



Birla Institute of Technology & Science, Pilani

Hyderabad Campus

SECOND SEMESTER 2024-25

Course Handout Part II

Date: 07.01.2025

In addition to Part – I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : BIO F241

Course Title : ECOLOGY & ENVIRONMENTAL SCIENCE

Instructor-in-charge : P. SANKAR GANESH (<https://universe.bits-pilani.ac.in/hyderabad/psankarganesh/Profile>)

Instructor : P. Sankar Ganesh

1. Scope of the course:

In the past few decades, man has achieved mental development that has translated into scientific and technological innovations to improve/manipulate life and the environment. As a consequence, the science of ecology, dealing with organism-environment relationships, has become more and more an integrated discipline that links the natural and the social sciences. While ecology retains its strong and basic roots in biological sciences, it is a 'hard' science involving mathematics, chemistry, and physics. It is a 'soft' science, too, as it involves a study of human behavior and activity. As an integrated science, ecology has a vast potential for application to human welfare, merging natural science with its social, economic, and political counterparts. In short, ecology helps us better understand our planet – Mother Earth – and devise sustainable methods to preserve it.

2. Objective of the course:

The objective of this course is to make the students aware of the various segments of our environment, the interaction between abiotic and biotic components of ecosystems, energy, and material utilization strategies, anthropogenic activities leading to ecosystem imbalance, depletion of natural resources, and the impact of 'greedy' and polluting technological developments on the ecosystem. The course culminates by examining the Indian scenario on protecting local ecology and environment. Additionally, the course is well aligned with the syllabus for Life Sciences (10. Ecological Principles) of the CSIR-UGC National Eligibility Test (NET) for Junior Research Fellowship and Lectureship.

3. Intended learning outcomes:

After successful completion of this course, students will be able to but not limited to:

- Define various segments of the environment and limiting factors
- Demonstrate knowledge of principles and concepts of ecosystem
- Outline regional ecology and major ecosystem types
- Design effective experiments to calculate nutrient budgets
- Measure energy flow in ecosystems
- Explain the influence of carrying capacity on population ecology
- Compare and contrast interactions among various species in a community
- Examine large-scale patterns of ecosystem development
- Relate pollution ecology and environmental biotechnology and their impact on society

4. Textbook (TB):

Eugene P. Odum & Gary W. Barrett, *Fundamentals of Ecology*, 5th Ed, Cengage Learning, India Edition, 2005.

5. Reference Book (RB):

E J Kormondy, *Concepts of Ecology*, 4th Ed, Prentice Hall of India Pvt. Ltd., 1996.

6. Suggested Reading:

Thomas M. Smith & Robert Leo Smith, *Element of Ecology*, 6th Ed, Pearson Education, Inc., 2006

Madhab Chandra Dash & Satya Prakash Dash, *Fundamentals of Ecology*, 3rd Ed, Tata Mc Graw Hill Education Private Limited, New Delhi, 2009.

Richard T. Wright & Dorothy F. Boorse, *Environmental Science: Towards a Sustainable Future*, 11th Ed, Benjamin Cummins, 2011.

Daniel B. Botkin, & Edward A. Keller, *Environmental Science: Earth as a Living Planet*, 7th Ed, Wiley, India, 2010.

7. Selected Web resources:

<http://ecology.com>

<http://www.ecologyasia.com>

<http://pbil.univ-lyon1.fr/Ecology/Ecology-WWW.html>

<http://www.envirolink.org>

<http://ice.ucdavis.edu>

8. Course Plan:

| <i>Lecture Number</i> | <i>Learning objectives</i> | <i>Topics to be covered</i> | <i>Reference chapter</i> |
|-----------------------|---|--|--------------------------|
| 1 | Introduction | Scope of ecology | TB Chap 1 |
| 2-3 | Beginning the science of Ecology: Segments of environment | Soil, nutrients, and other limiting and regulatory factors | TB Chap 5 |
| 4 | Principles of limiting factors | Minimum and tolerances laws | TB Chap 5 |
| 5-6 | Principles and concepts of ecosystem | Concept and structure | TB Chap 2 |
| 7 | | Ecosystem cybernetics and Technoecosystems | |
| 8-9 | Regional Ecology: Major ecosystem types | Marine ecosystems | TB Chap 10 |
| 10 | | Freshwater ecosystems | |
| 11 | | Terrestrial ecosystems, desert ecology, human-designed and managed systems | |
| 12 | Nutrient budgets | Internal and external nutrient budget | TB Chap 5 |

