

Techno India NJR Institute of Technology



Course File

Environmental Engineering (6CE4-03)

Session 2022-23

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Department of CE



RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus 3rd Year - VI Semester: B.Tech. (Civil Engineering)

6CE4-03: ENVIRONMENTAL ENGINEERING

Credit: 3
3L+0T+0P

Max. Marks: 100(IA:30, ETE:70)

End Term Exam: 3 Hours

S N	CONTE NTS	Hour s
1	Introduction: Objective, scope and outcome of the course.	1
2	<i>Water:</i> -Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices. Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design. Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes.	4 5 6
3	<i>Sewage-</i> Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small boresystems, Storm Water- Quantification and design of Storm water. Sewage characteristics: Quality parameters: BOD, COD, TOC, Solids, DO, Nitrogen, Phosphorus, Standards of disposal into natural watercourses and on land, Indian standards. Sewage and Sullage, Pollution due to improper disposal of sewage, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage - quality requirements for various purposes. Wastewater Disposal and Refuse: Disposal of sewage by dilution, Self-purification of streams, sewage disposal by irrigation sewage farming, waste water reuse.	5 4 7 5
4	<i>Air</i> Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air quality standards, Control measures for Air pollution	3
5	<i>Noise-</i> Basic concept, measurement and various control methods.	2
	Total	42

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

Syllabus of 3rd Year B. Tech. (CE) for students admitted in Session 2021-22 onwards.

Course Overview:

Student will learn basics of EVS from this 42-hour course. They will be able to perform operations such as insertion, deal with the protection of people from the effects of adverse environmental effects such as pollution. You will also work on improving the quality of the environment, recycling, waste disposal, public health as well as water and air pollution control. The main areas of environmental engineering include air pollution control, industrial hygiene, radiation protection, hazardous waste management, toxic materials control, recycling, water supply, wastewater management, storm water management, solid waste disposal, public health and land management.

Course Outcomes:

CO. NO.	Cognitive Level	Course Outcome
1	Analysis	Understand demand for water supply to households, industry and public services.
2	Application	Understand source of water and their quality parameter.
3	Design	Analyse the process of preliminary treatment of water and their transmission.
4	Design	Analyse the process of advanced treatment of water.
5	Synthesis	Understand the basic knowledge of water distribution and plumbing system in building.

Prerequisites:

1. Analyze characteristics of water and wastewater
2. Calculate the quantity of drinking water and domestic wastewater generated
3. Illustrate the several types of water demands
4. Demonstrate an integrative approach to environmental issues with a focus on sustainability

Course Outcome Mapping with Program Outcome:

ENVIRONMENTAL ENGINEERING															
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO363.1	3	2	2	2	2	2	2	1	2	1	1	1	2	2	1
CO363.2	3	2	2	2	2	2	1	1	2	1	2	2	2	1	1
CO363.3	3	2	2	2	2	2	1	1	2	1	2	2	2	1	1
CO363.4	2	2	3	3	2	1	3	1	1	1	1	2	2	2	1
CO363.5	2	2	2	3	1	1	2	1	1	2	1	2	2	2	1
CO363 (AVG)	2.6	2	2.2	2.4	1.8	1.6	1.8	1	1.6	1.2	1.4	1.8	2	1.6	1

Lecture No.	Unit	Topic
1	1	INTRODUCTION: Objective, scope and outcome of the course
2	2	WATER: Sources of Water and quality issues
3	2	Student Should be able to write about Water quality requirement for different beneficial uses
4	2	Student Should be able to write about Water quality standards, water quality indices
5	2	Student Should be able to write about Water quality standards, water quality indices
6	2	Student Should be able to write about Water Supply systems, Need for planned water supply schemes
7	2	Student Should be able to write about Water Supply systems, Need for planned water supply schemes
8	2	Student Should be able to write about Water demand industrial and agricultural water requirements
9	2	Student Should be able to write about Components of water supply system; Transmission of water, Distribution system.
10	2	Student Should be able to write about (Contd.) Components of water supply system
11	2	Student Should be able to write about Various valves used in W/S systems, service reservoirs and design.

