FLOW THROUGH POROUS MEDIA

PROF. SOMENATH GANGULY  TYPE OF COURSE : New | Core_Elective | UG/PG
Department of Chemical Engineering
IIT Kharagpur

COURSE DURATION : 12 weeks (29 Jul’19 - 18 Oct’19)
EXAM DATE : 16 Nov 2019

PRE-REQUISITES : Background in Fluid Mechanics or equivalent is preferred

INTENDED AUDIENCE : Chemical / Mechanical / Civil / Petroleum / Environmental / Biomedical
Engineering Water Resources, Soil Science, Hydrogeology, Agriculture

INDUSTRIES APPLICABLE TO : Chemical Process Industries, Oil & Gas Companies, Environmental
Consultants

COURSE OUTLINE :
A general overview of porous media flow, and introduction to various theoretical tools to characterize
and predict the flow is provided in this course. The course is meant for undergraduate students,
pursuing degrees in various engineering disciplines, listed above. The course will serve as a
refresher course for PG students, who are engaged in research related to porous media flow.

ABOUT INSTRUCTOR :
Prof. Somenath Ganguly teaches at IIT Kharagpur and supervises a research laboratory on
Microstructured Porous Media. He performed research work in the area resulting in several sole-
author publications in Transport in Porous Media (Springer), Journal of Porous Media,
Chemical Engineering Research and Design. Also, he stays abreast with new knowledge in
this field by regularly reviewing manuscripts.

COURSE PLAN :
Week 1: Introduction, Permeability, Porosity, Various forms of characterizations
Week 2: Darcy’s Law, Mass Continuity in Cartesian and Cylindrical Coordinates, Pressure Equations
Week 3: Reynold’s Number for Porous media, Kozeny Carman, and Ergun Equation
Week 4: Transport mechanisms: Bulk and Surface Diffusion, Knudsen Transport, Klinkenberg
effect, slip flow
Week 5: Immiscible displacement, two phase mass continuity, capillary pressure
Week 6: Conceptual models of relative permeability and saturation
Week 7: Progression of saturation front in two phase flow, Buckley Leverett theory
Week 8: Miscible displacement, Diffusion in porous media, Tracer Test
Week 9: Introduction to Taylor Aris Dispersion, Dispersion Regimes
Week 10: Migration and interception of fine particles
Week 11: Introduction to flow through deformable porous media
Week 12: Applications, Summary