| <i>Lecture Number</i> | <i>Learning objectives</i> | <i>Topics to be covered</i> | <i>Reference chapter</i> |
|-----------------------|--|--|---------------------------|
| 13-14 | Principles and concepts of energy flow in ecosystems | Global production and decomposition | TB Chap 2 |
| 15 | | Solar radiation and the energy environment | RB Chap 6 TB Chap 3 |
| 16-17 | | Concept of productivity: Measuring primary productivity | RB Chap 6 |
| 18 | | Ecological pyramids and energy flow models | RB Chap 7 |
| 19 | | Energy partitioning in food chains and food webs | RB Chap 7 |
| 20 | Population ecology: concept and attributes | Properties of population and carrying capacity | TB Chap 6 |
| 21 | | Density-independent and density-dependent mechanisms of population regulation | |
| 22 | | Allee principle, home range, and territoriality | |
| 23 | | Metapopulation dynamics, energy partitioning, and optimization: <i>r</i> - and <i>K</i> - selection | |
| 24 | Community Ecology: structure and function | Types of interactions among species | TB Chap 7 |
| 25 | | Cooperation and competition | |
| 26 | | Positive and negative interactions | |
| 27-28 | | Concepts of habitat, ecological niches, guilds, and paleoecology | |
| 29-30 | | Biodiversity | |
| 31-32 | Ecosystem development: Evolution | Ecosystem development and succession | TB Chap 8 |
| 33-35 | | Concept of climax and evolution of the biosphere | |
| 36-37 | Pollution ecology | Anthropogenic impact on atmosphere, aquatic and terrestrial ecosystems, solid waste management | RB 2 Chap 8 & class notes |
| 38-39 | Introduction to Environmental Biotechnology | The basic concept of environment and its components. Biotechnology for the environment; definitions and facts. A brief introduction to the topic with relevant examples. | Class notes |
| 40 | Ecology and society | Viewing Indian society from an ecological perspective. | Class notes |

Portions for self-study:

- Insolation, precipitation and climate (RB1 Ch 4)
- Biogeochemical cycles (TB Ch 4)

9. Evaluation scheme:

| Evaluation component | Duration | Weightage % | Date and time | Nature of the component* |
|--|-----------------|--------------------|-----------------------------------|---------------------------------|
| Mid-semester examination | 1.5 Hrs | 25 | 05/03/2025 2:00 to 3:30 PM | CB |
| Lecture & tutorial participation/ surprise evaluation | Diverse | 15 | Continuous Evaluation | CB |
| Assignments/ Classwork[§] | Diverse | 20 | Continuous Evaluation | OB |
| Comprehensive examination | 3 Hrs | 40 | 13/05/2025 9:30 AM to 12:30 PM | CB |

*OB: Open book; CB: Closed book

[§]Classwork: Presentation/Group Discussion/Comprehension/Practical Sessions, etc.

10. Chamber consultation hour:

To be announced in the class.

11. Minimum pass-mark criteria for getting a valid grade:

40% of the class median score or 30% of the top score - whichever is less. Students failing to obtain such a score will be reported as NC (Not Cleared). Consequently, they must repeat this course.

12. Grading policy:

Award of grades will be guided in general by the histogram of marks. Decision on border line cases will be taken based on individual's sincerity, student's regularity in attending classes, and the section instructor's assessment of the student.

13. Make-up policy:

Make-up for Mid semester examination will be given only in genuine (medical emergency) cases of absence. If the absence is anticipated, before the examination, prior permission of the instructor-in-charge is necessary. Request for make-up should reach the instructor-in-charge at the earliest. Make-up for class tests/ quizzes and assignments are not given. Also refer to Clause 4.07 of BITS *Academic Regulations* for more details.

14. Notices:

All notices/ announcements regarding this course shall be displayed in Course Management System (CMS).

15. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Prof. P. Sankar Ganesh
Instructor In-charge
BIO F241