12	2	Student Should be able to write about Water Treatment: Aeration, sedimentation
13	2	Student Should be able to write about Coagulation flocculation,
14	2	Student Should be able to write about Filtration.
15	2	Student Should be able to write about Disinfection
16	2	Student Should be able to write about Advanced treatments like adsorption, ion exchange, membrane processes
17	3	SEWAGE: Domestic and Storm water, Quantity of Sewage

18	3	Student Should be able to write about Sewage flow variations. Conveyance of sewage- Sewers
19	3	Student Should be able to write about Shapes design parameters, operation and maintenance of sewers
20	3	Student Should be able to write about Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems
21	3	Student Should be able to write about Small bore systems, Storm Water- Quantification and design of Storm water
22	3	Student Should be able to write about Sewage characteristics: Quality parameters: BOD, COD
23	3	Student Should be able to write about TOC, solids, DO, nitrogen, phosphorus.
24	3	Student Should be able to write about Standards of disposal into natural watercourses and on land, Indian standards
25	3	Student Should be able to write about Sewage and Sullage
26	3	Student Should be able to write about Pollution due to improper disposal of sewage
27	3	Student Should be able to write about Pollution due to improper disposal of sewage
28	3	Student Should be able to write about Wastewater treatment: aerobic and anaerobic treatment systems
29	3	Student Should be able to write about Aerobic and anaerobic treatment systems
30	3	Student Should be able to write about Suspended and attached growth systems
31	3	Student Should be able to write about Recycling of sewage – quality requirements for various purposes
32	3	Wastewater Disposal and Refuse: Disposal of sewage by dilution
33	3	Student Should be able to write about Self-purification of streams
34	3	Student Should be able to write about Sewage disposal by irrigation sewage farming
35	3	Student Should be able to write about Wastewater reuse
36	4	AIR: Composition and properties of air, Quantification of air Pollutants
37	4	Student Should be able to write about Monitoring of air pollutants, Air quality standards
38	4	Student Should be able to write about Control measures for Air pollution
39	5	NOISE- BASIC CONCEPT,
40	5	Student Should be able to write about Measurement and various control methods
41		Revision to course work
42		Revision to course work

TEXT/REFERENCE BOOKS

1. S.K. Garg (1999), Water supply Engineering – Environmental Engineering
2. P.N. Modi (2006), Water supply Engineering – Environmental Engineering (Vol.I) – Standard Book House.
3. S.K. Garg (1999), Sewage Disposal and Air Pollution Engineering – Environmental

Course Level Problems (Test Items):

CO.NO.	Problem description
1	<ol style="list-style-type: none">1. Write about importance of safe water in detail2. Write about Requirement of safe water in urban area.3. Write about sources of drinking water and Quality of Drinking water4. Write a short note on Transmission of water and Component of water supply System5. Write about different types of water treatment Process
2	<ol style="list-style-type: none">6. Write a note on Domestic and Storm Water7. Explain in detail about BOD of Sewage8. Write a note on DO and COD of Sewage9. Explain in detail Process of Wastewater Treatment10. Explain in detail Methods of Sewage Treatment
3	<ol style="list-style-type: none">11. Explain in detail about Composition of Air Pollution12. Write a note on Quantification of Air Pollutants13. How can we Monitoring the Air Pollution?14. Explain in detail Air Quality Standards15. Write a note on Control and Measures of Air Pollution
4	<ol style="list-style-type: none">1. What is Noise and How we will Measure it2. What are Typical Decibel Levels of some Common Sounds3. Explain in detail BIS standards for pollutant in Air and noise4. What are effects of Noise on Humans health5. Write a note on Types of Pollutants in detail

Assessment Methodology:

1. Practical exam in lab where they have to write Tests Related to the Quality of Water and Sewage . (Once in a week)
2. Assignments one from each unit.

3. Midterm subjective paper where they have to write About all Study Of Environmental Engineering (Twice during the semester)
4. Final paper at the end of the semester subjective.

