Government Degree College (Autonomous), Baramulla

Semester 4th **Major/Minor Course**

Subject: Environmental Science

Title: Environmental Chemistry Code: EVSC1422M
Credit: Theory 06 (Th: 04, Practical: 02) Contact Hours: 64 Th and 64Pr

Course Objectives:

The course shall help the student:

- To gain knowledge about the fundamentals of environmentalchemistry including Stoichiometry-spectrophotometry.
- To understand Gibb's energy and Beer Lambert's law
- Develop basic understanding about the solubility product, pH and pE
- The student should get equipped with the nature of freshwater and seawater.
- To understand the concept of oxygen and its demand
- To gain a complete understanding of carbonate system in water and concept of redox potential.
- To understand how rocks weather and how soil is formed.
- To gain knowledge about the composition of soil.
- To understand the soil-water interaction.
- To understand the behaviour of fertilisers and pesticides in soil.
- To understand the radical and ionic and aerosolic composition of air.
- To know about the different atmospheric pollutants and the reactions taking place in the atmosphere.
- To learn the methodology for determining preservation of water/soil samples and estimate different chemical parameters.
- To prepare a tour/field visit dairy

Learning Outcomes:

After completion of this course, the student should be able to:

- Demonstrate the knowledge, principles and techniques related to Stoichiometry, titrimetry,gravimetry, Potentiometry and spectrophotometry
- Explain the thermodynamics of Gibb's energy.
- Demonstrate the Principal and applications of Beer Lambert's law
- Define the solubility product, its significance and concept of pH/pE
- Explain the composition as well as the physical and chemical characteristics of freshwater and seawater.
- Explain the dissolved, biological and chemical demand of oxygen in water.
- Explain the dynamics of carbon dioxide-carbonate-bicarbonate system in water and

its dependence on pH.

- Describe the redox potential associated properties.
- Explain how weathering of rocks results in soil formation.
- Describe the organic and inorganic components of soil in detail.
- Explain the processes of interaction between soil and water and the associated processes driven by this mechanism.
- Explain the reactions and transformations that take place when fertilisers and pesticides are added to the soil.
- Discuss the radicals and ions in the atmosphere and the associated processes.
- Describe atmospheric chemistry based on aerosols and photo/thermo chemical reactions.
- Discuss the fate of different atmospheric pollutants.
- To be able to preserve the water samples and determine the different chemical parameters in water/soil.
- To be able to document the technical findings and observations in a field book and preparation of field report.

Unit I: Fundamentals of environmental Chemistry **16 hours**

1.1.Stoichiometry, titrimetry,gravimetry
1.2.Potentiometry,spectrophotometry
1.3.Gibbs'energy
1.4.Beer-LambertsLaw
Solubility product, concepts of pH andpE

Unit II: Water Chemistry **16 hours**

2.1. Physical and chemical nature ofwater
2.2. Concept of DO, BOD and COD
2.3. Solubility of gases inwater
2.4. Composition ofseawater
2.5. Carbonate system and redoxpotential

Unit III: Soil chemistry **16 hours**

3.1. Rock weathering, processes of soil formation
3.2. Inorganic components of soil
3.3. Organic components of soil
3.4. Soil- water interaction
3.5. Fate of fertilizers and pesticides insoil

Credit IV: Atmospheric Chemistry **16 hours**

4.1. Radicals and ions inatmosphere
4.2. Thermo-chemical reactions inatmosphere
4.3. Photochemical reactions inatmosphere
4.4. Aerosols: definition andtypes

4.5. Atmospheric fate of airpollutants

Credit V & VI: Laboratory Course

1. Preservation of water samples for chemicalanalyses
2. Estimation of Chloride, Hardness, Sodium and Potassium in different watersamples.
3. Estimation of different forms of nitrogen and phosphorus in different watersamples.
4. Estimation of Calcium, Magnesium, Sodium and Potassium in different soil samples.
5. Visit to an industrialarea
6. Visit to a solid waste disposal site/ sewage treatmentplant

Suggested Reading:

