Two-week GIAN Course on
PRINCIPLES OF ENVIRONMENTAL CATALYSIS

(Course code: 174040C01)

[ Sponsored by Ministry of Human Resource Development (MHRD)
der under the scheme Global Initiative for Academic Network (GIAN)]

(6th August – 17th August, 2018)

FOREIGN FACULTY

Dr. Praveen Kolar is currently an Associate Professor in Biological and Agricultural Engineering at the North Carolina State University, Raleigh, NC, USA. Kolar runs a research program in value-added agricultural waste management, where the research is primarily focused on converting agricultural wastes into catalysts and adsorbents that are applied to environmental and bioenergy processes. Kolar’s research has resulted in 43 articles in refereed journals and over 50 presentations on various aspects of catalysis. He has directed/directing five dissertations and eight masters’ theses and served/serving on 15 masters and dissertation committees. Kolar is an active member of the American Society of Agricultural and Biological Engineering, wherein he serves as a chair of the P-128 ethics competition committee. He teaches undergraduate courses in Transport Phenomenon and Food Processing Engineering and a graduate course in Engineering Principles of Heterogeneous Catalysis.

COURSE COORDINATOR

Dr. Somvir Bajar is currently working as an Assistant Professor in Department of Environmental Sciences, Central University of Haryana, Mahendergarh, Haryana, India. He has started his research carrier focusing on exploration of energy recovery possibilities from waste sectors and sustainable solutions for abatement of pollutants through bioremediation. He has more than 6 years of teaching and research experience and has published 13 publications in peer reviewed national & international journals and 08 book chapters. He has served PGIMER, Chandigarh as Senior Demonstrator of Environmental Health for more than 02 years and worked on several projects focussed on extending evidence based association of environmental pollutants and human health to reduce burden of diseases and disabilities. He has been also involved in providing environmental consultancy to more than 600 industries including 03 thermal power plants. He also played a considerable role in development and implementation of self-sustaining business model with the consultancy activities in his carrier.

How to Participate:

- Register yourself on GIAN Portal of IIT Kharagpur (http://www.gian.iitkgp.ac.in/GIREGN/index).
- Choose the course i.e. “Principles of Environmental Catalysis” by drop down menu.
- Fill the registration form and pay the course by DD/Cheque/RTGS.
- Scan filled Registration form and send to course coordinator.

Course Coordinator
Dr. Somvir Bajar
Teacher-in-Charge & Assistant Professor
Department of Environmental Sciences
Central University of Haryana
Mahendergarh – 123031
Haryana, India
E-mail: sksomvir@gmail.com
Mob.: +91-89 50 000270

Local Coordinator
Dr. Aditya Saxena
Department of Physics
Central University of Haryana
Mahendergarh – 123031
Haryana, India
E-mail: adityasaxena@cuh.ac.in
Principles of Environmental Catalysis
MH RD Scheme on Global Initiative on Academic Network (GIAN)

OVERVIEW
There is a significant interest in developing practical and novel technologies that can minimize environmental pollutants produced from anthropogenic processes. Environmental catalysis is one such tool available to scientists and engineers not only to control and treat harmful environmental pollutants but also to prevent the formation of pollutants in the first place. In addition, environmental catalysis also involves alternate and greener routes to production of value-added products. Centi et al. estimated the demand for environmental catalysis to exceed US$3 billion and expected to grow significantly. Concurrent with research and development in the area of catalysis, it is equally important to train and equip the future workforce with relevant technological skills needed for application of environmental catalysis. However, currently, there is no practical course available to students and personnel of environment-related industries that specifically focus on principles, mechanisms, and the mathematics of environmental catalysis. The proposed course titled “Principles of Environmental Catalysis” is expected to fulfill this need by introducing the participants to the fundamentals of environmental catalysis and their applications. The course will review the basics of chemical kinetics, cover adsorption, heterogeneous catalysis, rate equations, external and internal transport processes in heterogeneous reactions. Relevant examples from gaseous and liquid waste treatment and bioprocessing will also be discussed.

OBJECTIVES
After completion of the course, the participants will be able to:
I. Define a catalyst & distinguish between homogeneous & heterogeneous reactions
II. Describe the general protocols for preparation of environmental catalysts
III. Perform mole balances, derive design equations, and size reactors
IV. Write general steps in a heterogeneous catalytic process for packed bed, slurry, and trickle bed reactors and derive rate equations
V. Design adsorption systems for pollution mitigation
VI. Design and size biological filter for treatment of air pollutants
VII. Derive rate equations and synthesize rate laws for kinetic-limited reactions
VIII. Predict concentration profile and determine reactor size for a packed bed reactor
IX. Calculate internal and overall effectiveness factors for porous catalysts
X. Determine whether the reactor is mass transfer-limited or reaction-limited using Thiele modulus and other empirical relations

Course Structure & Schedule
20 lectures and 10 tutorials
6th August – 17th August, 2018

You Should Attend If you are:
- M.Sc./M.Tech/Ph.D. students
- Faculty from academic and technical institutions
- Engineers and researchers from manufacturing, service and government organizations
- R&D staff from industries & laboratories

Fee Structure
The participation fees for taking the course is as follows:
Participants from abroad : US $300
Industry Participants: INR 8,000/-
Faculty: INR 4,000/-
Students: INR 2,000/- (OBC/UR); INR 1,000 (SC/ST); INR 0/- (PWD)
The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The paid hotel/guest house accommodation may be provided with prior request.

