

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA  
19ABS43-Marine Chemistry  
(Open Elective-I)

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**Course Objectives:**

- To classify the different dissolved gases in sea water.
- To predict the role of biological processes in affecting oceanic carbonate system.
- To describe chemical and pharmacological properties of bioactive substances in marine organisms.
- To determine micro-nutrient elements (N, P, Si) in seawater.
- To identify dissolved elements in the estuary.

**UNIT – 1: Dissolved gases in seawater**

9 Hrs

Dissolution of gases in seawater and their solubility; classification of dissolved gases and factors affecting their concentration in seawater; distribution of dissolved oxygen in seawater and affecting factors, Apparent Oxygen Utilization (AOU) and oxygen minimum zone formation in the ocean, origin and consequences of ocean hypoxia, Methane hydrate, clathrates

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the factors affecting on the dissolution of gases L1
- Understand apparent oxygen utilization and oxygen minimum zone formation in ocean. L1
- Compare the distribution of dissolved gaseous in sea water L4
- Analyze origin and consequences of ocean hypoxia, methane hydrate and clathrates L3

**UNIT – II: Carbonate systems in the ocean**

Acid base equilibria in seawater, carbon dioxide system – absorption of carbon dioxide, carbon cycle; parameters of carbonate systems and their distribution in the ocean; role of biological processes in affecting oceanic carbonate system; precipitation and dissolution of calcium carbonate in seawater, lysocline and carbonate compensation depth; Ocean acidification

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basic principle of acid-base equilibria in sea water L1
- Explain the concept of carbon cycle L1
- Lists the various biological process in affecting oceanic carbonate, pptn and dissolution L1
- Analyze the parameters of carbonate system in oceanic water L3

**UNIT – III: Chemistry of marine natural products**

Biomedical aspects; chemical and pharmacological properties of bioactive substances in marine organisms, carbohydrates and their derivatives in red and brown algae, aliphatic acids and their derivatives in marine organisms, steroids and their use as biomarkers, nitrogenous compounds in invertebrates, nucleosides from sponges, biopolymer

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the chemical and pharmacological properties of bioactive substances in marine organism L1
- Explain the steroids and their use as biomarkers L2
- List the chemical properties in nitrogenous compounds in invertebrates L1

**UNIT – IV: Micronutrients in seawater**

Micro-nutrient elements (N, P, Si) in seawater, their forms, distribution and seasonal variation in the ocean. Stoichiometry of uptake and regeneration of nutrients elements and Apparent Oxygen Utilization (AOU)

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List the micro-nutrients in sea water L1
- Understand the stoichiometry of uptake and regeneration of nutrients L1
- Differentiate the distribution of micronutrients with seasonal variation in the ocean L2

**UNIT – V: Estuarine chemistry**

Behavior of dissolved and particulate material during estuarine mixing, interaction among them and speciation of dissolved elements in the estuary; physico-chemical characteristics of estuarine sediment, anoxic sediments and pore water; heavy metals in estuaries and the processes affecting their distribution

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the behavior of dissolved and particulate matter in estuarine system L1
- Analyze the physicochemical characteristics of estuarine system L3
- Differentiate the effect of heavy metals in estuaries and affecting in distribution L2

**Text Books:**

1. Riley, J.P. and Chester, R., Introduction to Marine Chemistry, Academic Press, 1971.
2. Chester, R., Marine Geochemistry, Blackwell Science, 1990, 2000

**Reference Books:**

1. Riley, J.P., Skirrow, G, Chemical Oceanography (Vol.1,2, 3 ), Academic Press, 1975.
2. Horne, R.A, Marine Chemistry - The Structure of Water and the Chemistry of the Hydrosphere, 1969 Wiley- Interscience.
3. Seawater: Its composition, properties & behaviour, 2<sup>nd</sup> Edn, The Open University Team, 1989
4. Martin, D.F., Marcel Dekker, Marine Chemistry (Vol.2), 2<sup>nd</sup> Edition, Academic Press, NY, 1970.
5. Broecker and Peng, Tracers in the Sea, Lamont-Doherty Geological Observatory, 1982, NY.
6. Chemical Oceanography, 1992 – Millero, F. J. and Sohn, M.L., CRC Press
7. Burton et al., Dynamic processes in the chemistry of the upper ocean, Plenum Press, 1986.
8. Heinrich D Holland, The Chemistry of the Atmosphere and Oceans, John Wiley & sons Inc, 1978.

**Course Outcomes:**

At the end of this Course the student will be able to

- List the various dissolved gases in sea water and factors affecting their. L1
- Demonstrate knowledge of concepts and principles of ocean acidification. Analyse and evaluate biomedical aspects of marine natural products. L2
- Integrate and apply the knowledge of stoichiometry of uptake and regeneration of nutrients elements. L3
- Reflect on the influence heavy metals in estuaries. L4
- Evaluate total findings in marine chemistry to solve engineering problems L3

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