds through several phases and requires a concerted, multidisciplinary effort. Of all the remediation technologies used nowadays, bioremediation is one of the most popular and cost-effective options because bioremediation uses naturally occurring organisms to break down hazardous substances into less toxic or non-toxic substances. However, for efficient, cost effective, real-world applications of bioremediation-based technologies, one needs to understand the microbial ecology (e.g., growth and biodegradation), characteristics and bioavailability of organic compounds, site characterization, and factors making organics amenable to biological treatment.

This course will introduce key concepts of bioremediation, fate and transport of hazardous wastes in subsurface environments, fundamentals of microbiology that is related to microbial energy, metabolic pathways and microbial transformation of hazardous materials, redox reaction and mass requirement for electron acceptor and nutrients in bioremediation processes, sorption/desorption and bioavailability of hazardous wastes, in-situ, on-site and extra-site bioremediation in different phases (e.g., solid, liquid and vapor-phase bioremediation).

Internationally acclaimed academics, researchers, and practitioners with proven knowledge, experience, and demonstrable ability in teaching, consultancy, research, and training in the field of advanced environmental engineering will deliver lectures and discuss cases in the course. The course will be planned and offered as per the norms set by IIT Indore for BHW subjects.

Objectives

The primary objectives of the course are as follows:

- Providing a sound understanding of the principles, applications, and limitations of BHW;
- Developing the course attendees' ability to design some bioremediation systems; and
- Enhancing the course attendees' capability to identify major issues related to bioremediation.

Who Can Attend

- Executives, engineers, and researchers from manufacturing, service, and government organizations, including R&D laboratories.

- Students at all levels (B.Tech/MSc/M.Tech/PhD).
- Faculty from reputed academic institutions and technical institutions.

Modules Coverage

Day 1	Lecture 1: Introduction to site remediation and bioremediation of hazardous wastes Lecture 2: The soil environment
Day 2	Lecture 3: Source zone and its characterization Lecture 4: Fate and transport of hazardous wastes in subsurface environments (1) Lecture 5: Fate and transport of hazardous wastes in subsurface environments (2) Tutorial 1: Problem-solving session with examples
Day 3	Lecture 6: Microbial growth and biodegradation Lecture 7: Biodegradation kinetics, metabolisms, and energy production Lecture 8: Mass requirement for electron acceptor and nutrients (1)
Day 4	Lecture 9: Mass requirement for electron acceptor and nutrients (2) Lecture 10: Site characterization for bioremediation Tutorial 2: Problem-solving session with examples
Day 5	Lecture 11: In-situ remediation of groundwater and aquifers (1) (pump/treat/reinjection) Lecture 12: In-situ remediation of groundwater and aquifers (2) (subsurface delivery systems)
Day 6	Lecture 13: In-situ remediation of groundwater and aquifers (3) (air sparging) Lecture 14: In-situ bioremediation of soil (1) (soil vapor extraction)
Day 7	Lecture 15: In-situ bioremediation of soil (2) (bioventing) Tutorial 3: Problem-solving session with examples Lecture 16: Design of soil vapor extraction and bioventing systems
Day 8	Lecture 17: Design of air sparging systems Lecture 18: Design considerations for aerobic, anoxic, and anaerobic bioremediation systems Lecture 19: Design considerations for reductive dechlorination bioremediation systems Lecture 20: Bioavailability (1)
Day 9	Lecture 21: Bioavailability (2) Tutorial 4: Problem-solving session with examples Lecture 21: Solid-, and slurry-phase bioremediation (1)
Day 10	Lecture 22: Solid- and slurry-phase bioremediation (2) Lecture 23: Liquid-phase bioremediation Lecture 24: Vapor-phase biological treatment

Important Dates

- Registration Opens: August 15, 2023
- Registration Closes: December 5, 2023
- Accommodation Requests: till December 5, 2023

Venue: Indian Institute of Technology Indore

About The Host Institute

In keeping with India's vision to become a world leader in Science and Technology and to usher in a new revolution, resulting in unprecedented economic growth, the Government of India reassessed the need for technical human resources and set up eight new IITs. Indian Institute of Technology Indore, located in Madhya Pradesh, known as IIT Indore or IITI, is an institute of national importance established by the Government of India in 2009. It is one of the eight new IITs the Ministry of Human Resource Development (India), Government of India started. The institution started functioning from 2009–10 on a temporary campus at the Institute of Engineering and Technology of Devi Ahilya University under the mentorship of IIT Bombay. Shri Arjun Singh, the union HRD minister, laid the foundation of the permanent campus, spread over an area of around 501.42-acre (2.1 km²), on 17th February 2009 at Simrol, a location on Khandwa Road about 25 km from the city of Indore. Since

February 2016, IIT Indore has started functioning from its permanent campus. All the Administrative Offices, Material Management Section, Finance and Account Section, The School of Basic Sciences, The School of Humanities and Social Sciences, The School of Engineering, Basic Science Labs, and Engineering Labs are all established on this campus. The Central Library is also situated on this campus.

