

Academic Course Description

BHARATH UNIVERSITY
 Faculty of Engineering and Technology
 Department of Civil Engineering
**BCE074 Physical and Chemical Treatment
 Of Water and Wastewater**
 Sixth Semester, 2016-17 (Even Semester)

Course (catalog) description

The purpose of this course is to educate the student on the working principles and design of various physical and chemical treatment systems for water and wastewater.

Compulsory/Elective course : Elective course for Civil students

Credit / Contact hours : 3 credits / 45 hours

Course Coordinator : Dr P.Rajasulochana, Professor

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@bharathuniv.ac.in)	Consultation
Dr P.Rajasulochana	Third year Civil	Civil Block			9.00 - 9.50 AM
Ms.B.Saritha	Third year Civil	Civil Block		saritha.civil@bharathuniv.ac.in	12.45 - 1.15 PM

Relationship to other courses:

Pre –requisites : BCE505 Environmental Engineering

Assumed knowledge : Basic knowledge in Water and Wastewater Treatment

Following courses : NIL

Syllabus Contents

UNIT I INTRODUCTION 9

Pollutant in water and wastewater – characteristics, standards for performance – significant and need for physic – chemical treatment.

UNI II PHYSICAL TREATMENT PRINCIPLES 9

Principles of screening – mixing, equalizations –sedimentation – filtration –modeling –backwashing – evaporation-incineration- gas transfer-mass transfer coefficients. Adsorption-isotherms-principles, equilibrates and kinetics, reactors, regeneration, membrane separation, reverse osmosis, nano filtration ultra filtration and hyper filtration – electro dialysis, distillation – stripping and crystallization-recent advances.

UNIT III CHEMICAL TREATMENT PRINCIPLES 9

Principles of chemical treatment – coagulation flocculation – precipitation –floatation, solidification and stabilization- disinfection .ion exchange, electrolytic methods -Solvent extraction –advanced oxidation / reduction –recent advances.

UNIT IV DESIGN OF CONVENTIONAL TREATMENT PLANTS 9

Selection of unit operation and processes – design of conventional water treatment plant units –aerators –

chemical feeding –flocculation –clarifier – filters –rapid sand filter, slow sand filter, pressure filterchlorinators. Displacement and gaseous type. layouts- flowcharts –hydraulic profile –O & M aspects case studies , residue management – up gradation of existing plants – recent advances.

UNIT V DESIGN OF INDUSTRIAL WATER TREATMENT AND ECLAMATIO 9

Selection of process –design of softeners – demineralisers –wastewater reclamation – reverse osmosis plants –residue management – O & M aspects –recent advances –case studies.

TEXT BOOKS:

1. Eckenfalder W.W, "Industrial Water Pollution Control", McGraw Hill, New York, 1989.
2. Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse Tata McGraw-Hill, New Delhi, 2003.
3. Casey, T.J. Unit Treatment Processes in Water and Wastewater Engineering, John Wiley and Sons, London 1993.

REFERENCES:

1. Arceivala S.J & Shyam Asolekar R, "Waste Water Treatment and Pollution Control Tata McGraw Hill, 1998.
2. Nelson Leonard Nemerow, " Theories and practice of industrial waste treatment", Addison Wesley Pub. Co., 1963
3. World Bank Group "Pollution prevention and Treatment Hand Book" World Bank and UNEP Washington DC, 1998.
4. Manual on water supply and Treatment CPHEEO, Ministry of Urban Development ,GOI, New Delhi, 1999.
5. Lee ,CC and Shun dar Lin , Handbook of Environmental Engineering Calculations, McGrawhill, Newyork , 1999.
6. Qasim, S.R motely, E.N., Zhu, G. Water Works Engineering – Planning, Design and Operation, Prentice Hall, New Delhi, 2002.

Computer usage: NIL

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area: Physical and chemical Treatment Methods of Water and Wastewater

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	February 1 st week	Session 1 to 14	2 Periods
2	Cycle Test-2	March 2 nd week	Session 15 to 28	2 Periods
3	Model Test	April 1 st week	Session 1 to 45	3 Hrs
4	University	TBA	All sessions / Units	3 Hrs.

