ENVIRONMENTAL GEOMECHANICS

PROF. DEVENDRA NARAIN SINGH

Department of Civil Engineering

IIT Bombay

PRE-REQUISITES : Basics in Geotechnical Engineering

INTENDED AUDIENCE : Civil Engineering, Geotechnical Engineering, Environmental Engineering, Geoenvironmental Engineering

INDUSTRIES APPLICABLE TO :

- Bhabha Atomic Research Centre, Mumbai
- Jawaharlal Nehru Port Trust, Navi Mumbai
- Reliance Industries Limited, Mumbai
- Hindustan Lever Limited, Mumbai
- Council of Scientific and Industrial Research (CSIR), New Delhi
- Hindalco Industries Pvt. Ltd.
- Department of Science and Technology, New Delhi
- Indian Council of Agricultural Research, New Delhi
- Municipal Corporations
- Landfill operators
- Mining Industries
- Ministry of Ports Shipping and waterways
- Oil India Limited and Engineers India Limited

COURSE OUTLINE :

A consideration of technical and scientific aspects of key geo-societal issues will be covered in this course. Case studies and analysis of current and historic databases will be used to illustrate topics including, but not limited to, impact of climate change, energy resources, water and soil pollution, and health risks posed by heavy metals and emerging pollutants. Upon successful completion of this course, the student would:

- Have an exposure to interdisciplinary issues pertaining to environment and geotechnical engineering.
- Be trained to develop sustainable and environmentally sound solutions for geoenvironmental issues.
- Understand the relevance of various legal aspects involved in addressing environmental consequences associated with geotechnical issues

ABOUT INSTRUCTOR :

Prof. Devendra Narain Singh has been a faculty member of Civil Engineering at the Indian Institute of Technology Bombay since 1994. Before joining IIT Bombay, he served Central Road Research Institute, New Delhi, and the Indian Institute of Technology Kharagpur for short durations. His early education was completed at Lucknow, UP, India. He obtained his Bachelor's, Master's, and Doctoral degrees from IIT Kanpur in 1986, 1989 and 1993, respectively.

His teaching and research & developmental activities are in quite diversified areas of geotechnical engineering (viz., environmental geotechnology, mechanics of unsaturated soils, soil characterization based on thermal and electrical properties, contaminant transport in porous media, mineralogical characterization, utilization and recycling of industrial waste, geotechnical centrifuge modeling, CCUS & CCU, etc.). He has published 359 technical articles, of which 269 are in refereed journals. He has supervised 42 Doctoral (and 5 ongoing) dissertations and 35 Masters theses. He has successfully filed 37 patents, out of which 29 (including 1 US) patents have been granted. He has also successfully filed 4 Copyright applications.

Apart from teaching and research, Dr. Singh has been very actively associated with some of the most prestigious business houses as an in-house instructor and retainer consultant. He has taken up sponsored projects from Bhabha Atomic Research Centre (BARC), the Indian Council of Agricultural Research (ICAR), the Department of Science and Technology (DST-TIFAC), All India Council of Technical Education (AICTE), and the Atomic Energy Regulatory Board (AERB). With financial aid from these and several other organizations, he has established a state-of-the-art Environmental Geotechnology Laboratory in the department.

Dr. Singh has founded Environmental Geotechnics, ICE Publishing, London, UK, and has been its Editor-in-chief. He has been an Editorial Board Member of several journals of repute. He is the recipient of Young teachers' award instituted by the AICTE, New Delhi and JUNIOR/SENIOR Paper Award from the International Association for Computer Methods and Advances in Geomechanics (IACMAG) for the year 2005. He was Chairman, 12th IACMAG, GOA, India, 1-6 October 2008.

He is the recipient of (i) Outstanding Contributions Medal, 2022, IACMAG, for individuals who have made outstanding and seminal research contributions in geomechanics for a longer time, which have been adopted for basic research and practical applications, (ii) Richard Feynman Prize 2014, for the best paper published by the ICE journal, (iii) John R. Booker Excellence Award-2011, which is given by the IACMAG for the advancement of research, education and practice of Environmental Geotechnology and development of novel techniques to simulate contaminant transport in geomaterials, under laboratory and in-situ conditions, (iv) Excellent Contributions Award 2008, IACMAG, to individuals who have a record of significant contributions in research, academic activities, and professional service in different regions of the globe, and (v) Canadian Geotechnical Journal Fredlund Award 2019, for the paper with the highest number of citations among all those published by the journal in previous five years.
Dr. Singh is Fellow of:

1. Indian National Academy of Engineering, New Delhi
2. American Society of Civil Engineers (ASCE) and
3. Institution of Civil Engineers (ICE), London, UK `

COURSE PLAN :

Week 1 : Introduction, Nature of Soil
Week 2 : Natural and Manmade Environments
Week 3 : Physico-chemical Characterization of Soil
Week 4 : Mineralogical Characterization of Soil
Week 5 : Soil-water-air Interaction
Week 6 : Shrinkage and Swelling
Week 7 : Cracking Characteristics of Soil
Week 8 : Hydraulic Conductivity
Week 9 : Mass Transport Phenomena
Week 10 : Thermal and Electrical Properties of Soils
Week 11 : Thermal and Electrical Properties of Soils
Week 12 : Applications