COURSE DETAILS
Course Structure (6th August-17th August, 2018)

DAY 1 (6th August, 2018)
Lecture 01
(10:00-11:00)
Material Balances: Introductory principles, opportunities and challenges in environmental catalysis, concept of mass and energy balances in environmental engineering followed by simple example problems

Tutorial 01
(14:00-16:00)
 applying mass and energy balances to solve numerical problems commonly encountered in environmental engineering.

DAY 2 (7th August, 2018)
Lecture 02
(11:30-13:30)
Reactor Design-I: Fundamentals of reactions and kinetics, concept of reactor design and fractional conversions.

Lecture 03
(10:00-11:00)
Reactor Design-II: Types of reactors used for treatment of solid, liquid, and gaseous wastes, batch and continuous reactors, and rate laws.

Lecture 04
(11:30-12:30)
Analysis of Experimental Data: Planning, collection, and analysis of laboratory data to determine time, concentration, and reaction kinetics. Differential and integral rate laws & estimation of reaction rate constants via mathematical analysis.

Tutorial 02
(14:00-16:00)
Use of design equations for analysis of data and reaction kinetics. Example problems on differential and integral rate laws and estimation of reaction rate constants via least-square regression analysis.

DAY 3 (8th August, 2018)
Lecture 05
(10:00-11:00)
Concept of Catalysis: Principles of catalysis, definition, characteristics, and mechanism, homogeneous and heterogeneous catalysts with examples.

Lecture 06
(11:30-12:30)
Characterization of Catalysts: Theories of heterogeneous catalysis, catalyst preparation and characterization techniques, use of nanotechnology in catalyst synthesis, and general steps in a catalytic reaction.

Tutorial 03
(14:00-16:00)
Interpretation of catalyst characterization data

DAY 4 (9th August, 2018)
Lecture 07
(10:00-11:00)
Adsorption: Principles of adsorption, adsorpive treatment for mitigation of environmental pollutants, kinetics and mechanism.

Lecture 08
(11:30-12:30)

Tutorial 04
(14:00-16:00)
Solutions to problems related to estimation of adsorption capacity using linear and non-linear models followed by design of adsorption systems.

DAY 5 (10th August, 2018)
Lecture 09
(10:00-11:00)
Biological Filtration: Bio-catalytic treatment of pollutants, concept of biological filtration, design considerations, operation and scale up

Lecture 10
(11:30-12:30)
Modelling of Biological Filters: Kinetics of contaminant removal and modelling of biofiltration systems and practical aspects

Tutorial 05
(14:00-16:00)
Biological filtration system: design problem.

DAY 6 (11th August, 2018)
Lecture 11
(10:00-11:00)

Lecture 12
(11:30-12:30)

Tutorial 06
(14:00-16:00)
Analysis of reaction rate equations for Langmuir-Hinshelwood, Eley-Rideal, and other mathematical models.

DAY 7 (12th August, 2018)
Lecture 13
(10:00-11:00)
Advanced Oxidation Concepts: Advanced oxidation of environmental pollutants, catalytic ozonation, use of oxygen, hydrogen peroxide, and permanganate as oxidants. Design of nanostructured catalytic materials

Lecture 14
(11:30-12:30)
Selective and Partial Oxidation: Selective oxidation of organic pollutants and rational design of catalysts. Selective oxidation catalysts for reduction of the vehicular pollutants

Tutorial 07
(14:00-16:00)
Analysis of data for catalytic oxidation of volatile organics using mechanistic and empirical mathematical models

DAY 8 (13th August, 2018)
Lecture 15
(10:00-11:00)
External Diffusion in Catalysis-I: External transport processes in heterogeneous reactions, diffusion and mass transfer coefficients, diffusion through a film to a catalyst particle.
Two-week GIAN Course On
Principles of Environmental Catalysis
(Course code: 174040C01)
(6th August-17th August, 2018)
[Sponsored by Ministry of Human Resource Development (MHRD) under the scheme Global Initiative for Academic Network (GIAN)]

To

Correspondence Address:
Dr. Somvir Bajar
Course Coordinator (GIAN Course)
Department of Environmental Sciences
Central University of Haryana
Mahendergarh-123031
Mob.: +91-89 50 000270
E-mail: sksomvir@gmail.com

REGISTRATION FORM

PERSONAL DETAILS

Name of the Applicant: 
Designation: 
Institution Address: 
E-mail: 
Mobile Number: 

REGISTRATION FEE DETAILS

By Cheque
Amount (INR): 
Account Number: 
Account Holder’s Name: 
Cheque No. & Date: 

By NEFT
Amount (INR): 
Account Number: 
Account Holder’s Name: 
Transaction ID & Date: 

By Demand Draft
Amount: 
Bank: 
DD No.: 
Date: 

Signature

Note:
- Registration should be made in favour of GIAN, Central University of Haryana A/c via cheque/online transfer mode only. (Bank Name & Address: Punjab National Bank, Jant-Pali, Mahendergarh, Pin-123031; Account no. 7824000100095605; MICR 123024001; IFSC PUNB0782400)
- Proof of Registration fee should be sent to Dr. Somvir Bajar, Department of Environmental Science, Central University of Haryana, Mahendergarh - 123031
- The scanned copy of filled Registration form duly signed by the applicant along with the proof of fee submission should also be sent by E-mail to Dr. Somvir Bajar (sksomvir@gmail.com)
- In case the candidate requires an accommodation a separate E-mail regarding this should be sent to sksomvir@gmail.com before 25th July, 2018.

Contact Person:
Dr. Somvir Bajar
Course Coordinator (GIAN Course); sksomvir@gmail.com; Mob. No. +91-895000270