

# UNIT - I

## DIVERSITY IN THE LIVING WORLD

Chapter

1

### Biological Classification

*As there are millions of living organisms of diverse variety and habitat it is very difficult to study them without proper arrangement. Hence classification of organisms into groups becomes necessary. Biological classification started since the time of Aristotle. Consequently more elaborate classifications were suggested by Linnaeus, Whittaker and recently by Carl Woese. This chapter deals with the different kingdoms of classification, general characters of various groups of organisms that come under the five kingdom classification and the characters of organisms which are excluded from it.*

#### Values and Attitudes

- The learner recognises the economic importance and helpful role of microorganisms like bacteria, methanogenic bacteria, diatoms etc.
- The learner develops a positive attitude towards the importance of conservation of biodiversity.

**Time : 8 Periods**



### Unit Frame

| Concepts/Ideas and process skills  | Process/Activity with assessment   | Learning outcomes  |
|--|--|--|
| <ul style="list-style-type: none"> <li>• Aristotle - Contribution</li> <li>• Linnaeus - two kingdom classification</li> <li>• Whittaker five kingdom classification</li> <li>• Its criteria               <ul style="list-style-type: none"> <li>- Observing</li> <li>- Communicating</li> </ul> </li> </ul>             | <ul style="list-style-type: none"> <li>• Observation of prepared chart of Table 2.1</li> <li>• General Discussion on classification</li> <li>• Preparation of notes</li> </ul>   | <ul style="list-style-type: none"> <li>• Identifies contributions of Linnaeus, Whittaker and criteria of five kingdom classification.</li> </ul>   |
| <ul style="list-style-type: none"> <li>• Characteristics of two kingdom, five kingdom and six kingdom classification.</li> <li>• Merits and demerits of five kingdom classification               <ul style="list-style-type: none"> <li>- Observing</li> <li>- Communicating</li> <li>- Charting</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Prepares a chart showing differences between two kingdom and five kingdom classification.</li> <li>• Preparation of chart/slide based on general discussion. Presentation of prepared chart</li> </ul>  | <ul style="list-style-type: none"> <li>• Compares two kingdom, five kingdom and six kingdom classification.</li> <li>• Evaluates the merits and demerits of given classification.</li> </ul> |
| <ul style="list-style-type: none"> <li>• Kingdom Monera- General characters and its groups with examples.</li> <li>• Useful and harmful effects               <ul style="list-style-type: none"> <li>Observing</li> <li>Classifying</li> </ul> </li> </ul>   | <ul style="list-style-type: none"> <li>• General discussion/Preparation of notes/Picture collection Observation of specimens(PE) Picture reading from T.B.</li> <li>• General discussion               <ul style="list-style-type: none"> <li>- Observation of videos</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Describes important characters of kingdom Monera and its groups</li> </ul>  |
| <ul style="list-style-type: none"> <li>• Kingdom Protista - General characters -and its groups with examples.</li> </ul>   | <ul style="list-style-type: none"> <li>• General discussion</li> <li>• Observation of video/ photographs</li> </ul>  | <ul style="list-style-type: none"> <li>Describes important characters of</li> </ul>  |

| Concepts/Ideas and process skills   | Process/Activity with assessment  | Learning outcomes  |
|---|---|--|
| <ul style="list-style-type: none"> <li>- Useful and harmful effects</li> <li>- Observing</li> <li>- Classifying</li> <li>- Communicating</li> </ul>   | <ul style="list-style-type: none"> <li>• Mind mapping</li> <li>• Preparation of notes</li> </ul>  | <ul style="list-style-type: none"> <li>• kingdom Protista and its groups.</li> </ul>   |
| <ul style="list-style-type: none"> <li>• Kingdom Fungi - general characters, reproduction classification with examples</li> <li>- Observing</li> <li>- Classifying</li> <li>- Communicating</li> </ul>  | <ul style="list-style-type: none"> <li>• Observation of permanent slides/Drawing-Rhizopus, Agaricus (PE)</li> <li>• List the example of fungi and prepare notes in the activity log.</li> </ul>   | <ul style="list-style-type: none"> <li>• Describes important characters, reproduction of kingdom Fungi and its classification</li> <li>• Lists the examples of organisms comes under each group and its importance.</li> </ul> |
| <ul style="list-style-type: none"> <li>• Viruses - Structure , types and harmful effects.</li> <li>• Contribution of Scientists - Ivanowsky, Beijerinck, Stanley.</li> <li>• Viroids - Discovery, structure</li> <li>• Lichens - Features</li> <li>- Communicating</li> <li>- Observing</li> <li>- Analysing</li> </ul> | <ul style="list-style-type: none"> <li>• Picture reading(Fig. 2.6 a,b) using Textbook.</li> <li>• Lists of plant and animal diseases caused by virus. Observation of specimen, draw diagrams and write notes in the practical log (PE).</li> <li>- Preparation of notes.</li> </ul> | <ul style="list-style-type: none"> <li>• Describes the organisms which are excluded from the five kingdom classification.</li> </ul>   |



## *Towards the chapter*

### **CONCEPTS**

- ❖ Relevance of classification
- ❖ Contribution of Aristotle, Whittaker
- ❖ Criteria, merits and demerits of the five kingdom classification.
- ❖ Six kingdom classification

**Suggested Activities :** Observation of chart/slide presentation, general discussion

The mentor asks simple questions to elicit previous knowledge about classification.