Teaching and Learning resources

Unit-1

Water

Video Tutorials https://www.youtube.com/watch?v=LiL0_sfdhQ0

_Water Quality

https://www.youtube.com/watch?v=ZHYvoSF_BKk

Water Supply System

<https://www.youtube.com/watch?v=b4stML-Mt9s>

Water Treatment

<https://www.youtube.com/watch?v=6u9L0nVUYPY>

Theory concepts

Water Quality

https://www.who.int/water_sanitation_health/resourcesquality/wqachapter1.pdf

Water Supply System

<https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture-notes/env-health-science-students/In-water-supply-i-final.pdf>

Water Treatment <https://web.iitd.ac.in/~arunku/files/CVL100/L8.pdf>

Sample Quiz: <https://www.ruvival.de/water-quantity-quality-quiz/>

<https://www.objectivebooks.com/2018/03/exam-test-questions-on-water-supply.html>

Unit 2

Sewage

Video Tutorials <https://www.youtube.com/watch?v=-clXHOKhfmA>

Quantity of Sewage

https://www.youtube.com/watch?v=pW3kB285_Ig

Sewage Characteristics

https://www.youtube.com/watch?v=z2I3_RSucqg

waste water Disposal and Reuse

<https://www.youtube.com/watch?v=cNiy1kR-W74>

Theory concepts: <https://nptel.ac.in/courses/105/104/105104102/>

Quantity of Sewage

https://www.youtube.com/watch?v=pW3kB285_Ig

Sewage Characteristics

https://www.youtube.com/watch?v=z2I3_RSucqg

waste water Disposal and Reuse

<https://www.youtube.com/watch?v=cNiy1kR-W74>

Sample Quiz: <https://www.objectivebooks.com/2016/04/waste-water-engineering-mcq-practice.html>

Unit 3

Air

Video Tutorials <https://www.youtube.com/watch?v=uivuzDeEe1Q>

Theory concepts: <https://nptel.ac.in/courses/105/102/105102089/>

Sample Quiz: <https://quizizz.com/admin/quiz/572a0725d8da6c2816b69ab2/air-pollution>

Unit 4

Noise

Video Tutorials Video Tutorials <https://www.youtube.com/watch?v=AQ4BakagMvM>

Theory concepts: <https://nptel.ac.in/courses/112/104/112104227/>

Sample Quiz: <https://quizizz.com/admin/quiz/572a0725d8da6c2816b69ab2/air-pollution>

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

B. TECH 3rd – YEAR (VI SEM.) CIVIL ENGINEERING

Environment Engineering (6CE3-03)

Assignment 1:

1. What are the factors affecting the selection of surface sources of water
2. Explain different types of water demands.
3. Explain hydrological cycle with diagram.
4. What are different physical & chemical characteristics of water?
5. Explain the functioning of sedimentation tanks, with diagram.
6. Explain functioning of slow sand filters, with diagrams.

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

B. TECH 3rd – YEAR (VI SEM.) CIVIL ENGINEERING

Environment Engineering (6CE3-03)

Assignment 2

1. Write a note on grit removal tanks.
2. What do you understand by the quality & characteristics of sewage?
3. Define activated sludge process.
4. What is sewage farming?
5. With the help of flow dig, explain the working of WTP, enumerating the impurities getting removed at each step.
6. Write in detail about functioning & construction of Trickling Filters.
7. Calculate 1 day 37°C BOD of sewage sample whose 5 day 20° BOD is 100mg/l.
Assume K_d at 20°C as 0.1
8. Write a note on disposal by dilution.
9. What is the effect of SO_x NO_x, & SPM on human beings? What are their permissible limits in air?
10. Describe methods to control air pollution

MCQ's:

1. The term 'Sullage' refers to:
 - a) Fresh wastewater
 - b) Septic wastewater
 - c) Wastewater from kitchen, laundry
 - d) Toxic wastewater
2. Wastewater can become septic by the loss of:
 - a) Dissolved oxygen content
 - b) Carbon content
 - c) Organic compounds
 - d) Water content
3. Which one of the below is not an attribute of drinking water?
 - a) Aesthetics
 - b) Economic
 - c) Safety
 - d) Source
4. The extent of water treatment depends on how many factors?
 - a) 5
 - b) 2
 - c) 3
 - d) 4
5. One of the major objectives of water treatment plants is the removal of turbidity.
 - a) True
 - b) False
6. What is added to the water treatment tank to settle the colloidal particles?
 - a) Alum
 - b) Alum and lime
 - c) Lime
 - d) Potash
7. Disinfection of water in our country is mainly done by _____
 - a) Oxygenation
 - b) Hydration
 - c) Chlorination
 - d) Filtration
8. Which minerals and in what form are present in ground water?
 - a) Fe & Mn in Ferrous and Manganous
 - b) Fe & Cu in Ferric and Cupric
 - c) Fe & Mn in Ferric and manganous
 - d) Cu & Mn in Cuprous and manganous