About The Host Department

The Department of Civil Engineering was started in 2016. The Department's faculty members are well-equipped to conduct high-quality research programs in various fields of civil engineering and engaged in interdisciplinary research activities. The department is committed to high-quality research. Interested people are encouraged to contact the concerned faculty for collaborative research. The department is actively engaged in organizing various research activities.

GIAN Portal Registration

Step-1: One-Time Web Portal Registration

Create a login and password at <http://www.gian.iitkgp.ac.in/GREGN/index> login, complete the Registration Form, and pay Rs. 500/- (non-refundable, GIAN Portal Registration Fee) through an online payment gateway. After Payment, select this course from the listed GIAN courses.

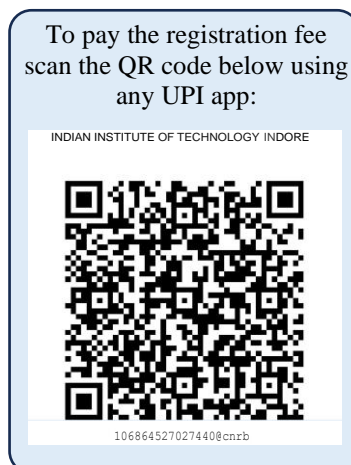
Step 2: Institute Registration

It is mandatory to fill the Google Form ([click here](#)). The registration fee details are listed below:

IIT Indore Course Registration Fee (Exclusive of GIAN Portal Registration Fee)

Students (UG, PG, and PhD)	Rs. 1000
Academicians	Rs. 2500
Industry and Research	Rs. 2500
Participants from Abroad	US \$ 100

The above fee includes all instructional materials, computer use for tutorials and lab, and free Internet facility. The accommodation will be provided to the outstation participants on a payment basis, subject to availability.



How to reach IIT Indore

IIT Indore is well connected with major cities of India by road, rail, and air. It is located approx. 34 km from the Indore Airport and approx. 25 km from Indore Railway Station and Sarwate Bus Stand. Frequent city bus services are available from Bhawarkua to IIT Simrol (Bus no. M-19).

Local Accommodation

Accommodation at the Institute Guest houses will be available on a payment basis based on availability.

TA/DA will not be paid for any participants.

Brief Profile of Resource Person

Dr. Tian C. Zhang is a Professor in the Department of Civil & Environmental Engineering at the University of Nebraska-Lincoln (UNL), USA. He received his B.S. degree in Civil Engineering from Wuhan University of Technology, P.R.C. in 1982, M.S. degree in Environmental Engineering from Tsinghua University, P.R.C. in 1985, and Ph.D. in Environmental Engineering from the University of Cincinnati in 1994. He joined the UNL faculty in August 1994. Professor Zhang teaches courses related to water/wastewater treatment, remediation of hazardous wastes, and non-point pollution control. Professor Zhang's research involves fundamentals and applications of nanotechnology and conventional technology for water, wastewater, and stormwater treatment and management, remediation of contaminated environments, and detection/control of emerging contaminants in the environment. Professor Zhang has published more than 250 peer-reviewed journal papers, 90 book chapters, and 18 books since 1994. Professor Zhang is a member of the Water Environmental Federation (WEF) and the Association of Environmental Engineering and Science Professors (AEESP). Professor

Zhang is a Diplomate of Water Resources Engineer (D.WRE) of the American Academy of Water Resources Engineers, Board Certified Environmental Engineers (BCEE) of the American Academy of Environmental Engineers, a distinguished member of the American Society of Civil Engineers (Dist.M.ASCE), Fellow of American Association for the Advancement of Science (F.AAAS), and Academician of European Academy of Sciences and Arts (EASA). Professor Zhang is an Associate Editor of the *Journal of Environmental Engineering* (since 2007), the *Journal of Hazardous, Toxic, and Radioactive Waste* (since 2006), and the managing editor of *Water Environment Research* (2008–2018). He has been a registered professional engineer in Nebraska, USA since 2000. He has received awards/honors from various professional organizations.

Course Coordinators

Prof. Manish Kumar Goyal
Professor, Department of Civil Engineering,
Indian Institute of Technology Indore,
Simrol, Indore 453552,
Email: mkgoyal@iiti.ac.in
Phone: 07316603288