- Why do we arrange organisms based on similarities?
- 

Provides discussion points, learners discuss and prepare notes.

### **Discussion Points**

- When does biological classification begin?
- Who introduced the two kingdom classification?
- Is the two kingdom classification adequate or inadequate? Why?
- Is it essential to arrange organisms into more than two kingdoms?
- Who proposed the five kingdom classification?

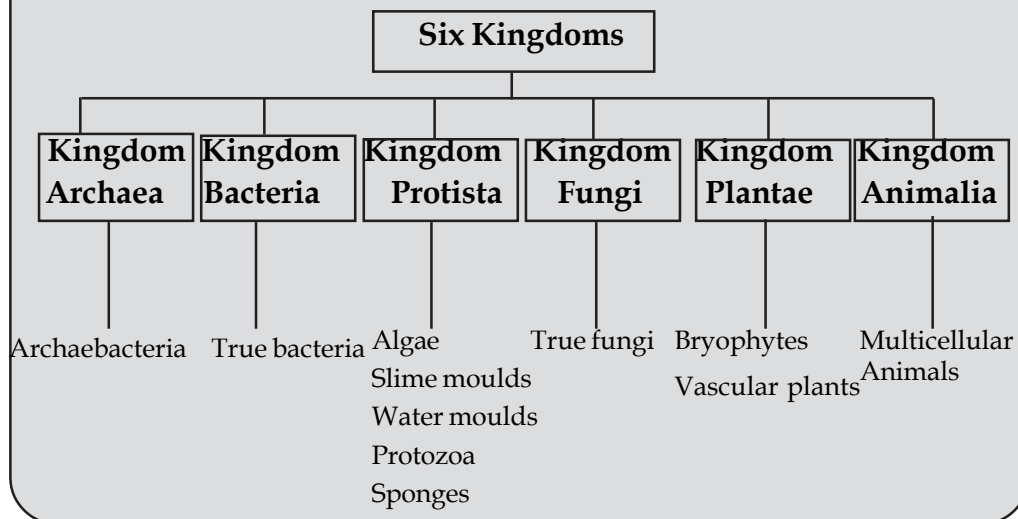
The mentor exhibits a prepared chart of Table 2.1 in T.B and provides discussion points.

- Which are the five kingdoms? What are the characters taken into consideration for this classification?
- What are the features of the five kingdoms?
- Which is the new type of classification?
-

Learners discuss with one other and note the discussion points in their activity log and learner prepares notes.

**More to know**

Since the early 1980s when Carl Woese, a microbiologist and leading authority on bacteria argued that Kingdom Monera should be divided into two kingdoms. His proposal for two kingdoms of bacteria gained increasing acceptance in the 1990s and is now generally recognised.



**Consolidation**

- ◆ Relevance of classification
- ◆ Contribution of Aristotle and Linnaeus
- ◆ The two kingdom and the five kingdom classification
- ◆ Criteria, merits and demerits of five kingdom classification
- ◆ The six kingdom classification
- ◆

Learners are asked to copy and complete the given table in the activity log.



| Characters        | Monera         | Protista        | Fungi          | Plantae    | Animalia |
|-------------------|----------------|-----------------|----------------|------------|----------|
| Cell type         | .....          | Eukaryotic      | .....          | .....      | .....    |
| Cell wall         | Non cellulosic | Present in some | .....          | Cellulosic | .....    |
| Nuclear membrane  | .....          | Present         | .....          | Present    | Present  |
| Body organisation | Unicellular    | .....           | Multi cellular | .....      | Organ    |
| .....             | Autotrophic    | Autotrophic     | Heterotrophic  | -----      | -----    |

**Note:** This can be used as a tool for self assessment/peer assessment

### CONCEPTS

- ❖ General characters of Kingdom Monera and its groups with examples
- ❖ Bacteria - Habitat, shape, different forms based on nutrition, reproduction, useful and harmful effects.
- ❖ Cyanobacteria - Habitat, habit, useful and harmful effects
- ❖ Mycoplasma -Structure, relevance

**Suggested Activities :** General discussion, slide observation, picture reading, labwork.

The mentor asks simple questions to present the topic.

- Can you name the organism present everywhere in the world?
- 

Asks to refer Figure 2.1 in the TB and provides the following table

| Shape   | Name of bacterial group |
|---------|-------------------------|
| • Round | • Coccus                |
| •       | •                       |
| •       | •                       |

Then provides discussion points. Learners discuss and refer TB

**Discussion points**

- Which are the two main groups of bacteria?
- How are archaebacteria classified?
- What is the use of methanogens?
- How will you classify eubacteria based on nutrition?
- What are the peculiarities of eubacteria?
- What is algal bloom?
- What do you mean by chemosynthetic autotrophs?
- What are the useful and harmful effects of bacteria?
- How do bacteria reproduce?
- How will you differentiate bacteria and mycoplasma?
- 

Learners discuss with one another and note the discussion points in their activity log. Asks to observe Fig.2.2 in T.B. Asks to observe permanent slide of Oscillatoria. Learners observe, prepare notes and draw diagram in the practical (PE). Consolidates the general characters of Kingdom Monera and its groups.