9. How many types of wastewater treatment plants are there based on the type of wastewater?

- a) 5
- b) 4
- c) 2
- d) 3

10. On how many conditions does the intervention of wastewater depend on?

- a) 5
- b) 7
- c) 6
- d) 4

Solution: 1.c , 2.a, 3.d, 4.b, 5.a, 6.b, 7c, 8.a, 9.d, 10.b



TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY UDAIPUR

Civil Engineering Department

B. TECH III- YEAR (VI Sem.)

II MID-TERM (2020-2021)

SUBJECT –ENVIRONMENTAL ENGINEERING (6CE4-03)

Time: 1Hr 30 minutes + 15 Minutes for Submission

Max. Marks: 40

Attempt any five questions.

[5 * 8 =40]

1. Explain the composition and importance characteristics of sewage. **[CO1]**
2. List out the difference as well as advantages and disadvantages of various sewerage systems. **[CO1]**
3. Define BOD and COD. What is the difference between them? Write their significance in waste water treatment. **[CO2]**
4. Explain **any two** following terms: **[CO2]**
i) Sewerage ii) Sullage iii) Sewage iv) Drinking Water & Domestic waste water
5. Determine 2-day BOD and ultimate BOD for a sewage having 5 Days BOD at 20° C as 180 ppm. Assume the base 10 rate constant $k = 0.1$ per day. **[CO2]**
6. Explain various methods of sewage disposals. **[CO3]**
7. Calculate the diameter of a circular sewer laid at slope of 1 in 400 when it is running half full and with a velocity of 1.9 m/s, assuming manning's coefficient n as **0.012** **[CO3]**

Previous Year Question Papers:

6E 6033	Roll No. _____	[Total No. of Pages : 3]
	6E 6033	
B.Tech. VI-Semester (Main & Back) Examination, April-2019 Civil Engineering 6CE3A Environmental Engineering - II		

Time : 3 Hours

Maximum Marks : 80
Min. Passing Marks : 26

Instructions to Candidates:

Attempt any **Five questions**, selecting **One question** from each unit. All Questions carry **equal marks**. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly).

Unit - I

1. a) Explain the importance of determination of solids in sewage. How do you determine the suspended solids in a given sample of waste water? (8)
- b) Data from an unseeded domestic waste water BOD test are: 5 ml of waste water in 300 ml bottle, initial DO of 7.8 mg/l and 5 days DO equal to 4.3mg/l. Find out BOD and the ultimate BOD. Assume a k-rate of 0.10 per day. (8)

(OR)

1. a) Write notes on following:
- i) Population Equivalent
 - ii) TOC
 - iii) COD/TOC Ratio
 - iv) Sullage and sludge (4×2=8)
- b) The BOD_5 of a waste water is 150mg/l at 20°C. The k value is known to be 0.23 per day. What would be BOD_8 if the test was run at 15°C? (8)

Unit - II

2. a) What are different components of pumping stations? (8)
- b) A 350 mm dia sewer is to flow at 0.35 depth on a grade ensuring a degree of self-cleansing equivalent to that obtained at full depth at a velocity of 0.8 m/sec. Find : (8)
- i) The required grade
- ii) Associated velocity

Given that :

Manning's rugosity coefficient = 0.014

Proportionate area = 0.315

Proportionate wetted perimeter = 0.472

Proportionate HMD (γ/R) = 0.7705

(OR)

2. a) What are properties of sewer materials? Explain different types of sewer materials. <http://www.rtuonline.com> (8)
- b) A rectangular sewer with width 2 times its depth is hydraulically equivalent to a circular one. Find the relation between the width of the rectangular sewer and the diameter of the circular sewer. (8)

Unit - III

3. a) Draw a sketch of sewerage treatment plant and explain each unit briefly. (8)
- b) A rectangular grit chamber is designed to remove particles with a diameter 0.2mm specific gravity 2.65. The settling velocity have been found to be 0.020 m/sec. A flow through velocity of 0.3 m/sec will be maintained by proportioning weir. Determine the channel dimensions for a maximum waste water flow of 20,000 cu m/day. (8)

