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INCLUSIVE | INTEGRATED | INNOVATIVE

Faculty of Science

B. Sc. Environment Science

Semester - 2

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Faculty of Science

B. Sc. Environment Science

Faculty: Science	**Department:** Environmental Science
Program: B. Sc. Environmental Science	**Type of Subject:** Theory + Practical
Subject: Geology and Earth Science	
Semester- 2	

Student Learning Outcomes (SLOs):

- The paper will enable students to understand concepts related to earth science and the fundamental principles of geology.
- Students can identify the salient features of the basic concepts of earth science and geology. This includes the ability to understand basic principles of earth system processes.
- Students recognize and can accurately articulate how their environment (including the Earth, the atmosphere, ocean, and biosophere) affects humans' lives and how human activities affect their environment.

References and Textbooks: (With Author, Edition, Publishers, ISBN)

1. Keller E.A (2012): Introduction to Environmental Geology, Pearson Publication, USA.
2. Sagar Rajendra (2014): Geochemistry and Environmental Geology, Anmol Publications Pvt. Ltd., New Delhi.
3. Holden J. (2012): Physical Geography and the Environment, Pearson Publishers.
4. Kailash R. (2014): General Geology, Anmol Publications Pvt. Ltd.
5. Selley R.C (1998): Elements of Petroleum Geology, Academic Press.

UNIT-1: Philosophy and Fundamental Concepts (7 hours)

1.1 Introduction

1.2 Fundamental concepts

1.3 Gaia Hypothesis

1.4 Easter Island

UNIT-2: Structure of Earth (7 hours)

2.1 Internal Structure

2.2 Plate Tectonics

2.3 Sea Floor Spreading

2.4 Types of Plate Boundaries

UNIT-3: Fundamentals of Minerals (7 hours)

3.1 Atoms and Elements

3.2 Model of Atom

3.3 Isotopes

3.4 Important Rock Forming Minerals

UNIT-4: Soil and Environment (7 hours)

4.1 Soil Profile

4.2 Soil Properties

4.3 Soil Fertility

4.4 Soil Classification

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UNIT-5: Concepts of Rocks (7 hours)

5.1 Rock Cycle
5.2 Igneous Rocks
5.3 Sedimentary Rocks
5.4 Metamorphic Rocks

UNIT-6: Geology and Mining (7 hours)

6.1 Acid Rock Drainage
6.2 Coal Mining and the Environment
6.3 Impact of Mining on Ecology
6.4 Environmental Effects of Mining

UNIT-7: Mineral Resources and Environment (7 hours)

7.1 Minerals and Humans
7.2 Geology of Resources
7.3 Environmental Impact of Development
7.4 Minerals and Sustainability

UNIT-8: Geology and the Future (7 hours)

8.1 Geology and Environmental Health
8.2 Air Pollution and Geologic Perspective
8.3 Waste Management and Geology
8.4 Environmental Analysis

Practicals:

1. Detection of Saturated Hydrocarbons in geological samples.
2. Detection of Unsaturated Hydrocarbons in environmental samples.
3. Identification of Soil Texture.
4. Determination of Water Holding Capacity of Soil.

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Faculty of Science

B. Sc. Environment Science

Faculty: Science	**Department:** Environmental Science
Program: B. Sc. Environmental Science	**Type of Subject:** Theory + Practical
Subject: Microbial Ecology	
Semester-2	

Student Learning Outcomes (SLOs):

- Having basic knowledge of microbial ecology and its fundamental concepts.
- Understanding dynamics and interactions of microbial communities.
- Understanding of microbial association with higher plants.

References and Textbooks: (With Author, Edition, Publishers, ISBN)

- Atlas RM, Bartha R. Microbial ecology: fundamentals and applications. The Benjamim. Cummings Publ., Menlo Park. 1987.978-8131713846
- Willey J, Sherwood L, Woolverton CJ. Prescott's microbiology. McGraw-Hill, New York, NY. 2013.978-0071313674

Unit-1 Scope and overview of microbial ecology

1.1 The scope of microbial ecology
1.2 Historical overview
1.3 Relation of microbial ecology with environmental science
1.4 Sources of information

Unit-2 Microbial Evolution and Biodiversity

2.1 Chemical evolution
2.2 Cellular evolution
2.3 Bacterial and Archael Biodiversity
2.4 Eukaryal biodiversity

Unit-3 Physical Environment of microorganisms

3.1 Microenvironment and niche
3.2 Biofilms and microbial mats
3.3 Microorganisms and ecosystems
3.4 Microorganism movement between ecosystems

Unit-4 Biogeochemical cycling

4.1 Carbon cycle
4.2 Nitrogen cycle
4.3 Phosphorus cycle
4.4 Sulfur cycle

Unit-5 Microbial interactions: Mutualism

5.1 Microorganism-insect mutualism
5.2 Zooxanthellae
5.3 Sulfide-based mutualisms
5.4 Methane-based mutualisms
5.5 Rumen ecosystem

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Unit-6 Other Microbial interactions

