**University of Kerala**

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|---|---|---|---|---|---|
| Discipline | CHEMISTRY | | | | |
| Course Code | **UK4SECCHE200** | | | | |
| 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 |
|---|---|---|---|
| | **WATER QUALITY ANALYSIS** | | **60** |
| **I** | **QUALITY PARAMETERS FOR DRINKING WATER** | | **6** |
| | 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 - $CO_2$, pH. | 3 |
| **II** | **HARD AND SOFT WATER, CHEMICAL AND BIOLOGICAL CONTAMINATION OF WATER** | | **12** |
| | 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 |
| **III** | **QUALITATIVE AND QUANTITATIVE ANALYSIS** | | **6** |
| | 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 |
| **IV** | **REAL SAMPLE ANALYSIS - CASE STUDIES** | | **6** |
| | 12 | Collection of samples from different area | 4 |
| | 13 | Application in environment | 2 |
| **V** | **PRACTICALS** | | **30** |
| | **A** | **Section A (Any 5 experiments from the following 1 & 2 are compulsory)** | **18** |
| | 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** | **Section B (OPEN ENDED)** | **12** |
| | | 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 – **(Or any other related activities introduced by the teacher)** | |

**REFERENCES**


1. De., *Environmental Chemistry*, 6th 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, 15th 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 2 | 2 | - | 1 | - | - | - | - | 2 | - | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | - | 1 | 2 | 2 | - | - | 2 | - | 2 |
| **CO 3** | 2 | 3 | 3 | 2 | - | 1 | 2 | 2 | - | - | 2 | - | 2 |
| **CO 4** | 3 | 3 | - | - | - | 1 | - | - | - | - | 2 | - | - |
| **CO 5** | 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 | ✓ | | ✓ | |