1. Baird C. (1999) *Environmental Chemistry* (2nd edition), WH Freeman and Co.
2. Buell P. and Girard J. (2002) *Chemistry Fundamentals: An Environmental Perspective* (2nd edition), Jones & Bartlett Publishers.
3. Bunce N. (1991) *Environmental Chemistry*, Wuerz Publishing Ltd., Winnipeg, Canada.
4. Cunningham W.P. and Cunningham M.A. (2007) *Principles of Environmental Science: Inquiry and Applications*, Tata McGraw-Hill.
5. Harrison R.M. (1991) *Introductory Chemistry for the Environmental Sciences*, Cambridge University Press.
6. Harrison R.M. (Edited) (1999) *Understanding our Environment: An Introduction to Environmental Chemistry and Pollution*, Royal Society of Chemistry.
7. Miller G.T. (2001) *Environmental Science*, (eighth edition), Brooks/Cole.
8. Pepper I.L., Gerba C.P. and Brusseau M.L. (2006) *Environmental and Pollution Science*, Second edition, Academic Press.
9. De, A. K. Environmental Chemistry. 4th ed. New Age International (P) Ltd., New Delhi, India.2001.
10. Manahan, S. E. Fundamentals of Environmental Chemistry. 2nd ed. CRC Press, Inc., US. 2001.
11. Sawyer, C.N. and McCarty, P.L. G.F. Parkin (eds). Chemistry for Environmental Science and Engineering,Tata-McGraw-Hill Edition. 2003.

Government Degree College (Autonomous), Baramulla

Semester 4th **Major Course**

Subject: Environmental Science

Title: Biological Environment Code: EVSC2422M
Credit: Theory 06 (Th: 04, Practical: 02) Contact Hours: 64 Th and 64Pr

Course Objectives:

The course shall help the student:

- To understand the microbial kingdom and its importance.
- To classify the diversity of prokaryotes on this earth.
- To develop an understanding about the eukaryotic origins.
- To understand the general characteristics of protists and fungi.
- To develop an understanding about the plant kingdom and their important role on this earth.
- To gain the necessary knowledge about seedless plants and general characteristics of angiosperms and gymnosperms.
- To understand the general characteristic with basic taxonomic position of sponges to echinoderms.
- To understand the general characteristic with basic taxonomic position of chordates and vertebrates.
- To understand the importance of the diversity animals on this earth
- To understand the basic concept of adaptation and develop an in-depth understanding of the different adaptations of plants and animals.
- To be able to understand the conditions of parasitic and volent adaptation.
- Train in the methods of collecting medicinal plants, fishes, plankton, xerophytes and mesophytes.
- Train in the method for determining biomass in aquatic and terrestrial plants.
- To learn how to make a field visit report.

Learning outcomes

After completion of this course, the student should be able to:

- Describe the importance of the diverse micro-organisms
- Classify the prokaryotic diversity.
- Describe the evolutionary process of the eukaryotes
- Explain the distinguishing characteristics of prostists and fungi.
- Explain the diversity of plant kingdom on earth and describe their importance.
- Describe the distinguishing characteristics of seedless plants, angiosperms and

gymnosperms.

- Discuss the ecological role of the diversity of plants.
- Describe unique characters of sponges, cnidarians, flatworms, nematodes, arthropods, molluscs, annelids andechinoderms
- Describe unique characters of chordates andvertebrates.
- Recognize the basic life functions of these animal groups.
- Recognize the diversity and ecological role of sponges, cnidarians, flatworms, nematodes, arthropods, molluscs, annelids, echinoderms, chordates andvertebrates.
- Describe the concept of adaptation and explain the different adaptations of plants and animals in different environments.
- Understand the conditions that favour parasitic and volent adaptation.
- Identify the diversity of medicinal plants, fishes, plankton, xerophytes and mesophytes.
- Demonstrate and determine the biomass of aquatic and terrestrial plants.
- Prepare a field report based on the observations and the specimens collected.