**Consolidation**

- ◆ Classification of kingdom Monera- Archaebacteria and Eubacteria
- ◆ Archaebacteria- Halophiles, Thermoacidophiles and Methanogens
- ◆ Eubacteria-classification
- ◆ Useful and harmful effects of bacteria
- ◆ Reproduction
- ◆ Mycoplasma- structure
- ◆

**CONCEPTS**

- ❖ General characters - Kingdom Protista
- ❖ Useful and harmful effects of kingdom protista
- ❖ Different groups with examples.



**Suggested Activities:** General discussion, picture reading  
(Fig 2.4 a,b)

The mentor exhibits the video clipping of diatoms, desmids, Gonyaulax

**Discussion points**

- What are the different groups of kingdom Protista?
- What kind of organisms are included in chrysophytes?
- What are the peculiarities of diatoms?
- What are the uses of diatoms?
- What are the peculiarities of chrysophytes?
- What is red tide? What is its reason?
- What are the harmful effects of red tide?
- 

Learners are asked to observe Figure 2.4 a and the video showing Euglena and slime moulds. Provides discussion points. Learners prepare notes.

**Discussion points**

- What are the peculiarities of Euglenoids?
- What are the characteristic features of Euglena?
- Why are slime moulds called saprophytic protists?
- 

Learners are asked to refer Figure 2.4 b and complete the table.

| Name of group       | Peculiarities  | Examples  |
|---------------------|--|---|
| Amoeboid Protozoans | <ul style="list-style-type: none"> <li>• .....</li> <li>• .....</li> </ul> | <ul style="list-style-type: none"> <li>• Amoeba</li> </ul>      |
| .....               | <ul style="list-style-type: none"> <li>• .....</li> <li>• .....</li> </ul> | <ul style="list-style-type: none"> <li>• Trypanosoma</li> </ul> |
| Ciliated protozoans | <ul style="list-style-type: none"> <li>• .....</li> <li>• .....</li> </ul> | <ul style="list-style-type: none"> <li>• .....</li> </ul>       |
| Sporozoans          | <ul style="list-style-type: none"> <li>• .....</li> <li>• .....</li> </ul> | <ul style="list-style-type: none"> <li>• Plasmodium</li> </ul>  |

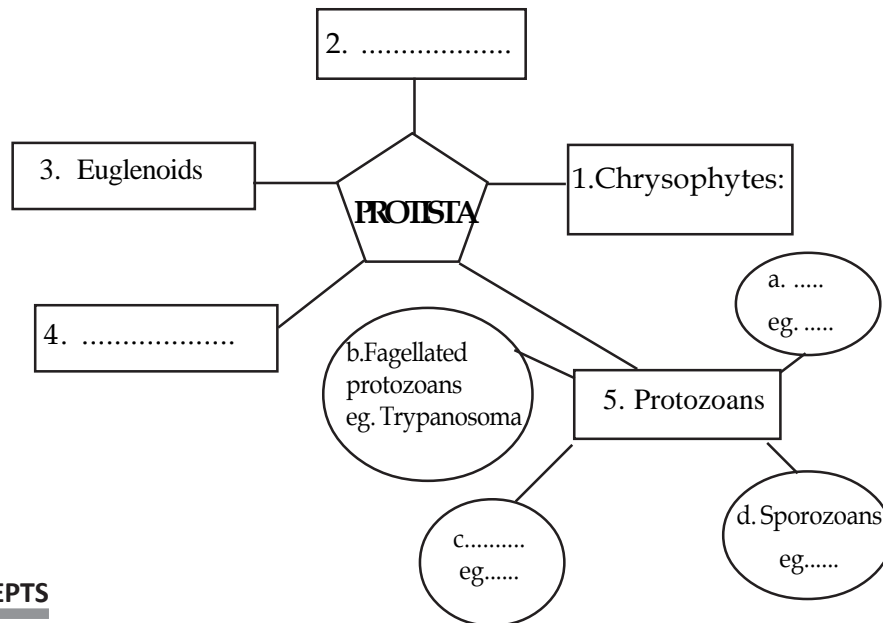


**Consolidation**

- ◆ General chatacteristic features of kingdom protista
- ◆ Classification of protists with examples
- ◆ Useful and harmful effects of some members of the above group
- ◆

**Assignment**

Asks to copy and complete the mind map.



**CONCEPTS**

- ❖ Kingdom fungi - General characters
- ❖ Reproduction
- ❖ Classification with examples.

**Suggested Activities :** General discussion, observation of permanent slides, picture reading, picture drawing, Labwork

The mentor asks some questions to elicit the previous knowledge

- Does fungi need a separate kingdom?
- How do they differ from plants?

The mentor exhibits the video clip of fungal hyphae and mycelium and asks to observe and then provides discussion points.



- What is the body of fungi known as?
- What is mycelium?
- What are the two types of hyphae?
- What are the different mode of nutrition in fungi?
- How do fungi reproduce vegetatively?
- How do fungi reproduce asexually?
- What are the steps in the sexual cycle of fungi?
- What is dikaryon?
- Which group of fungi shows this?
- 

The mentor shows a piece of stale bread and asks to observe it using hand lens. Then asks simple questions

- Have you seen any fungus?
- Can you draw this fungus?

Learners try to draw Rhizopus. The mentor mounts the slide of Rhizopus and asks to observe it and provides discussion points(PE).