6.1 Cooperation
6.2 Commensalism
6.3 Predation
6.4 Parasitism
6.5 Amensalism and Competition

Unit-7 Microorganism association with vascular plants

7.1 Phyllosphere, rhizosphere and rhizoplane microorganisms
7.2 Mycorrhizae
7.3 Symbiotic nitrogen fixation: Rhizobia
7.4 Symbiotic nitrogen fixation: Actinorhiza and stem-nodulating bacteria

Unit-8 Other associations with plants

8.1 Fungal and bacterial endophytes
8.2 Agrobacterium
8.3 Other plant pathogens
8.4 Tri-partite and Tetra-partite associations

Practicals:

1. Demonstration of presence of bacteroids in root nodules and isolation of *Rhizobium* from it.
2. Isolation of plant pathogenic fungi from sugarcane red rot.
3. Study of lichens using permanent slides.

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Faculty of Science

B. Sc. Environment Science

Faculty: Science	**Department:** Environmental Science
Program: B. Sc. Environmental Science	**Type of Subject:** Theory + Practical
Subject: Microbial Diversity	
Semester- 2	

Student Learning Outcomes (SLOs):

- Students will expand knowledge about events of evolution and diverse group of microbes .
- Complete awareness about major group of organism including bacteria, fungi, algae , protozoa, viruses, and some parasites.
- Expanded knowledge will be gain with respect to microbial cell structure and reproduction systems.

References and Textbooks: (With Author, Edition, Publishers, ISBN)

2. Jacquelyn G Black MICROBIOLOGY 8th Edition (2013). John Wiley & Sons Singapore Pte.Ltd ISBN :978-0-470-64621-2
3. James T Staley, Robert P Gunsalus, Stephen Lory, Jerome J Perry. Microbial Life 2nd Edition (2007) Sinauer Associiates, Inc All right reserved .ISBN:13:978-0-87893-685-4; 10:0-87893-685-8
4. Joanne M. Willey , Linda M. Sherwood , Christopher J. Woolverton Prescotts Microbiology 9th Edition (2014) 978-0-07-340240-6 Mc Graw Hill
5. Microbiology :A Human Perspective Nesters Eight Edition (2015) .Published by McGraw Hill Education ISBN 978-0-07352259-3
6. O.P Sharma : ALGAE Diversity of Microbes and Cryptogams. (2011): Tata Mc Graw Hill Education Private Limited New Delhi. ISBN -13:978-0-07-068194-1; ISBN -10:0-07-068194-5.

Further Reading:

1. Ananthanarayan and Panikar Text book of Microbiology. 7th edition (2005).Orient Longman Private Limited.ISBN 81 250 2808 0.
2. HA Modi .Hand book of Elementary Microbiology. 1st edition.(2019). Shanti Prakashan ISBN 97893501010.

Unit-1: Introduction to Microbial World (8 hours)

1.1 Members of the Microbial World

1.2 Microbial Evolution

1.3 Prokaryotic Versus Eukaryotic Microorganism

Unit-2: Diversity of Bacteria (8 hours)

2.1 Cyanobacteria

2.2 Microorganisms in Phyllosphere, Rhizosphere and Rhizoplane

2.3 Nitrogen-Fixing Bacteria , Agrobacterium

2.4 Extremophiles.

Unit-3: Mycology (8 hours)

3.1 Fungi:. Structure, Distribution and Importance

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3.2 Fungal Reproduction
3.3 Endomycorrhizae
3.4 Ectomycorrhizae
3.5 Arbuscular

Unit-4: Phycology (8 hours)

4.1 Introduction to Phycology
4.2 Characteristics of algae
4.3 Algae: similarities and Diversities
4.4 Occurrence and distribution of algae
4.5 Reproduction in algae

Unit-5: Fundamentals of Virology

5.1 Virion Structure
5.2 Viral Multiplication
5.3 Types of Viral Infections
5.4 Viroids and Satellites
5.5 Prions

Unit-6: Essentials of Virology (8 hours)

6.1 Cultivation of viruses
6.2 Bacteriophage: T4 and Lambda
6.3 Archaeal Viruses
6.4 Tobacco Mosaic Virus
6.5 Poliovirus

Unit-7: Protistology (8 hours)

7.1 Overview of protist
7.2 Protist Morphology
7.3 Encystment and Excystment
7.4 Protist Reproductive cell structure
7.5 Importance of Protist

Unit-8: Multicellular Parasites (4 hours)

8.1 Mosquitoes
8.2 Fleas
8.3 Lice
8.4 Tick
8.5 Mites

Practicals:

1. Types of stain and preparation of staining solution.
2. Demonstration of bacterial lysis by bacteriophage.
3. Preparation of bacteriological and mycological cultural media & Study of economically important fungi . (Aspergillus, Penicillium, Mucor, Rhizopus, Curvularia, Helminthosporium, Cunninghaemella, Fusarium, Alternaria).

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4. Cultivation of anaerobic bacteria using Thioglycollate medium.
5. Disposal of laboratory waste and cultures.
6. Gram staining & Acid fast staining.
7. Staining techniques: Cell wall, Metachromatic Granules, Capsule, Endospore.