

Module 2: Ecosystems - Detailed Notes

These notes cover all important topics of Module 2: Ecosystems for Energy & Environmental Engineering (EEES/ES-301).

1. Concept of an Ecosystem

An ecosystem is a structural and functional unit of nature where living organisms interact with each other and with the physical environment.

Components of ecosystem:

- Biotic Components (living)
- Abiotic Components (non-living)

Examples:

- Forest ecosystem
- Pond ecosystem
- Desert ecosystem

2. Structure and Function of Ecosystem

Structure of ecosystem includes biotic and abiotic components.

Abiotic Components:

- Air
- Water
- Soil
- Temperature

Biotic Components:

- Producers
- Consumers
- Decomposers

Functions of ecosystem:

- Energy flow
- Nutrient cycling
- Ecological balance
- Decomposition

3. Producers, Consumers and Decomposers

Producers:

Green plants that prepare food by photosynthesis.

Example: Trees, algae.

Consumers:

Depend on producers for food.

Types:

- Primary consumers
- Secondary consumers
- Tertiary consumers

Decomposers:

Microorganisms that decompose dead matter.

Example: Bacteria and fungi.

4. Energy Flow in Ecosystem

Energy enters the ecosystem through sunlight.

Flow of energy:

Sun → Producers → Consumers → Decomposers

Characteristics:

- One-way process
- Energy decreases at each trophic level
- Governed by 10% law

5. Ecological Succession

Ecological succession is the gradual process of change in species composition in an area over time.

Types:

- Primary succession
- Secondary succession

Stages:

1. Nudation
2. Invasion
3. Competition
4. Stabilization

6. Food Chain, Food Web and Ecological Pyramid

Food Chain:

Linear sequence of organisms through which energy flows.

Example:

Grass → Deer → Tiger

Food Web:

Interconnection of different food chains.

Ecological Pyramid:

Graphical representation of trophic levels.

Types:

- Pyramid of numbers
- Pyramid of biomass
- Pyramid of energy

7. Forest Ecosystem

A forest ecosystem consists of trees, animals, microorganisms and environment.

Characteristics:

- High biodiversity
- Rich nutrient cycling
- Large biomass

Functions:

- Oxygen production
- Climate regulation
- Soil conservation

8. Grassland Ecosystem

Grassland ecosystem is dominated by grasses.

Characteristics:

- Moderate rainfall
- Few trees
- Grazing animals present

Examples:

- Savanna grasslands
- Prairies

9. Desert Ecosystem

Desert ecosystem occurs in areas with very low rainfall.

Characteristics:

- Extreme temperature
- Scarcity of water
- Xerophytic plants

Examples:

- Camel
- Cactus

10. Aquatic Ecosystem

Aquatic ecosystems are water-based ecosystems.

Types:

- Pond ecosystem
- Lake ecosystem
- River ecosystem
- Ocean ecosystem
- Estuary ecosystem

Characteristics:

- Presence of aquatic organisms
- Nutrient cycling in water
- High biodiversity in oceans

11. Pond Ecosystem

A pond ecosystem includes producers, consumers and decomposers in freshwater.

Producers:

Algae and aquatic plants.

Consumers:

Fish, insects and frogs.

Decomposers:

Bacteria and fungi.

12. River and Ocean Ecosystem

River ecosystem has flowing water while oceans contain saline water.

River ecosystem:

- Freshwater
- Continuous water flow

Ocean ecosystem:

- Saline water
- Largest aquatic ecosystem
- Rich biodiversity

13. Estuary Ecosystem

Estuaries are areas where freshwater mixes with seawater.

Characteristics:

- Nutrient-rich ecosystem
- Breeding grounds for fish
- High productivity

Conclusion

Ecosystems are essential for maintaining ecological balance and supporting life on Earth. Understanding ecosystem structure, functions and interactions helps in environmental conservation.