Unit I: Diversity of Microbes, Fungi andProtists **16 hours**

1.1. Prokaryoticdiversity
1.2. Eukaryoticorigins
1.3. General characteristics of protists
1.4. General characteristics of fungi
1.5. Importance ofmicroorganisms

Unit II: Plant Diversity **16 hours**

2.1. The plantkingdom
2.2. Seedlessplants
2.3. General characteristics of seed plants: gymnosperms
2.4. General characteristics of seed plants: angiosperms
2.5. Importance ofplants

Unit III: Animal Diversity **16 hours**

3.1 Features of the animal kingdom
3.2 General characteristics of sponges, cnidarians, flatworms andnematodes
3.3 General characteristics of arthropods, molluscs, annelids andechinoderms
3.4 General characteristics of chordates andvertebrates
3.5 Importance ofanimals

Unit IV: Adaptations **16 hours**

4.1 Concept ofadaptations

4.2 Microbial adaptations: thermophiles, psychrophiles, acidophiles, alkaliphiles andhalophiles

4.3 Plant adaptations: hydrophytes, mesophytes andxerophytes

4.4 Animal adaptations: hydrocoles, xerocoles andmesozoics

4.5 Adaptation to parasitic life and volantadaptation

Credit V & VI: Laboratory Course

1. Collection and identification of different types of medicinalplants, mesophytes and xerophytes
2. Collection and identification of common fishes ofKashmir.
3. Collection and slide study of zooplankton andphytoplankton
4. Collection and identification of some important mesophytes andxerophytes
5. Determination of biomass interrestrial and aquatic plants
6. Visit to National park/Wildlifesanctuary

Suggested Reading:

1. Brock Biology of Microorganisms. Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, W. Matthew Sattley, and David A. Stahl (Edition: 16th, Publisher: Pearson)
2. Microbiology: An Evolving Science. Joan L. Slonczewski and John W. Foster (Edition: 5th, Publisher: W. W. Norton & Company)
3. Microbial Diversity: Form and Function in Prokaryotes James W. Brown (Edition: 1st, Publisher: Wiley-Blackwell)
4. Microbial Ecology: Fundamentals and Applications. Henry L. Ehrlich and Daniel H. Kelley (Edition: 1st, Publisher: Benjamin-Cummings Publishing Company)
5. Botany: An Introduction to Plant Biology. James D. Mauseth (Edition: 6th, Publisher: Jones & Bartlett Learning)
6. Plant Diversity and Evolution: An Introduction. Gwilym P. Lewis and Mark A. Lewis (Edition: 2nd, Publisher: CABI)
7. Plant Ecology. Ernst-Detlef Schulze, Erwin Beck, Nina Buchmann, Stephan Clemens, Klaus Müller-Hohenstein, and Heinz Rennenberg (Edition: 3rd, Publisher: Springer)
8. These books cover a wide range of topics related to botany, including plant biology, systematics, diversity, evolution, and ecology. Zoology. Stephen A. Miller and John P. Harley. 1999. WCB/McGraw-Hill,
9. Animal Diversity Cleveland Hickman Jr., Susan Keen, Allan Larson, David Eisenhour, and Helen I'Anson. 2011. McGraw-Hill Science/Engineering/Math
10. Zoology: Inside the Secret World of Animals" by DK. 2019. Smithsonian Institution.
11. The Diversity of Life. Edward O. Wilson. 1992. Penguin Books Ltd

12. Fundamentals of Ecology. Eugene .P. Odum. And Gary W. Barret. 5th edition. Cengage Publisher.
13. Ecology: The Economy of Nature. Robert Ricklefs and Rick Relyea. 9th Edition. W.H. Freeman.

Government Degree College (Autonomous), Baramulla

Semester 4th **Major Course**

Subject: Environmental Science

Title: Environmental Geoscience Code: EVSC3422M
Credit: Theory 06 (Th: 04, Tutorial: 02) Contact Hours: 64 Th and 32 Tu

Course Objectives:

The course shall help the student to:

- Understand fundamentals of geoscience and the geochemical differentiation of the earth's interiors
- Understand the geological processes, rock formation and classification.
- Understand the phenomena that governs the earth's energy budget leading to seasons.
- Understand the process of weathering as well as the different categoriesof minerals that form the soil.
- Know the different soil and major geo-chemical element classifications.
- Understand the cation exchange capacity of the soil.
- Understand the concept of hydrology-geology and gain knowledge about the hydrological scenario of the country.
- Understand Darcy's law.
- Have knowledge about the natural hazards, their prediction and mitigation.
- Understand the concept of residence time and its importance in natural cycles.
- Gain knowledge about the climatic systems of India, the climate of J&K and the processes determining the climate of a place.
- Understand the global wind patterns.
- Understand the basics of computer programming in Python.

