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# I SEMESTER M. TECH (ENVIRONMENTAL ENGINEERING)
# END SEMESTER EXAMINATION, DEC 2023
# SUBJECT: APPLIED ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY [CIE 5119]
**/12 /2023**

**TIME: 3 HRS.** **MAX. MARKS: 50**

**Note: 1. Answer all questions.**
**2. Any missing data may be suitably assumed.**
**3. Periodic table is allowed.**

| Q.NO | QUESTION | Marks | CO | BL |
|---|---|---|---|---|
| 1A. | Determine weight in grams of oxygen contained in 10 liters volume under a pressure of 5 atm and at a temperature of 0℃. | 02 | CO1 | 4 |
| 1B. | Determine the activity coefficient for the mono and divalent ion. The data are given below. Using the value of activity coefficient for divalent ion estimate the equilibrium concentration of calcium in solution needed to satisfy the solubility product of calcium carbonate at $25^0$ C. The value of the solubility product constant $K_{sp}$ at $25^0$ C is $5\times10^{-9}$.<br><br>Cation — Concentration (mg/l) — Anion — Concentration (mg/l)<br>$Ca^{2+}$ — 82.2 — $HCO_3^-$ — 220<br>$Mg^{2+}$ — 17.9 — $SO_4^-$ — 98.3<br>$Na^+$ — 46.4 — $Cl^-$ — 78<br>$K^+$ — 15.5 — $NO_3^-$ — 25.6 | 04 | CO1 | 4 |
| 1C. | What are amphoteric hydroxides? Explain its application in Environmental Engineering field. | 04 | CO1 | 3 |
| 2A. | What are catalysts? Explain how a catalyst changes the rate of reaction. With examples mention the use of catalysts in control of air pollution. | 04 | CO1 | 3 |
| 2B. | With the neat sketch explain electrodialysis process and its application in water treatment. | 04 | CO2 | 3 |
| 2C. | The solubility of picric acid at 20℃ is 9.56 g per 100 g of benzene, and 1.4 g per 100 g of water. If an industrial wastewater contains 5000 mg/L of picric acid, what concentration would remain after 1 extraction with 1L of benzene for each 2L of water? | 02 | CO2 | 3 |
| 3A. | Biotransformation of chlorinated organic compounds such as 1,1,1-trichloroethane can be modelled using a second-order rate expression. Given the following laboratory data for an experiment measuring the biotransformation of 1,1,1-trichloroethane by 100 mg/l of bacteria. Determine the second order rate constant.<br>Time ,min — Concentration , mg/L<br>0 — 0.5<br>2 — 0.48<br>5 — 0.45<br>10 — 0.41<br>24 — 0.3<br>48 — 0.18 | 04 | CO2 | 3 |

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| **3B.** | A coagulation treatment plant with a flow of 0.9 m3/ s is dosing alum at 30 mg/l. No other chemicals are being added. The raw water suspended solid concentration is 50 mg/l. the effluent suspended solid concentration is measured as 10 mg/l. the sludge content is 1% and the specific gravity of sludge is 3.01. What volume of sludge must be disposed of each day? | **04** | **CO2** | **4** |
| **3C.** | What are consecutive reactions? With an example explain its application in Environmental Engineering. | **03** | **CO2** | **3** |
| **4A.** | Calculate the normality of standard solution required for analysis of alkalinity as $CaCO_3$, ammonia nitrogen, ammonia and chlorides in water or wastewater. | **04** | **CO3** | **4** |
| **4B.** | With a neat sketch explain the working principle of flame photometer. | **03** | **CO3** | **3** |
| **4C.** | Considering 50 % pure sodium hydroxide is available, calculate the amount of NaOH needed to prepare 0.02 N NaOH solution. And also calculate amount of primary standards required to standardize the prepared NaOH solution. | **03** | **CO3** | **4** |
| **5A.** | Discuss the importance of algae in environmental engineering. | **03** | **CO4** | **3** |
| **5B.** | With the neat sketch differentiate between gram-negative and gram-positive bacteria. | **04** | **CO4** | **3** |
| **5C.** | With neat sketch explain the growth curve of bacteria. | **03** | **CO5** | **3** |