

Course title: Design of Water supply and sanitation system				
Course code: WSW 186	No. of credits: 4	L-T-P distribution: 43-13-0	Learning hours: 56	
Pre-requisite of the course (if any): Passed any course that discusses various water quality parameters				
Department: Department of Regional Water Studies				
Course coordinator(s): Prof Arun Kansal		Course instructor(s): Prof Arun Kansal		
Contact details: The course has direct relevance to jobs requirements of water consultancy organizations and industries				
Course type: Compulsory Core		Course offered in: Semester 2		
Course Description The course explains treatment technologies used in public water supply and sewage, their operation and design principles. It also includes low cost treatment methods and advanced technologies for unconventional pollutants.				
Course objectives To plan water supply projects and pollution control.				
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		
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		
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	7	
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. Sludge stabilization and dewatering systems; Low cost sewage treatment technologies- septic tanks; reed bed; oxidation ponds and lagoons	14	6	
	Total	43	13	

Evaluation criteria	
2 minor tests	20% each
Assignments	10%
Major	50%
Learning outcomes	
<ol style="list-style-type: none"> 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	
<ol style="list-style-type: none"> 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 has significant technological details and hence attendance and class participation will enhance learning experience.	

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.