Learning outcomes

After completion of this course, the student should be able to:

- Be equipped with the knowledge of geochemical differentiation and the associated processes including rock formation.
- Classify rocks on the basis of composition and process of formation.
- Explain the processes of plate tectonics in detail and explain the formation of landforms formed as a result of plate tectonics.
- Describe the energy balance of the earth and the seasons.
- Explain the different processes of weathering.
- Characterize the different minerals present in the soil

- Classify the soil under the different systems of classifications including Indian and USDA.
- Explain the importance of cation exchange capacities in different types of soils.
- Be equipped with the basic understanding of hydrology and its geological perspective.
- Classify the different hydrological zones of the country based on major basinsand groundwater provinces.
- Validate Darcy's law in hydrology.
- Describe the various causes of natural hazards, their impact, how they are predicted and the measures for their mitigation.
- Explain how the residence time affects the rate of different geochemical cycles.
- Classify climatic systems and the effect of El Nino, La Nina and westerndisturbances on the climate.
- Explain the how the global wind patterns affect the climate.
- Develop a working knowledge of the Python programming language and basic program solving.

Unit I: EarthSystem **16 hours**

1.1. Primary geochemicaldifferentiation
1.2. Brief account of rock classification and formation
1.3. Plate tectonics and formation oflandforms
1.4. Energy budget of earth
1.5. Earth's thermal environment and seasons

Unit II: Environmental Geochemistry **16 hours**

2.1. Weatheringprocesses
2.2. Characterization of soil formingminerals
2.3. Soil classification: Indian andUSDA
2.4. Cation exchange capacity
2.5. Classification and recycling of Major geo-chemicalelements

Unit III: Earth Dynamics **16 hours**

3.1. Hydrology and hydrogeology: Definition andconcept
3.2. Major basins and groundwater provinces ofIndia
3.3. Darcy's law and itsvalidity
3.4. Natural hazards –floods, landslides, earthquakes, tsunami and cloudbursts
3.5. Prediction and mitigation of naturalhazards

Unit IV: Earths Climatic Processes **16 hours**

4.1 Concept of residence time and rates of naturalcycles

4.2 Climatic systems ofIndia

4.3 El Nino, La Nina and westerndisturbances

4.4 Global windpatterns

4.5 Climatic system of J & KState

Credits V and VI: Tutorial

Introductionto Phython Programming

Python IDE/Editor Installation, Python Variables, Arithmetic Operators, Comparison Operator, Assignment Operator, Membership Operator, If Statement, If Else Statement, Break & Continue Statement, Exception, File Operation, Python Built-in Modules, Packages in Python, Python Date and Time, Python Regular Expressions (RegEx), Python XML Parser, Python Database Communication, Web Scrapping, GUI Programming-Tkinter**.**

Suggested Reading:

1. Keller, E. A. (2012). Introduction to environmental geology. Upper Saddle River, NJ, Prentice Hall.
2. Skinner, B. J., and Porter, S. C. 1995. The Blue Planet, An Introduction to Earth System Science, John Wiley & Sons, Inc.
3. Carla Montgomery (2019) Environmental Geology (11th Edition) McGraw-Hill
4. Valdiya KS, 2013. Environmental Geology, Tata McGraw-Hill Education
5. Valdiya KS, 2004. Coping with Natural Hazards: Indian Context, Orient Longmann
6. Strahler and Strahler (2010), *Modern Physical Geography*, John Wiley & Sons, Inc.
7. Mukherjee, S. (2006). Earthquake Prediction. Published by Brill Academic Publishers Koninklijke Brill NV, Leiden (The Netherlands) & Boston (USA).
8. Bryant R.H. (1990) Physical Geography: Made Simple, New Delhi, Rupa Publications.
9. Chorley R.J. (1969) Water, Earth and Man: A Synthesis of Hydrology, Geomorphology and Socio-economic Geography, London: Methuen Young Books.
10. Python Crash Course . Eric Matthes. 1st Edition. No Starch Press
11. Head First Python. Paul Barry. 2nd Edition. O'Reilly Media
12. Python For Dummies. Stef Maruch and AahzMaruch. 1st Edition. Dummies.
13. https://groundwater.ucdavis.edu/files/156562.pdf
14. https://opengeology.org/textbook