I. Course Title : Hydro-Chemical Modeling

II. Course Code : SWCE 606

III. Credit Hours : 2+0

IV. Aim of the course

To provide comprehensive knowledge to the students about hydrodynamics of flow through porous media and development of analytical, statistical and numerical models.

V. Theory

Unit I

Review of hydrodynamics in flow through porous media. Miscible displacement, physical processes.

Unit II

Breakthrough curves and mathematical models for miscible displacement. Hydrodynamic dispersion convection equations and its solutions.

Unit III

Statistical models for dispersion. Gaseous (CO_2 and O_2) diffusion equation.

Unit IV

Heat flow through soil by conduction. Concept of adsorption in solute transport.

Unit V

Analytical and numerical models of contaminant transport in unsaturated soil profile and groundwater aquifers.

VI. Learning outcome

Students will be able to demonstrate understanding of hydrodynamics of fluid transport through modeling and will be able to do water quality analysis of lakes and reservoir based physical and chemical characteristics. Develop water reclamation and water reuse plans for irrigation and industries.

VII. Lecture Schedule

S.No.	Topic	No. of Lectures
1.	Review of hydrodynamics in flow through porous media	7
2.	Miscible displacement, physical processes, breakthrough curves	2
3.	Mathematical models for miscible displacement	5
4.	Hydrodynamic dispersion convection equation and its solutions	4
5.	Heat flow through soil by conduction	2
6.	Concept of adsorption in solute transport	2
7.	Analytical and numerical models of contaminant transport in unsaturated soil profile and groundwater aquifers.	6
8.	Statistical models for dispersion	3
9.	Gaseous (CO_2 and O_2) diffusion equation.	3
	Total	**34**

VIII. Suggested Reading

- Larry W Mays 1996. *Water Resources Handbook*. Mc Graw Hill.
- Metcalf and Eddey 1994. *Wastewater Treatment Engineering and Reuse*. John Wiley.
- Soli J Arceivala 1998. *Wastewater Treatment for Pollution Control*. Tata Mc Graw-Hill.