(OR)

3. a) Explain the various operation and units of an activated sludge plant. (08)
- b) A sewage contains 550 ppm of suspended solids. 2.25 million litres per day is treated in a sedimentation tank. The tank removes 50% of suspended solids. Calculate the quantity of sludge produced per day in bulk and weight of it, if the moisture content of sludge is 94%. (8)

Unit - IV

4. a) Critically discuss one and two pipes systems of plumbing. (8)
b) Write a detailed explanatory note on the self-purification of streams with neat sketch. (8)

(OR)

4. Write notes on following:
- a) P, Q and S traps in sanitary plumbing systems.
 - b) Dilution standards for waste water have different degree of BOD.
 - c) Importance of sewage disposal by irrigation sewage farming.
 - d) Sewage plans of buildings and their testing. (4×4=16)

Unit - V

5. Write notes on following: <http://www.rtuonline.com>
- a) Acid rains and their harmful effects on environment.
 - b) Emission standards for various polluttional gases.
 - c) Ozone depletion and effects.
 - d) Global warming and greenhouse gases. (4×4=16)

(OR)

5. Explain the following: (8)
- a) Octave Band analysis.
 - b) Effect of air pollution on human health. (8)
-

Roll No. _____

[Total No. of Pages : 2]

6E1543**6E1543****B.Tech. VI Sem.. (Main/Back) Examination, June - 2022****Civil Engg.****6CE4-03 Environmental Engineering****Time : 3 Hours****Maximum Marks : 120****Min. Passing Marks : 42****Instructions to Candidates:**

Attempt all ten questions from Part A, five questions out of Seven from Part B and Four questions out of Five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

Part - A**(Answer should be given up to 25 words only)****All questions are compulsory****(10×2=20)**

1. Describe about the term 'water softening'.
2. What are the prime functions of service Reservoir.
3. Define Design period.
4. What are the different pipe materials, which are commonly used for water conveyance.
5. Give the maximum acceptable limit of the following for the public drinking water.
 - a. Color.
 - b. pH.
 - c. Chlorides.
 - d. Sulphates.
6. What factor control water supply to building.
7. Give the flow diagram of a conventional municipal waste water treatment.
8. List out any four indoor air pollutants.
9. Describe noise pollution standards.
10. Define sullage and sewage.

Part - B

(Analytical/Problem solving questions)

Attempt any five questions (5×8=40)

1. Discuss the merit and demerits of separate and combined system of sewage. (8)
2. Explain the sedimentation process used in water treatment plant. (8)
3. Determine the size of a circular sewer for a discharge of 800 litres per second running half full. Assume $S = 0.0001$ and $n = 0.015$. (8)
4. Define BOD. What is the significance of 5 day BOD determination? What is the role of temperature in BOD satisfaction. (8)
5. Describe noise pollution and the ways of reducing noise pollution. (8)
6. Describe the primary and secondary air pollutants and their ill effects. (8)
7. Describe the various water distribution systems and compare them. (8)

Part - C

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any Four questions (4×15=60)

1. a. What is the effect of SO_x, NO_x and SPM on human beings? What are their permissible limits in air. (8)
b. Describe methods of controlling air pollution. (7)
2. a. What is sewage farming? What are its advantages over the methods of disposal of sewage by dilution. (8)
b. Explain briefly the principles of working of aerobic, anaerobic and Facultative type of stabilization ponds. (7)
3. a. Write down the physical, chemical and biological water quality standards for drinking water. (8)
b. Discuss the common impurities found in water along with their adverse effect. (7)
4. a. With the help of a flow diagram, describe the unit process in a municipal water treatment system. Also describe what kind of impurities will be removed after the end of each process. (8)
b. Explain the working of a rapid sand filter with neat sketch. What are the desirable qualities of filter media. (7)
5. a. The population of a city as per the census record available is as follows.

Census year	1951	1961	1971	1981	1991	2001	2011
Population	24835	29578	36147	49960	57620	67832	74638

Estimate the population of the city after four decades by Arithmetical increase, Geometrical increase and Incremental increase method. (8)

b. The BOD of a sewage sample when incubated for 7 days at 30°C was 450 mg/litre. Calculate the 5 days BOD at 20°C. (7)