#### **Discussion points**

- What is the basis for the classification of fungi?
- In which group does Rhizopus belong?
- What is the nature of mycelium?
- How does reproduction occur in Phycomycetes?
- Which are the other examples of Phycomycetes?
- 

The mentor exhibits the video of yeast and asks to write its features. Then shows the video of Aspergillus, Claviceps and Neurospora and asks to observe them. Then leads a discussion.

#### **Discussion points**

- What is the nature of mycelium of Ascomycetes?
- How do they reproduce?
- What is the economic importance of Ascomycetes?

The mentor shows the specimen of Agaricus and asks question.

- Have you seen this fungus?
- What is this structure known as?
- 

Learners draw and label, write notes on Agaricus in the practical (PE).

Shows the photographs or video of Ustilago and Puccinia

Asks to complete the following table. (Note : This can be used as a tool for peer assessment/self assessment)

| Name of Fungal Group | Nature of mycelium | Vegetative reproduction | Asexual reproduction | Sexual reproduction | Useful and harmful effects |
|----------------------|--------------------|-------------------------|----------------------|---------------------|----------------------------|
| Ascomycetes          |                    |                         |                      |                     |                            |
| Basidiomycetes       |                    |                         |                      |                     |                            |

The mentor shows the video of Alternaria, Colletotrichum and Trichoderma. Learners observe the video and the mentor leads a discussion.

### Discussion points

- Why are Deuteromycetes called imperfect fungi?
- What is the peculiarity of their mycelium?
- How do they reproduce?
- 

### Consolidation

- ◆ Classes of fungi
- ◆ Structure and reproduction of each class
- ◆ Economic importance of fungi.
- ◆



## Assignment

Copy and complete the Table.

| Characters           | Phycomycetes                            | Ascomycetes                     | Basidiomycetes         | .....                         |
|----------------------|---|---------------------------------|------------------------|-------------------------------|
| Mode of reproduction |   |                                 |                        |                               |
| a) Asexual           | Zoospores                               | .....                           | .....                  | Conidia/<br>Fragmen<br>tation |
| b) Sexual            | Isogamy or<br>Anisogamy<br>eg. Rhizopus | Ascospore<br>e.g .....<br>..... | .....<br>e.g. Agaricus | Absent<br>e.g. ....           |

## CONCEPTS

- ❖ Structure of Virus, types and harmful effects.
- ❖ Contribution of scientists.
- ❖ Viroids .
- ❖ Lichens - Symbiotic association.
- ❖ Pollution indicator

**Suggested Activities :** General discussion, picture reading, list preparation and lab work.

## Discussion points

- Can you mention an organism which shows living and non-living characters?
- What is the meaning of 'virus'? Who coined the term?
- Name some viral diseases of plants and animals?
  - Is there any living being smaller than virus?
  - Is lichen a single plant or an association?
  -

Learners note discussion points in their activity log. Asks to read picture (Fig.2.6 a,b) of T.B. Asks to prepare a list of viral diseases in plants and animals. The mentor shows the specimen of Lichen - Usnea(PE).

**Consolidation**

- ◆ Consolidates the characters of Virus, Viroids and Lichens.
- ◆ External and internal structure of Virus
- ◆ Types of Viruses
- ◆ Viral diseases
- ◆ Viroids, disease caused by them
- ◆ Lichen- Phycobiont and Mycobiont, significance

**Repository of CE**

| Process  | Portfolio                               | Unit assessment                          |
|--|---|--|
| Lab work   | Notes in the activity log               | Preparation of questions and Scoring key |
|  | Notes and sketches in the practical log |  |
| General discussion<br>Table completion<br>Assignment |   |  |

**Unit assessment**

**Teacher note:** Ask each learner to prepare 10 questions each with scoring indicators. Instruct them to prepare different types of questions. Give them enough time. Give opportunity to the learners to present their questions. The mentor should provide necessary suggestions to modify questions. When one student read the questions others can write the questions.

**SAMPLE TE QUESTIONS**

1. The bacteria which oxidises nitrates and ammonia for ATP production.
 

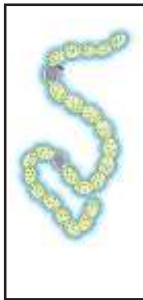
|                              |                              |
|------------------------------|------------------------------|
| a) Cyanobacteria             | b) Chemoautotrophic bacteria |
| c) Photoautotrophic bacteria | d) Archaeobacteria           |

(Score 1)
2. Which of the following contains chlorophyll *a* and heterocyst?
 

|               |                |
|---------------|----------------|
| a) Nostoc     | b) Plasmodium  |
| c) Mycoplasma | d) Trypanosoma |

(Score 1)



3. The symbiotic association of fungi with the roots of higher plants
  - a) Lichens
  - b) Mycorrhiza
  - c) Phycobiont
  - d) Mycobiont(Score 1)
4. T.O Diener discovered a new infectious agent which causes the spindle tuber disease. Name it
  - a) Viruses
  - b) Bacteria
  - c) Mycoplasma
  - d) Viroids(Score 1)
5. The cell wall of fungi is made up of
  - a) Cellulose
  - b) Chitin
  - c) Glycogen
  - d) Cholesterol(Score 1)
6. R.H Whittaker proposed the five kingdom classification of organisms. Write any four criteria for this classification.  
(Score 2)
7. Observe the diagram
  - a) Identify the organism
  - b) Label the part 1
  - c) write the function of 1(Score 2)
8. Following are some important features of an organism that comes under the Kingdom Monera. It lacks a cell wall, is the smallest living cell known and can survive without oxygen. Identify the organism.  
(Score 1)
9. Do fungi reproduce vegetatively, asexually or sexually? What are the three steps involved in sexual reproduction?  
(Score 2)
10. Pick the odd one and give reason.  
Cyanobacteria, Photoautotrophic bacteria, Chemoautotrophic bacteria  
Archaeobacteria  
(Score 1)

