NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF CIVIL ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	M.TECH - ENVIRONMENTAL ENGINEERING		
Course Title	Environmental Process Chemistry and Microbiology		
Course Code	CE701	**No. of Credits**	3
Course Code of Prerequisite subject(s)	NA	**Semester**	I
Session	July 2021	**Section (if, applicable)**	NA
Name of faculty	Dr. E. Aravinth Siva Subramaniam	**Department**	Civil Engineering
Email	aravinth@nitt.edu	**Mobile No.**	8903656204
Name of course coordinator(s)(if applicable)		-	
E-mail	-	**Telephone No.**	-
Course Type	Programme Core		

Syllabus (approved in Senate)

Environmental chemistry - chemical equilibria and kinetics fundamentals, chemical thermodynamics; acid base equilibria – equilibrium diagrams alkalinity and acidity, carbonic acid system, buffer and buffer intensity; gas laws; solubility equilibria – removal of heavy metals from complex water and wastewater systems; oxidation reduction equilibria – stability diagrams – application of redox chemistry; water stabilization – Langlier saturation index Caldwell Lawrence diagrams, water softening and neutralization – chemical precipitation; microbiological concepts – classification of microorganisms – prokaryotic, eukaryotic, structure – microbial metabolism – respiration and energy generation – microbial growth – enzyme kinetics – microbiology of wastewater treatment

COURSE OBJECTIVES

1. To study the basic concepts of environmental chemistry and acid base equilibria
2. To use the solubility equilibria approach for the removal of heavy metals from water and wastewater
3. To discuss the application of redox chemistry in water and wastewater treatment
4. To describe the characteristics and growth kinetics of microbial populations

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
On completion of the course, the students will be able to:	
CO1. infer the chemical processes involved in the treatment of water and wastewater	
CO2. apply the concepts of solubility equilibria and redox chemistry for treatment of industrial wastewater	
CO3. quantify the dosage of chemicals requirement based on chemical reactions in water treatment	
CO4. differentiate between different microbial species and their growth kinetics	

	1	2	3	4	5	6	7	8	9	10	11
CO1	3	3	5	5	5	3	1	1	3	1	5
CO2	3	5	5	5	5	3	1	1	3	5	5
CO3	5	1	5	3	5	3	1	1	1	1	5
CO4	3	1	1	5	1	3	1	1	1	1	5

1. Scholarship of knowledge 2. Critical thinking 3. Problem solving 4. Research skill 5. Usage of modern tools 6. Collaborative and multidisciplinary work 7. Project management and finance 8. Communication 9. Life-long learning 10. Ethical practices and social responsibility 11. Independent ad reflective learning

COURSE PLAN – PART II

COURSE OVERVIEW

This course offers to develop the understanding the strength of various materials used for construction purposes using various techniques and equipment. Knowledge gained in this course will help in identifying and choosing the materials for various construction activities.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week 1 (Sep 6 to Sep 10)	Chemical equilibria, kinetics, and fundamentals	Online through MS Teams
2	Week 2 (Sep 13 to Sep17)	Acid-base equilibria and equilibrium diagrams – alkalinity and acidity	
3	Week 3 (Sep 20 to Sep24)	Carbonic acid system, buffer and buffer intensity	
4	Week 4 (Sep 27 to Oct 1)	Gas Laws; Gas-liquid equilibria - Solubility Equilibria	
5	Week 5 (Oct 4 to Oct 8)	Removal of Heavy Metals from Complex Water and Wastewater Systems:	
6	Week 6 (Oct 11 to Oct 15)	Oxidation Reduction Equlilibria - Stability Diagrams	
7	Week 7 (Oct 18 to Oct 22)	Application of Redox Chemistry	
8	Week 8 (Oct 25 to Oct 29)	Water Stabilization, Langelier Saturation Index - Caldwell Lawrence Diagrams -	
9	Week 9 (Nov 1 to Nov 5)	Water Softening and Neutralization - Chemical Precipitation	

10	Week 10 (Nov 8 to Nov 12)	*Mid semester examination*. Introduction to environmental organic chemistry
11	Week 11 (Nov 15 to Nov 19)	Partitioning of organic compounds between different phases – octanol-water partition constant
12	Week 12 (Nov 22 to Nov 26)	Microbiological concepts - classification of microorganisms - prokaryotic, eukaryotic, structure
13	Week 13 (Nov 29 to Dec 3)	Microbial metabolism - respiration and energy generation
14	Week 14 (Dec 6 to Dec 10)	microbial growth-enzyme kinetics – bio kinetics
15	Week 15 (Dec 13 to Dec 17)	Microbiology of wastewater treatment
16	Week 16 (Dec 20 to Dec 24)	End semester examination

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week	Duration (min)	Weightage (%)
1	In class problems	-	-	10
2	Quiz (First class on every week)	-	10	15
3	Problem sets – 3 Nos.	-	-	20
4	Mid semester examination	Week 10	180	20
4a	*Compensation examination*	*Week 11*	*180*	*20*
5	Term Paper	Week 15	-	5
6	End semester examination	Week 16	120	30
Total (1+2+3+4/4a+5+6)				**100**

COURSE EXIT SURVEY

- Feedback from the students during class committee meetings
- Exit survey from the students at the end of the session

COURSE POLICY

ATTENDANCE

- Every student should maintain a minimum attendance of 75% during the contact hours and assessment.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final semester

MODE OF CORRESPONDENCE (email/ phone etc)

- All the correspondence regarding the course will be communicated through webmail or intimated during class hours.
- Queries/ Clarifications (if necessary) may be e-mailed to aravinth@nitt.edu or can be communicated directly during Institute working hours.

ACADEMIC HONESTY & PLAGIARISM

- Attending all the quizzes is mandatory for every student.
- Copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

MINIMUM PASS MARKS

- The student is expected to score the maximum of half of the average marks or one third of maximum marks to pass the course.

ADDITIONAL INFORMATION

Reference Textbooks:

1. Benjamin, M. M., Water Chemistry, 2nd edition, Waveland Press, Inc: Long Grove, Illinois, 2015
2. Benfield, L.D.; Weand, B.L.; Judkins, J.F., Process chemistry for water and wastewater, Prentice Hall Inc., Englewood cliffs, New Jersey, 1982
3. Weber Jr., W.J., Physico-chemical process for water quality control, Wiley Inc, Newyork, 1972
4. Stumm, W., & Morgan, J. J. (2012). Aquatic chemistry: chemical equilibria and rates in natural waters 3rd Edition John Wiley & Sons.
5. Schwarzenbach, R. P., Gschwend, P. M., & Imboden, D. M., Environmental organic chemistry. John Wiley & Sons, 2016
6. Tortora G.J; Furke, B.R.; Case, C.L., Microbiology – An Introduction (11th Ed.), Benjammin/Cummings Publication Co. Inc, California, 2013
7. Pelczar, M. J., Chan, E.C.S., and Kreig, N.R., Microbiology, 5th Edition, Tata Megrawgill, New Delhi, 1993

FOR APPROVAL

Dr. E. Aravinth Siva Subramaniam	Dr. J. Karthikeyan	Dr. G. Swaminathan
Course Faculty	**CC-Chairperson**	**HOD/Civil Engineering**