Indian Institute of Technology
Course Details Report

Course No: ME7790

Course Name: Heat and Fluid Flow in Porous Media

Course Type:

Theory

Description:

To learn and apply concepts of volume averaging, Darcy law and its extensions, volume averaged energy equations with specific validity to porous medium regions.

Course Content:

Analytical concepts fundamental for the effective modeling of morphology of porous media
Heat and Mass diffusion in fully saturated porous medium systems, Local thermal equilibrium and Effective Stagnant Conductivity Models, Introduction to non-linear heat diffusion equation and applications Momentum transport through single-phase saturated porous media, Permeability, Form-coefficient: their measurement and mathematical modeling
Flow Models: From Darcy to Turbulence.
Forced Convection: First and Second Law of Thermodynamics applied to convection in saturated porous media, Scale analysis, Confined Flow, Transient effects, Convection with variable viscosity.
Natural Convection: external flows over vertical and horizontal plate, similarity solution, transient case: integral method, internal flows: Horton-Rogers-Lap wood problem, constant temperature and heat flux cases with Darcy flow, Transient Effects, Method of asymptotes
Introduction to analysis and design of Porous Medium Enhanced Heat Exchangers, compact heat exchangers as porous media
Introduction to Radiation in saturated porous media: Porous continuum treatment, Scattering, Volume averaging for Independent Scattering, Experimental determination of Radiative properties

Text Books:

1. Transport Phenomena in Micro-scale and Porous Media, by Josè L. Lage, Marcel Dekker, NY, expected pub: May 2004
2. Principles of Heat Transfer in Porous Media, by Massoud Kaviany, 2nd Ed., Springer-Verlag, New York, 1999
3. Convection in Porous Media, by Donald A. Nield & Adrian Bejan, 2nd Ed., Springer-Verlag, 1999.

Reference Books:

None