Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2019-2020
Course Handout Part II

Date: 06-01-2020

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **CE F342**
Course Title : **Water and Wastewater Treatment**
Instructor-in-Charge : Murari R R Varma

Laboratory Instructors : Rampalli Madhuri
M Mounica
T Venkateswarlu

Scope and Objective of the Course:
The course is designed to give a preliminary understanding of concepts and basics of design of water supply and wastewater systems for a given town/city/locality. The unit operations and processes required in treating of water depending of sources of the raw water are given more emphasis than the distribution network. Similarly the collection of sewage from municipal household and processes involved in the treating the sewage before they can be let out into surface water bodies are discussed. Brief introduction advances in treatment technologies are included in the relevant sections.

Course outcomes:
At the end of the course the student will be able to

1. Evaluate water resources for their quantity, quality and sustainability
2. Estimate the amount of water that needs to be supplied to any given community over a specified period of time.
3. Identify and evaluate pollutants that need to be removed from water or wastewater.
4. Determine the kinds of treatment processes that will be required for treating water depending on the sources and design them.
5. Evaluate the extent and kind of treatment required for wastewater depending on where it is to be discharged, and design appropriate treatment units.
6. Apply appropriate standards and codes for designing water and wastewater treatment plants

Textbooks:

1. Garg, S. K. (2018). *Water Supply Engineering : Environmental Engineering - Vol. I* (31st ed., Vol. 1) Khanna
2. Garg, K. S. (2018). *Environmental Engineering (Vol. II) Sewage Waste Disposal and Air Pollution Engineering* (38th ed., Vol. 2). Khanna.

Reference books

1. Davis, M. L., 2013. *Water And Wastewater Engineering - Design Principles and Practice.* 1st ed. New Delhi: Tata McGraw-Hill Education.
2. Punmia, B. C., Jain, A. K. & Jain, A. K., 2018. *Environmental Engineering - I :Water Supply Engineering.* second ed. New Delhi: Laxmi Publications.
3. Punmia, B. C., Jain, A. K. & Jain, A. K., 2018. *Environmental Engineering - II :Wastewater Egineering (including Air Pollution).* Second Edition ed. New Delhi: Laxmi Publications.

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book	SLOs
1-3	Classify different sources of water and their stressors. Examine potential for exploitation and treatment required to reach drinking water standards.	Sources of water, wastewater	CH-3(T1) CH-1(T2)	a, c, f
4-6	Determine the minimum and desirable amounts of water required for different uses like domestic, public, industrial, institutional, etc. Predict population of a given community for the design period using an appropriate/justifiable method	Population forecasting methods, factors affecting rate of demand	CH-2(T1)	a, c
7-8	Identify pollutants present in water and the levels to which they need to be removed	Common Impurities in water, physical and chemical analysis, Standards of purified water	CH-8(T1)	a, b
9-18	Analyze water quality determine treatment needs using appropriate standards. Explain the different types of settling that are encountered in water and wastewater treatment. Explain the mechanisms and importance of coagulation and flocculation in water and wastewater treatment plants Design appropriate treatment processes to achieve treatment objectives	Important Unit Operations in Water Treatment: Screening, aeration, Sedimentation tanks. Coagulation and flocculation, Design of sedimentation tanks, Filtration: Filtration hydraulics, porous media filters, Softening	CH9(T1), CH-9 (T2)	a, c, e
19-20	Describe the need for disinfection in water or wastewater treatment. Evaluate the merits and demerits of different types of disinfectants. Define terms such as chlorine demand, breakpoint chlorination, and chlorine residuals.	Various approaches for disinfection	CH-9(T1)	a, b
21-22	Describe types of sewerage system and components of sewerage system	Separate and combined Sewerage systems. Estimation of design sewer discharge.	CH-2,5 (T2)	
23-25	Define and describe different methods for estimating oxygen-demand in water, their importance and applications: ThOD, COD and BOD	Wastewater - Physical chemical and biological characteristics, BOD, COD and DO Sag Curve	CH-7(T2)	a, b, c, e
26-28	Differentiate unit processes and unit operations Estimate the quantity and quality of wastewater generated in a community	Unit operations and chemical processes in waste water treatment: Screening procedures, Grit Chamber	CH-9(T2)	a, c

29-37	Describe differences between suspended and attached growth processes, and aerobic and anaerobic. Select an appropriate biological process for water or wastewater treatment. Design a complete suspended/attached growth process for wastewater treatment.	Unit processes: Biological treatment-Trickling Filters, Recirculation, Aeration tanks, Activated sludge systems, various design procedures, Miscellaneous processes: Oxidation ditches and ponds, Aerobic and anaerobic ponds, Sludge Treatment, Thickening	CH-9(T2)	a, c, e
38-40	Explain the various aspects of rural sanitation	Collection and disposal of excreta in unsewered and rural areas, Septic and Imhoff tanks. effluent re-purification and reuse.	CH-12,13 (T2)	a, c
41-42	Describe the different methods for analyzing flows or head losses in distribution networks. Make use of criteria like self-cleansing and maximum velocity to design sewers	Various approaches of design of water distribution system, Design of Sewers	CH-6(T1), CH-4(T2)	a, c

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Semester Test	90 min	30	3/3, 11.00 -12.30 PM	CB
Surprise Quiz	-	10	Continuous	OB
Mini Project	-	5	Continuous	OB
Laboratory	-	20	Continuous	OB
Comprehensive	3 hours	35	04/05 AN	CB

List of Experiments

1	Determination of Turbidity	1 Turn
2	Determination of Calcium/ Magnesium of water	1 Turn
3	Determination of Alkalinity of water	1 Turn
4	Determination of Dissolved Oxygen (DO) of water	1 Turn
5	Determination of Iron/ Fluoride content in water	1 Turn
7	Determination of Chloride/ Sulphate content in water	1 Turn
8	Determination of Residual Chlorine	1 Turn
9	Determination of Nitrate/ Phosphate content in wastewater	1 Turn
10	Determination of COD/BOD content in water & wastewater	1 Turn
11	Determination Solids in Wastewater (TDS,TSS, SVI)	1 Turn
12	Determination of Optimum dose of a coagulant	1 Turn
13	Microbiological examination (Coliform test) Demo	1 Turn

*** Student Learning Outcomes (SLOs) :**

SLOs are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

(a) an ability to apply knowledge of mathematics, science and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Chamber Consultation Hour: On prior appointment.

Notices: All notices concerning the course will be displayed on Google classroom

Make-up Policy: No make-ups are entertained. Make-up will be granted for genuine cases only.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE

CE F342