SEMESTER I

Core course 1 Code: BO1CRT01

METHODOLOGY OF SCIENCE AND AN INTRODUCTION TO BOTANY

(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Objectives:

- Understand the universal nature of science
- Demonstrate the use of scientific method
- To lay a strong foundation to the study in Botany
- Impart an insight into the different types of classifications in the living kingdom.
- Appreciate the world of organisms and its course of evolution and diversity.
- Develop basic skills to study Botany in detail.

Module 1: Introduction to science and the methodology of science (4 hrs)

Scientific method: steps involved - observation and thoughts, formulation of hypothesis; inductive reasoning - testing of hypothesis; deductive reasoning - experimentation - formulation of theories and laws.

Module 2: Experimentation in science (4 hrs)

Selection of a problem - searching the literature – designing of experiments - selection of variables, study area, and a suitable design. Need of control, treatments and replication. Mendel's experiments as an example of moving from observations to questions, then to hypothesis and finally to experimentation. Ethics in science.

Module 3: Origin and evolution of life (10 hrs)

Origin of life on earth from molecules to life - Oparin's hypothesis, Haldane's hypothesis, Miller-Urey experiment, Panspermia, origin of cells and the first organisms. Evolutionary history of Biological diversity – fossil record; geological time scale – major events in each era. Evidences of evolution; theories of evolution - Lamarck, Wallace, Charles Darwin, Hugo De Vries. Neo-Darwinism – major postulates - isolation, mutation, genetic drift, speciation.

Module 4: Diversity of life and its classification (12 hrs)

Diversity of life: two kingdom classification (Carolus Linnaeus, 1735); phylogenetic classification (August W Eichler, 1878); five kingdom classification (R H Whittaker, 1969). Three domains, six kingdom classification, (Carl Woese, 1990) – criteria for classification, general characters of each kingdom. The three domains of life: Archaea, Bacteria, Eucarya – general characters of each.

Diversity of plants: study the salient features of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.

Module 5: Basic Botanical skills (6 hrs)

Light microscope: dissection and compound microscope – parts and uses. Preparation of specimens for light microscopy - collection and preservation of plant specimens; killing and fixing; killing agents - formalin, ethyl alcohol; fixing agents - Carnoys fluid, Farmer's fluid, FAA; herbarium (brief study only). Whole mounts and sections – hand sectioning – TS, TLS, RLS. Staining plant tissues: purpose; stains - safranine, acetocarmine, crystal violet. Temporary and permanent mounting, mountants.

PRACTICAL (36 hrs)

1. Design an experiment to verify a given hypothesis.
2. Conduct a survey-based inquiry on a given topic (To test the validity of a given hypothesis. E.g., all angiosperm parasites are Dicot plants).
3. Select an important classical experiment and find out the different elements of the methodology of science (e.g., Robert Koch experiment).
4. Conduct field surveys to identify and collect plant specimens to appreciate the diversity of plant kingdom. Submit five preserved specimens (in bottles and/or herbarium) belonging to diverse groups.
5. Identification of plants with vascular elements, plants which produce flowers, fruits, seeds, cone, sporophyll, embryos and study their salient features.
6. Prepare temporary, stained hand sections (TS, TLS, RLS) of plant specimens appropriate for light microscopic studies.

REFERENCES

1. Carl R Woese, O Kandler, M L Wheelis, 1990. "Towards a natural system of organisms: proposal for the domains Archaea, Bacteria, and Eucarya". Proceedings of the National Academy of Sciences of the United States of America, 87 (12): 4576–4579.
2. Kenneth A Mason, Jonathan B Losos, Susan R Siger, 2013. Biology (IX Edn). McGraw Hill.
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9. James H Otto, Albert Towle. Modern Biology. Holt, Reinhart and Winston Publishers.
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11. William S Beck, Karel F Liem, George Gaylord Simpson, 1991. LIFE: An Introduction to Biology (III Edn). Harper Collins Publishers.
12. Michael G Simpson, Plant Systematics (II Edn). Academic press.
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