	Examination			
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Mapping of Instructional Objectives with Program Outcome

This Course is to introduce the principles of various surveying methods and applications to Civil Engineering projects.	Correlates to program outcome		
	H	M	L
1. To make them understand the fundamentals of waste water treatment .To learn about the various Pollutants in water and waste water and also to study about their characteristics.	a	e	j
2. To understand about the methods of waste characterization , source reduction and to study the various methods of generation of wastes.		d,g	i
3. To understand in detail about the various principles of chemical treatment which include precipitation coagulation etc.	a,f	b,c,g	a
4. To improve the knowledge on the Selection of unit operation and processes and to study the design oriented aspects of sand filters and other treatment processes.	g		i
5. To know about the basics of the design of industrial waste water treatment and reclamation processes	a,e	b,g	j

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Session	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I INTRODUCTION			
1.	Pollutant in water	No	[T1,T2, R2]
2.	Pollutant in wastewater	No	
3.	Characteristics of water	No	
4.	Characteristics of wastewater	No	
5.	standards for performance	No	
6.	Significance of physical treatment	No	
7.	Significance of physical treatment	No	
8.	Significance of chemical treatment	No	
9.	Significance of chemical treatment	No	
UNIT II PHYSICAL TREATMENT PRINCIPLES			
10.	Principles of screening	No	[T2,T3 & R3]
11.	mixing, equalizations	No	
12.	Sedimentation – filtration –modeling –backwashing	No	
13.	Evaporation-incineration- gas transfer-mass transfer coefficients.	No	
14.	Adsorption-isotherms-principles, equilibrate and kinetics reactors, regeneration	No	
15.	Membrane separation, reverse osmosis, nano filtration ultra filtration and hyper filtration	No	
16.	Electro dialysis, distillation	No	
17.	Stripping and crystallization	No	
18.	Recent advances	No	
UNIT III CHEMICAL TREATMENT PRINCIPLES			
19.	Principles of chemical treatment	No	[T1 & R1,R5]
20.	Coagulation flocculation	No	
21.	Precipitation –floatation	No	
22.	Solidification and stabilization	No	
23.	Disinfection .ion exchange	No	
24.	Electrolytic methods	No	
25.	Solvent extraction	No	
26.	Advanced oxidation / reduction	No	
27.	Recent advances	No	
UNIT IV DESIGN OF CONVENTIONAL TREATMENT PLANTS			
28.	Selection of unit operation and processes	No	
29.	Design of conventional water treatment plant units	No	

30.	aerators – chemical feeding –flocculation –clarifier – filters – rapid sand filter, slow sand filter	No	[T1,T3 & R1,R4]
31.	pressure filter,chlorinators. Displacement and gaseous type layouts-	No	
32.	flowcharts –hydraulic profile –O & M aspects	No	
33.	case studies	No	
34.	Residue management	No	
35.	Up gradation of existing plants	No	
36.	Recent advances	No	
UNIT V DESIGN OF INDUSTRIAL WATER TREATMENT AND ECLAMATION			
37.	Selection of process.	No	[T3 & R1,R6]
38.	Design of softeners	No	
39.	Demineralisers	No	
40.	Wastewater reclamation	No	
41.	Reverse osmosis plants	No	
42.	Residue management	No	
43.	O & M aspects	No	
44.	Recent advances	No	
45.	Case studies	No	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	5%
assignment	-	5%
Attendance	-	10%
Final exam	-	70%

Prepared by: Dr.M.P.Chockalingam ,Professor , Department of Civil

Dated :

Addendum**ABET Outcomes expected of graduates of B.Tech / Civil / program by the time that they graduate:**

- 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 hardware and software 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.

Program Educational Objectives**PEO1: PREPARATION**

Civil Engineering graduates will have knowledge to apply the fundamental principles for a successful profession and/or for higher education in Civil Engineering based on mathematical, scientific and engineering principles, to solve realistic and field problems that arise in engineering and non engineering sectors

PEO2: CORE COMPETENCE

Civil Engineering graduates will adapt to the modern engineering tools and construction methods for planning, design, execution and maintenance of works with sustainable development in their profession.

PEO3: PROFESSIONALISM

Civil Engineering Graduates will exhibit professionalism, ethical attitude, communication and managerial skills, successful team work in various private and government organizations both at the national and international level in their profession and adapt to current trends with lifelong learning.

PEO4: SKILL

Civil Engineering graduates will be trained for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS

Civil Engineering graduates will be installed with ethical feeling, encouraged to make decisions that are safe and environmentally-responsible and also innovative for societal improvement.

Course Teacher	Signature
Dr P.Rajasulochana	
Ms.B.Saritha	

Course Coordinator

HOD/CIVIL