| <b>Evaluation : Scoring Key</b> |  |  |                    |
|---------------------------------|--|--|--------------------|
| <b>Q. No.</b>                   | <b>Scoring indicator</b>   | <b>Splitted Score</b>  | <b>Total Score</b> |
| 1                               | Chemoautotrophic bacteria  | 1  | 1                  |
| 2                               | Nostoc   | 1  | 1                  |
| 3                               | Mycorrhiza   | 1  | 1                  |
| 4                               | Viroids  | 1  | 1                  |
| 5                               | Chitin   | 1  | 1                  |
| 6                               | Cell structure, Thallus organisation<br>Mode of nutrition, Reproduction<br>Phylogenetic relationship<br>(Any Four) | $\frac{1}{2}$<br>$\frac{1}{2}$<br>$\frac{1}{2}$<br>$\frac{1}{2}$ | 2                  |
| 7                               | a) Nostoc      b) Heterocyst<br>c) Nitrogen Fixation   | $\frac{1}{2}, \frac{1}{2}$<br>1                                  | 2                  |
| 8                               | Mycoplasma   | 1  | 1                  |
| 9                               | yes<br>Plasmogamy, Karyogamy, Meiosis  | $\frac{1}{2}$<br>$\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$         | 2                  |
| 10                              | Archaeobacteria<br>Others belong to eubacteria   | $\frac{1}{2}$<br>$\frac{1}{2}$                                   | 1                  |

Chapter

2

## Plant Kingdom

*All the classifications hitherto can be broadly categorised under artificial, natural and phylogenetic systems of classification. As the Kingdom Plantae includes a large variety of plants further classification is essential for a better understanding. Kingdom Plantae of Whittaker's classification includes Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms. This chapter deals with the habitat, classification, vegetative structure, reproduction and economic importance of these groups.*

### **Values and attitudes**

- The learner appreciates the diversity and habitat of plants
- The learner develops an attitude to engage in bio - conservation activities.

**Time: 6 Periods**



| <b>Unit Frame</b>  |  |   |
|--|--|---|
| <b>Concepts/Ideas<br/>&amp; Process skills</b>   | <b>Process/Activity<br/>with assessment</b>  | <b>Learning<br/>Outcomes</b>  |
| <ul style="list-style-type: none"> <li>• Contribution of Linnaeus, Bentham and Hooker.</li> <li>• Different systems of classification</li> <li>• Branches of systematics               <ul style="list-style-type: none"> <li>- Communicating</li> <li>- Observing</li> <li>- Comparing</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Photograph collection and prepare footnotes for each</li> <li>• General Discussion</li> </ul>   | <ul style="list-style-type: none"> <li>• Identifies the contributions of scientists in classification and defines different systems of classification with examples.</li> <li>• Defines important branches of systematics.</li> </ul> |
| <ul style="list-style-type: none"> <li>• Algae- habitat, vegetative structure, classification, reproduction, economic importance.</li> <li>- Observing</li> <li>- Identifying</li> <li>- Communicating</li> <li>- Comparing</li> <li>- Classifying</li> </ul>  | <ul style="list-style-type: none"> <li>• Picture album, video presentation, general discussion, picture reading, observation of specimens, slides, drawing.</li> <li>Table Analysis 3.1 of T.B Spirogyra, Sargassum (P.E) - Observation</li> </ul> | <ul style="list-style-type: none"> <li>• Describes and illustrates the vegetative structure, classification, pigmentation, reproduction and economic importance of algae.</li> </ul>  |
| <ul style="list-style-type: none"> <li>• Bryophytes - vegetative structure, classification, reproduction, economic importance.</li> <li>- Observing</li> <li>- Identifying</li> <li>- Communicating</li> <li>- Classifying</li> </ul>  | <ul style="list-style-type: none"> <li>• Funaria (P.E)</li> <li>Moss Protonema (P.E)</li> <li>• General discussion</li> </ul>  | <ul style="list-style-type: none"> <li>• Illustrates the vegetative structure and identifies the classification, reproduction and economic importance of bryophytes.</li> </ul>   |
| <ul style="list-style-type: none"> <li>• Pteridophytes - vegetative structure, classification, reproduction and seed habit.</li> <li>- Observing</li> <li>- Identifying</li> <li>- Comparing</li> <li>- analysing</li> </ul>   | <ul style="list-style-type: none"> <li>• Observation of specimen Nephrolepis and Sporophyte</li> <li>• Observation of permanent slide- Fern prothallus (PE)</li> <li>Preparation of notes</li> </ul>   | <ul style="list-style-type: none"> <li>• Illustrates the vegetative structure and explains the classification, reproduction and seed habit of pteridophytes.</li> </ul>   |



