



**University of Kerala**

Discipline	CHEMISTRY				
Course Code	UK4SECICHE200				
Course Title	WATER QUALITY ANALYSIS				
Type of Course	SEC				
Semester	4				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4
Pre-requisites	Basic knowledge, practical skills and interest in chemistry				
Course Summary	The course cover water quality parameters, different types of water, removal of hardness of water, qualitative and quantitative analysis of different contaminant of water, different types of contaminants of water and real sample analysis f water and its application in environment.				

**Detailed Syllabus:**

Module	Unit	Content	Hrs
		<b>WATER QUALITY ANALYSIS</b>	<b>60</b>
<b>I</b>		<b>QUALITY PARAMETERS FOR DRINKING WATER</b>	<b>6</b>
	1	Contaminants vs pollutants	1
	2	Water quality parameters and their interaction	2
	3	Physical and chemical characteristics - turbidity, colour – temperature - chemical constituents, taste, colour, acidity, alkalinity - CO <sub>2</sub> , pH.	3
<b>II</b>		<b>HARD AND SOFT WATER, CHEMICAL AND BIOLOGICAL CONTAMINATION OF WATER</b>	<b>12</b>
	4	Classification of water, difference between soft and hard water	2
	5	Causes of hardness, removal of temporary and permanent hardness	2
	6	Standard for drinking water as per WHO and BIS specifications, application in environmental situation.	2
	7	Chemical contaminant- classification- inorganic, organic-health effects, and removal.	3
	8	Biological contaminants- type of contaminants, health effects and remedial measures.	3
<b>III</b>		<b>QUALITATIVE AND QUANTITATIVE ANALYSIS</b>	<b>6</b>
	9	Chloride, Nitrite, nitrate, phosphate, ammonia	2
	10	BOD, COD, DO, pH	2

	11	Estimation of hardness of water, Jar test- water quality enhancement.	2
<b>IV</b>	<b>REAL SAMPLE ANALYSIS - CASE STUDIES</b>		<b>6</b>
	12	Collection of samples from different area	4
	13	Application in environment	2
<b>V</b>	<b>PRACTICALS</b>		<b>30</b>
	<b>A</b>	<b>Section A (Any 5 experiments from the following 1 &amp; 2 are compulsory)</b>	<b>18</b>
	1	Qualitative determination of chloride, nitrite, nitrate, phosphate, ammonia	
	2	Estimation of hardness of water-total hardness by complexometric method, temporary hardness by acid base titration	
	3	Determination of pH, Temperature, Electrical Conductivity (EC), and Total Dissolved Solids (TDS)	
	4	Determination of Turbidity	
	5	Determination of Total Suspended Solids (TSS) and Total Dissolved Solids (TDS)	
	6	Determination of Alkalinity by Titration	
	7	Determination of Chloride by Argentometric Titration (Mohr's Method)	
	8	Determination of Dissolved Oxygen (DO) by Winkler's Method	
	9	Determination of Biochemical Oxygen Demand (BOD)	
	10	Determination of Chemical Oxygen Demand (COD)	
	11	Determination of Heavy Metals by Colorimetric or Instrumental Method (Eg- estimation of Cr etc.)	
	12	Jar test – water quality treatment	
	<b>B</b>	<b>Section B (OPEN ENDED)</b>	<b>12</b>
		Hands on sessions, seminar presentations, group discussions, debates, quizzes, case studies etc on the above modules - field trip to a local water body to collect samples - analyze the collected water samples for various parameters such as pH, dissolved oxygen, turbidity, temperature, conductivity, nutrient levels etc and compare the results with established water quality standards – presentation of the findings and remediation proposals - designing educational materials (brochures, posters etc) about water quality and its importance for public health – <b>(Or any other related activities introduced by the teacher)</b>	

#### REFERENCES

1. De., *Environmental Chemistry*, 6<sup>th</sup> Edition, New Age International, 2006.
2. P.K.Goel, *Water Pollution, Causes, Effects and Control*, New Age International Pvt Ltd. 2006.
3. Kochu Baby Manjooran, *Modern Engineering Chemistry* (Kerala University), Kochi Kannatheri Publications 2005.
4. Shashi Chowla, *Engineering Chemistry*, Dhanpat Rai Publishing Company, 2017.

5. P. C. Jain and Monika Jain, “*Engineering Chemistry*” Dhanpat Rai Publishing Company (P) LTD, New Delhi, 15<sup>th</sup> edition, 2015.
6. Dr. K. Mukkanti, *Environmental studies*, S Chand & Company 2010.
7. R.K. Trivedi and P.K. Geol, *Chemical and biological method for water pollution*, Environmental publications, 1986.

**Course Outcomes**

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	To apply standard analytical methods to determine key physical and chemical water-quality parameters and use the results to distinguish contaminants from pollutants and interpret their implications for overall water quality.	Ap	PSO-1,2,3,4
CO-2	To analyse the chemical and biological characteristics of water and evaluating the sources, health impacts, and mitigation strategies for inorganic, organic, and biological contaminants.	An	PSO-1,2,3,4
CO3	To evaluate water quality by interpreting the experimental results and by assessing the effectiveness of water-treatment procedures such as the Jar test, thereby making informed judgments on overall water quality and suitability for various applications.	E	PSO-1,2,3,4
CO4	To design and perform real-sample water analysis projects demonstrating the application of chemical principles to assess and address environmental quality issues.	C	PSO-1,2
CO5	To design and execute comprehensive water-quality assessment projects, interpret the resulting data against established water-quality standards.	C	PSO-1,2,3,4,5

**R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**

**Name of the Course: WATER QUALITY ANALYSIS**

**Credits: 2:0:2 (Lecture:Tutorial:Practical)**

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	CO1	PO-1,6,8 PSO-1,2,3,4	Ap	F, C	L	-
2	CO-2	PO-1,2,3,6,8 PSO-1,2,3,4	An	C, P	L	-
3	CO3	PO-1,2,3,6,8 PSO-1,2,3,4	E	C, P	L	-
4	CO4	PO-1,6 PSO-1,2	C	C, P	L	-
5	CO5	PO-1,2,3,6,8 PSO-1,2,3,4,5	C	P, M	-	P

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

**Mapping of COs with PSOs and POs:**

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
<b>CO 1</b>	3	2	2	2	-	1	-	-	-	-	2	-	2
<b>CO 2</b>	2	3	3	3	-	1	2	2	-	-	2	-	2
<b>CO 3</b>	2	3	3	2	-	1	2	2	-	-	2	-	2
<b>CO 4</b>	3	3	-	-	-	1	-	-	-	-	2	-	-
<b>CO 5</b>	2	3	3	3	2	2	2	3	-	-	3	-	2

**Correlation Levels:**

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments

- Final Exam

**Mapping of COs to Assessment Rubrics:**

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓
CO 5	✓		✓	