



BIOLOGICAL PROCESS DESIGN FOR WASTEWATER TREATMENT

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INTENDED AUDIENCE : Undergraduate, postgraduate and Ph.D. students of Environmental Engineering, Chemical Engineering, Civil Engineering, and Environmental Chemistry

COURSE OUTLINE :

This course is for Engineers and Scientists working towards the control of pollution from municipal and industrial wastewater. Considering the expectation of the Industries for wastewater pollution control in their premises to comply With newer and more stringent laws and acts being enforced in India and globally, wastewater treatment for effluent generated from industries has become highly challenging. This course introduces the principles of biological methods to control wastewater pollution. The course will be presented in a logical manner with several numerical problems and case studies. The topics to be covered include (but not limited to): biological treatment fundamentals, wastewater characterization, bacterial growth kinetics and reactor hydraulics, aeration and sedimentation. aerobic and anaerobic suspended and attached growth biological treatment processes, sludge management, and sustainability in wastewater treatment plant design.

ABOUT INSTRUCTOR :

Prof. Vimal Chandra Srivastava (emails: vimal.srivastava@ch.iitr.ac.in, vimalcsr@yahoo.co.in) is currently serving as Institute Chair Professor and Head of the Department of Chemical Engineering, Indian Institute of Technology (IIT), Roorkee, India. His major research interests are in Chemical & Environmental Engg., Wastewater Treatment, Solid waste management, and Valorization of spent-adsorbents/catalysts/residues. He has authored >12 book chapters, >215 papers (>210 in ISI) in peer-reviewed journals, and more than 115 papers in conferences/seminars. He has received more than 11,700 citations (as per Scopus as of Dec. 2021) with an h-index of 52. He has guided 18 Ph.D. thesis, 10 more are in progress. In addition, he has guided 51 M.Tech. Dissertations. Prof. Vimal has several sponsored and consultancy projects (>10) to his credit with a total overlay of more than Rupees Sixty million (6 crores). He has also organized 11 short-term courses sponsored by Central Pollution Control Board (CPCB), India and All India Council for Technical Education (AICTE). He was awarded the prestigious International award "Prosper.Net-Scopus Young Researcher Award 2010 – First Runner-up Prize" held at Tongji University, Shanghai, China, on 5 July 2010. This award is sponsored by SCOPUS, United Nations University, and the International Bureau of BMBF, Germany. Prof. V.C. Srivastava has been awarded numerous Top National Awards like "NASI-Scopus Award 2018" by the National Academy of Science, India (NASI) & Scopus, "INAE Young Engineers Award 2012" by Indian National Academy of Engineering (INAE); "INSA Young Scientist Medal 2012" by Indian National Science Academy (INSA) in the "Engineering Science Category"; "IE Young Engineer Award 2013" by Institution of Engineers, India in the "Environmental Engineering" division; "Amar Dye-Chem Award 2013", "Hindustan Lever Benial Award for Outstanding Chemical Engineer of the Year 2020" "Sisir Kumar Mitra Memorial Award 2018" & "CSIR-NEERI Chemcon Distinguished Speaker (CDS) Award 2019" by Indian Institute of Chemical Engineers (IChE). Prof. Srivastava is a Young Associate of INAE; Member of American Chemical Society (ACS); Fellow of Institution of Engineers, India; Life Member of National Academy of Science, India (NASI), IChE, Indian Science Congress Association (ISCA) and Indian Society for Electro-Analytical Chemistry (ISEAC); and The Biotech Research Society, India (BRSI).

COURSE PLAN :

- Week 1 :** Biological treatment fundamentals: Microbiology and ecology, Fundamentals of Biochemical Operations; Conversion processes of organic and inorganic matter. Wastewater characterization;
- Week 2 :** Modeling of biological treatment processes: Stoichiometry, reaction and bacterial growth kinetics; reactor hydraulics. Mass and heat balance
- Week 3 :** Aeration and sedimentation. Classification of biological treatment Processes. Biological nitrification, denitrification, and phosphorus removal
- Week 4 :** Aerobic Biological Treatment Processes: Aerated lagoon, activated sludge systems, trickling filter, rotating disc reactors; sequential batch reactor..
- Week 5 :** Anaerobic Biological Treatment Processes: UASB, and hybrid UASB reactors, biotowers.
- Week 6 :** Advanced Biological Wastewater Treatment: Fluidized bed bioreactors; Membrane bioreactors (MBRs); Moving bed biofilm reactor (MBBR), biological nitrogen removal
- Week 7 :** Sludge Management: Sludge characteristics, production, stabilization; thickening and dewatering; pathogen removal; sludge transformation and disposal methods
- Week 8 :** Sustainability in wastewater treatment plant designing; greater water availability; lower energy and chemical consumption; resource recovery. Case studies on biological wastewater treatment