| Concepts/Ideas & Process skills   | Process/Activity with assessment   | Learning Outcomes   |
|---|--|---|
| <ul style="list-style-type: none"> <li>Gymnosperms- vegetative structure, reproduction</li> <li>- Classifying</li> <li>- Observing</li> <li>- Identifying</li> </ul>  | <ul style="list-style-type: none"> <li>Pinus male cone, female cone (P.E)</li> <li>Discussion, preparation of notes</li> </ul>     | <ul style="list-style-type: none"> <li>Illustrates the vegetative structure, and explains classification, reproduction of Gymnosperms.</li> </ul>                           |
| <ul style="list-style-type: none"> <li>Angiosperm - classification, reproduction</li> <li>- Observing</li> <li>- Identifying</li> <li>-Communicating</li> </ul>   | <ul style="list-style-type: none"> <li>Dicot plant, monocot plant (P.E.)</li> <li>Picture analysis of fig. 3.6 from T.B</li> </ul> | <ul style="list-style-type: none"> <li>Identifies the classes of angiosperms and explains the methods of reproduction.</li> </ul>   |
| <ul style="list-style-type: none"> <li>Life cycle - Haplontic, Diplontic, Haplodiplontic with examples.</li> <li>Names of plants which shows exceptions in each life cycle.</li> <li>- Communicating</li> <li>- Interpreting</li> </ul> | <ul style="list-style-type: none"> <li>Chart Preparation</li> <li>Note preparation</li> <li>- General discussion</li> </ul>        | <ul style="list-style-type: none"> <li>Compares the life cycle patterns of different groups of plants and lists the plants which shows exceptions in each cycle.</li> </ul> |

### ***Towards the chapter***

#### **CONCEPTS**

- ❖ Various systems of classification
- ❖ Linnaeus - Artificial system
- ❖ Bentham and Hooker - Natural system
- ❖ Phylogenetic system
- ❖ Branches of systematics - Cytotaxonomy, Numerical Taxonomy, Chemotaxonomy.

**Suggested Activities:** Photograph collection, general discussion

The mentor asks to collect photograph of Linnaeus, Bentham and Hooker, Prepare footnotes on their contributions.

**Discussion points**

- How will you differentiate Natural system and Artificial system of classification?
- What is Phylogenetic system of classification?
- What are different branches of classification?

Learners discuss with one another and note the discussion points in the activity log.

**Consolidation**

- ◆ Contribution of scientists, systems of classification and branches of systematics.
- ◆ Systems of classification - Artificial, Natural and Phylogenetic
- ◆ Branches of classification - Numerical taxonomy, cytotaxonomy, chemotaxonomy

**CONCEPTS**

- ❖ Algae - Habitat, vegetative structure, reproduction and economic importance.
- ❖ Algae - Rhodophyceae, Phaeophyceae, Chlorophyceae (based on pigments)

**Suggested Activities:** Picture album preparation/Presentation with ICT (Video slides), general discussion, picture reading, observation of specimens or slides, picture drawing, table analysis Labwork.

- Asks to prepare a picture album of algae of different classes (as per the instructions given in previous classes) Asks the students to read the picture (fig 3.1 a-c) in T.B Exhibits video slides of different algae. The mentor elicits the previous knowledge through certain simple questions, Have you noticed the green colouration in ponds? What is its reason? Are there photosynthetic plants in the sea or ocean?

**Discussion points**

- What are the different habitats of algae?
- Can you cite examples for unicellular, colonial and filamentous algae?
- What are the different types of reproduction in algae?



- How does sexual reproduction differ from asexual reproduction?
- Can you mention the term used for the fusion of similar gametes, dissimilar gametes, motile and non motile gametes?

The mentor asks the learners to analyse Table 3.1 given in T.B and to prepare notes based on the following points.

- What are the different types of algae based on pigments?
- What are the important features of chlorophyceae with respect to habit, habitat, pigment, reserve food, cell wall and reproduction?
- How does phaeophyceae differ from chlorophyceae in habit, habitat, pigment, reserve food, cell wall and reproduction?
- What do you know about habit, habitat, cell wall, pigment, reserve food and reproduction in Rhodophyceae?
- How does algae become economically important?

Learners discuss with one another and note the discussion points in the activity log. The mentor asks to observe the given slides and specimens of Sargassum (thallus) and Spirogyra (filament) and draw diagrams in the activity log and practical log (P.E)

### **Consolidation**

- ◆ Habits and habitats of algae
- ◆ Different types of reproduction in algae-Vegetative, asexual and sexual
- ◆ Sexual reproduction-Isogamy, anisogamy, oogamy.
- ◆ Different classes of algae - chlorophyceae, phaeophyceae and rhodophyceae
- ◆ The habit, habitat, pigments, reserve food, cell wall and reproduction in chlorophyceae, pheophyceae, rhodophyceae with examples
- ◆ Economic importance of some algae

Assignment: collection of funaria in groups.

### **CONCEPTS**

- ❖ Bryophytes - Vegetative structure, classification, reproduction, economic importance.
- ❖ Amphibians of the plant kingdom

**Suggested Activities:** Picture reading, drawing observation of slides general discussion and lab work.

The mentor asks the learners to observe moss plant they collected, and to compare the specimen with the figure given in T.B

### Discussion points

- What are the parts seen in the plant body?
- Why are bryophytes called amphibians of plant kingdom?
- What are the male and female reproductive structures in bryophytes?
- How will you differentiate the gametophyte and sporophyte of bryophytes.
- What is the name given to the haploid plant body of bryophytes?
- What are the ecological and economic importance of bryophytes?
- What are the two major groups of bryophytes and give examples?
- Name the asexual reproductive structure in liverworts.
- What are the two different stages in the life cycle of mosses?
- How do mosses reproduce vegetatively and sexually?

