Course title: Water supply and sanitation

Course code WSW 184	**No. of credits** 3	**L-T-P distribution:** 43-2-0	**Learning hours:** 45

Pre-requisite of the course (if any): Passed the course on Water quality monitoring and assessment

Department: Department of Regional Water Studies

Course coordinator(s): Prof. Arun Kansal | **Course instructor(s):** Prof. Arun Kansal

Contact details: aknsal@terisas.ac.in;

Course type: Compulsory Core | **Course offered in:** Semester 2

Course description

The course will deal with technical aspects of drinking water supply and sanitation in an integrated way, pay attention to the choice of technologies and tools, ranging from low cost to advance options.

Course objectives

The course will deal with water supply and distribution, design and operation of conventional water treatment plants for ground and surface water, advance water treatment options, sewage treatment and disposal, planning for water supply projects and pollution control strategies.

Course content

Module	**Topics**	**L**	**T**	**P**
1	**Introduction:** Impact of water pollutants on environment and public health; self-purification of waste in streams; zones of purification; eutrophication; disposal standards and philosophy of MINAS Status of water supply and sanitation sector; key challenges	7	0	0
2	**Public water supply and sanitation schemes:** Planning and preparing water supply projects; water demand; population forecasting; and factors effecting demand; components of water supply schemes; water treatment flow-sheet; estimation of sewage quantity and characteristics; discharge variation; sewage treatment plant flow-sheet; components of water distribution and sewerage systems	7	0	0
3	**Water treatment:** Aeration and types of aerators; purpose and mechanism of flocculation; coagulants used in water treatment; factors influencing coagulation; estimation of coagulant dose; types of flash mixers and flocculators; sedimentation; analysis of discrete and flocculent settling; sedimentation tanks; filtration; types and design of filters; operational issues in filtration; chemical and non-chemical methods of disinfection; factors effecting efficiency of filtration; chick's law; tertiary treatment methods for removal of colour, salinity, hardness, fluorides, Arsenic, iron and manganese (using adsorption, RO; Electro-dialysis; ion-exchange; chemical; and distillation techniques)	15	1	0
4	**Sewage treatment:** Physical treatment methods- screen chamber; grit separators; primary and secondary settling tanks. Biological treatment: Biology of sewage treatment; BOD growth curve and analysis; estimation of BOD rate constant; types of biological treatment processes; process description and design principals; removal of nitrogen and phosphorus, high rate anaerobic treatment processes Sludge stabilization and dewatering systems; Low cost sewage treatment technologies- septic tanks; reed bed; oxidation ponds and lagoons. Urban waste management and sanitation challenges.	14	1	0
	Total	**43**	**2**	**0**

Evaluation criteria

2 minor tests	20% each
Assignments	10%
End-term exam	50%

Learning outcomes

1. Understand water quality concepts and their effect on treatment process selection
2. Appreciate the importance and methods of operation and maintenance of water supply systems;
3. Judge options for centralised and urban systems versus decentralised and rural systems;
4. Define and evaluate project alternatives on basis of chosen selection criteria;
5. Communicate effectively in oral and written presentations to technical and non-technical audiences.

Pedagogical approach

Classroom teaching will involve black board, power point presentations, and case study analysis. The sessions will be interactive and use of scientific calculators in class is essential.

Materials

1. CPHEEO 1999. Manual on water Supply and treatment. 3rd Edition
2. Metcalf & Eddy (2003) Wastewater engineering: treatment and reuse, 4th ed. New Delhi: Tata McGraw-Hill.
3. Nathanson, Jerry A. (2009) Basic environmental technology: water supply, waste management and pollution control, 4th ed. New Delhi: PHI Learning.
4. Qasim, Syed R., Motley, Edward M., and Zhu, Guang (2000) Water works engineering: planning, design and operation. New Jersey: Prentice Hall.
5. Garg, S. K. (2007) Water supply engineering, 18th ed, Vol. I. New Delhi: Khanna Publisher.
6. Garg, S.K. (2007) Sewage disposal and air pollution engineering, 20th ed, Vol. II. New Delhi: Khanna Publisher.
7. Chatterjee, A. K.2010.Water supply, Waste disposal and environmental Engineering, 8th ed. New Delhi: Khanna Publisher.
8. CPHEEO Manual on Sewerage and Sewage treatment, latest edition

Additional information (if any)

Student responsibilities

The course is highly technical so attendance and class participation will be given utmost importance. All assignments should be submitted as per the timeline.

Course reviewers

1. Prof Ram Karan Singh, Department of Civil Engineering, King Khalid University, Saudi Arabia.
2. Prof Narender Kanhe, Principal, Guru Nanak Institute of Engineering and Management, Nagpur.