The learners discuss with each other and prepare notes in the activity log. Asks to observe permanent slide of Funaria -Protonema and macrospecimen of Funaria-gametophyte with sporophyte and draw diagrams in the activity log and practical log (P.E)

### Consolidation

- ◆ Vegetative structure, classification, reproduction and economic importance of bryophytes
- ◆ Bryophytes-amphibians of plant kingdom
- ◆ Gametophytic plant body is haploid
- ◆ Sporophyte - diploid
- ◆ Ecological and economic importance of bryophytes
- ◆ Habit,habitat,reproduction-Asexual,Sexual
- ◆ Examples

### CONCEPTS

- ❖ Pteridophytes - Vegetative structure, classification, seed habit, reproduction.



**Suggested Activities:** Picture reading, general discussion, observation prothallus and Nephrolepis - sporophyte, labwork.

The mentor exhibits video/specimen of pteridophytes mentioned in the text book. Asks to observe them and write down the peculiarities.

### **Discussion points**

- Which is the most primitive vascular land plant?
- What are the economic importance of pteridophytes?
- Name the sporangia bearing leaf like structures of pteridophyte?
- Name the pteridophytes that have strobili or cones.
- What is prothallus?
- What are the male and female sex organs of pteridophytes?
- What is heterospory?
- How does heterospory become a precursor of seed habit?.
- Do pteridophytes produce seed?
- 

The learners discuss with each other and prepare notes in the activity log. Asks to observe permanent slide of Nephrolepis-prothallus and macrospecimen of Nephrolepis-sporophyte and draw diagrams in the activity log and Practical log (P.E).

### **Consolidation**

- ◆ Pteridophyte - Vegetative structure.
- ◆ Classification.
- ◆ Reproduction.
- ◆ Seed habit and heterospory.

### **CONCEPTS**

- ❖ Gymnosperms - Vegetative structure, classification, reproduction
- ❖ Mycorrhizal association in roots,
- ❖ Adaptation of gymnosperms
- ❖ Reproductive structure -male and female cones

**Suggested Activities:** General discussion, observation of macrospecimens (Pinus male cone and female cone labwork).

The mentor exhibits video /photograph of Cycas and Pinus

### Discussion points

- Which is the most primitive seed plant?
- Have you seen flowers in Cycas?
- Some gymnosperm roots show fungal association. What is it called?
- What is the importance of mycorrhizal association?
- Gymnosperms can withstand extreme temperatures. What are its adaptations?
- What are the reproductive structures of gymnosperm?
- How does sexual reproduction occur in gymnosperms?

Learners discuss each other and prepare notes in the activity log, the mentor ask to observe male and female cones of Pinus and draw it in the activity log and practical log (P.E)

### Consolidation

- ◆ Structure and reproduction of gymnosperms.

### CONCEPTS

- ❖ Angiosperms - Classification, reproduction
- ❖ Dicotyledons and monocotyledons - general features.
- ❖ Sexual reproduction - Double fertilisation - triple fusion and Syngamy

**Suggested Activities:** Video observation, general discussion, specimen observation. lab work

The mentor exhibits a monocot and a dicot plant. Asks to observe them

### Discussion points

- Which is the most prominent and advanced plant group?
- What are the two classes of angiosperms?
- What are the reproductive structures of angiosperms?



Then the mentor asks to observe Fig. 3.6 given in the textbook.  
Asks to prepare notes based on the figure.

- What is double fertilisation?
- How and where are the female gametes formed in angiosperms?
- What are the eight nuclei seen in embryo sac?

The learners discuss with each other and prepare notes in the activity log, asks to observe dicot and monocot plant and draw it in the activity log and practical log(PE).

### **Consolidation**

- ◆ Classification and reproduction of angiosperms.
- ◆ Double fertilisation
- ◆

**The chapter can also be transacted through project, details attached.  
See Appendix 1 at the end of the chapter.**

### **CONCEPTS**

- ❖ Life cycle - Haplontic, diplontic, haplodiplontic.

(Names of plants which shows exceptions in each life cycle.)

**Suggested Activities:** Reading figure from T.B(Fig. 3.7 a,b and c), general discussion, chart preparation.

The mentor asks the learners to draw the life cycle patterns given in the TB in the chart.

### **Discussion points**

- Are life cycle patterns of all plant groups similar?
- What is haplontic, diplontic and haplodiplontic life cycle?

The learners discuss with each other and prepare notes in the activity log. The mentor asks to prepare list of plants which shows exception from general life cycle pattern.

### **Consolidation**

- ◆ Different patterns of life cycle citing examples.
- ◆



## Repository of CE

| Process assessment                                  | Portfolio assessment   | Unit assessment      |
|---|--|----------------------|
| Lab work<br>General discussion<br>Album preparation | Album<br>Prepared notes in the activity log<br>Practical log | Open book assessment |

**Open book assessment**

Question: Compare the sexual reproduction in bryophytes, pteridophytes and gymnosperms.

## SAMPLE TE QUESTIONS

**Multiple Choice Questions**

- The classification based on evolutionary history is
  - Artificial classification
  - Phylogenetic classification
  - Natural classification
  - Numerical taxonomy

(Score 1)
- The classification carried out using computers based on all observable characters is
  - Cytotaxonomy
  - Chemotaxonomy
  - Numerical taxonomy
  - Natural classification

(Score 1)
- Which one is a colonial algae?
  - Volvox
  - Chlamydomonas
  - Ulothrix
  - Spirogyra

(Score 1)
- In Phaeophyceae, cell wall is covered by
  - Algin
  - Carrageen



c) Pectin

d) Murein

5. Stored food of Rhodophyceae is

a) Starch

b) Mannitol

c) Laminarin

d) Floridean starch

(Score 1)

6. The Bryophyte used as fuel is

a) Sphagnum

b) Funaria

c) Riccia

d) Marchantia

(Score 1)

7. Asexual reproduction in liverworts takes place by the formation of specialised structures called

a) Gemmae

b) Aplanospores

c) Zoospores

d) Conidia

(Score 1)

8. Prothallus represents the gametophytic stage of

a) Bryophytes

b) Fern

c) Gymnosperm

d) Angiosperm

(Score 1)

**Short Answer type questions**

9. Differentiate between
- a) Homosporous and heterosporous ferns
  - b) Anisogamy and oogamy (Score 2)
10. Agar is an economically important substance. From which plant is it commercially extracted? Give two economic importance. (Score 2)
11. Plant life cycle shows alternation of generations. Differentiate haplontic and haplodipontic life cycle with examples. (Score 3)
12. Double fertilisation is a unique feature of angiosperms.
- a) Differentiate syngamy and triple fusion.
  - b) What are the products of these fusions? (Score 3)
13. Comment on the reproductive structures of Gymnosperms. (Score 2)
14. Explain the importance of heterospory and seed habit in Pteridophytes. (Score 2)

\*\*\*\*\*



### SCORING KEY

| Q. No. | Scoring indicator  | Splitted Score                           | Total Score |
|--------|--|--|-------------|
| 1.     | Phylogenetic classification  |  | 1           |
| 2.     | Numerical taxonomy   |  | 1           |
| 3.     | Volvox   |  | 1           |
| 4.     | Algin  |  | 1           |
| 5.     | Floridean starch   |  | 1           |
| 6.     | Sphagnum   |  | 1           |
| 7.     | Gemmae   |  | 1           |
| 8.     | Fern   |  | 1           |
| 9.     | Spores of similar kinds-Homosporous<br>Spores of two kinds-Macro(large)and micro (small)spores- Heterosporous  | $\frac{1}{2}$<br>$\frac{1}{2}$           | 1           |
| 10.    | Gelidium/Gracillaria,used to grow microbes, preparation of icecreams or jellies  | $\frac{1}{2}$ + $\frac{1}{2}$            | 1<br>2      |
| 11.    | The dominant phase is haplontic gametophyte<br>eg:- Algae-Volvox/Spirogyra/some species of Chlamydomonas<br>The haploid gametophyte alternate with diploid sporophyte.<br>eg:- Bryophytes and pteridophytes  | 1<br>$\frac{1}{2}$<br>1<br>$\frac{1}{2}$ | 3           |
| 12.    | Syngamy – One of the male gametes fuses with egg cell<br>Syngamy results in the formation of zygote<br>One of the male gamete fuses with diploid secondary nucleus termed triple fusion.<br>Results in the formation of triploid PEN (Primary endosperm nucleus) | 1<br>$\frac{1}{2}$<br>1<br>$\frac{1}{2}$ |             |
| 13.    | The male reproductive organ of Gymnosperms is male cone or strobili. Strobili consists of an axis bearing  |  |             |

|     |   |        |   |
|-----|---|--------|---|
|     | spirally coiled microsporophylls with microsporangia Female reproductive organ of Gymnosperms is female cones or strobili. Strobili consists of an axis bearing spirally coiled megasporophylls with ovules or megasporangia.   | 1      | 2 |
| 14. | Certain pteridophytes produce two kinds of spores – macro and microspores known as heterospory. Macrospore germinate and produce female gametophyte. In some pteridophytes, embryo develop from the female gametophyte within the sporophyte is a precursor to seed habit | 1<br>1 | 2 |



## PROJECT

### PLANT KINGDOM

The learning of various plant groups can be done through a project .A survey project is more suitable to this topic.

#### STEPS

1. **Aim:** To study the morphological characters, habitat, reproductive structures of algae, bryophytes, pteridophytes, gymnosperms and angiosperms.
2. **Planning and Execution:** Brief introduction of the topic by the mentor. Learners are grouped into five(Each group must be assigned with all the five plant groups).
3. **Time Allotment:** The time allotted to complete the project is one and a half weeks.
4. **Data Collection:** Primary materials, Information can be collected from textbooks, from mentor ,reference books, newspaper, magazines, journals, internet etc.

**Field visit :** With the assistance of mentor learners visit nearby places and observe plants and take photographs. Note down the relevant details(date, habitat, nature of plants)in the field diary.

5. **Tabulation:**The data collected from different sources can be tabulated as follows.

| Classes                 | Algae | Bryophytes | Pteridophytes | Gymnosperms | Angiosperms |
|-------------------------|-------|------------|---------------|-------------|-------------|
| Habitat                 |       |            |               |             |             |
| Vegetative Characters   |       |            |               |             |             |
| Reproductive Structures |       |            |               |             |             |
| Economic Importance     |       |            |               |             |             |