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Core course 6

Code: BO5CRT06

RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

Theory: 54 hrs; Practical: 45 hrs; Credits: 3 + 1)

Objectives:

- To equip the students to conduct independent research and prepare research reports.
- To make the students acquaint with different tools and techniques used in research work.
- To equip the students with basic computer skills necessary for conducting research.
- To enable the students to have enough numerical skills necessary to carry out research.

RESEARCH METHODOLOGY (Theory 18 hrs; Practical 18 hrs)

Module 1: Introduction (4 hrs)

Objectives of research. Types of research - pure and applied. Identification of research problem. Review of literature: purpose, literature sources – names of reputed National and International journals in life science (2 international & 3 national); reprint acquisition - INSDOC, INFLIBNET.

Module 2: Process of research (7 hrs)

Conducting research: define the problem, identify the objective, design the study, collection of data, analysis and interpretation. Preparation of research report: preparation of dissertation - IMRAD system - preliminary pages, introduction and review of literature, materials and methods, results, discussion, conclusion and bibliography.

Module 3: Use of computer in research (7 hrs)

Introduction to MS - WINDOWS and LINUX, application of MS WORD - word Processing, editing tools (cut, copy, paste), formatting tools. MS EXCEL - creating worksheet, data entry, sorting data. Statistical tools (SUM, MEAN, MEDIAN and MODE). Preparation of graphs and diagrams (Bar diagram, pie chart, line chart, histogram). MS-POWERPOINT - presentation based on a biological topic; inserting tables, charts, pictures. Open source and free alternatives to MS Office: Libre Office, Open Office (brief study). Search engines: Google.com; meta search engine – dogpile.com; academic search - Google scholar. Educational sites related to biological science - Scitable, DNAi.

PRACTICAL (18 hrs)

1. Prepare outline of a dissertation (IMRAD system).
2. Prepare a list of references (not less than 10) on a topic in biological science.
3. Review the literature on a given topic.
4. Collect information on a topic related to biological science using the internet.

5. Make a report based on the collected information from the internet (using MS-WORD).
6. Prepare tables/charts/graphs using EXCEL.
7. Prepare a worksheet using a set of data collected and find out the SUM.
8. Prepare a PowerPoint presentation based on the report in Experiment 4.

BIOPHYSICS (Theory 18 hrs; Practical 9 hrs)**Module 4: Introduction (2 hrs)**

Introduction to biophysics; branches of biophysics - molecular, cellular, membrane and biomedical instrumentation (scope only).

Module 5: Biophysical instrumentation (16 hrs)

Principle, working and applications of the following:

Microscopy: compound microscope, phase-contrast microscope and electron microscope – SEM. Colorimeter, spectrophotometer. Centrifuge: ultracentrifuge. Chromatography: paper, thin layer and column. Electrophoresis, PAGE. pH meter. Haemocytometer.

PRACTICAL (9 hrs)

1. Measurement of pH and adjusting pH using pH meter.
2. Separation of plant pigments using TLC.
3. Determination of the concentration of a sample solution using colorimeter.
4. Demonstration of column chromatography.
5. Count the number of cells/spores using Haemocytometer.

BIOSTATISTICS (Theory 18 hrs; Practical 18 hrs)**Module 6: Introduction**

Introduction, statistical terms and symbols (Brief study only). Sampling: concept of sample, sampling methods - random and non random sampling. Collection and representation of data: diagrammatic and graphic representation - line diagram, bar diagram, pie diagram, histogram, frequency curve. Measures of central tendency: mean, median, mode, (discrete and continuous series). Measures of dispersion: standard deviation. Distribution patterns: normal distribution, binomial distribution. Tests of significance: Chi-square test - uses, procedure.

PRACTICAL (18 hours)

1. Collect numerical data, tabulate and represent in different types of graphs and diagrams mentioned in the syllabus.
2. Problems related to mean, median, mode, standard deviation and Chi-square test.

REFERENCES

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Core course 7 Code: BO5CRT07
PLANT PHYSIOLOGY AND BIOCHEMISTRY
(Theory 54 hrs; Practical 45 hrs; Credits 3 + 1)

Objectives:

- Acquire basic knowledge needed for proper understanding of plant functioning.
- Familiarize with the basic skills and techniques related to plant physiology.
- Understand the role, structure and importance of the bio molecules associated with plant life.

PLANT PHYSIOLOGY (Theory 36 hrs; Practical 27 hrs)

Module 1: Water relations (6 hrs)

Plant water relations - diffusion, imbibition, osmosis, OP, DPD, TP; water potential - concepts and components (pressure potential, gravity potential, osmotic potential and matric potential). Absorption of water - active and passive, pathway of water movement - apoplastic and symplastic pathway. Ascent of sap - cohesion-tension theory. Transpiration - types, mechanism, theories (Starch-sugar, Proton-K⁺ ion exchange), significance; antitranspirants. Guttation.

Module 2: Mineral nutrition (3 hrs)

Role of major and minor elements in plant nutrition, deficiency symptoms of essential nutrients; mineral uptake - passive (ion exchange) and active (carrier concept).

Module 3: Photosynthesis (12 hrs)

Photosynthetic pigments, photo excitation - fluorescence, phosphorescence; red drop and Emerson enhancement effect. Photosystems - components and organization; cyclic and non-cyclic photophosphorylation; carbon assimilation pathways - C₃, C₄ plants - Kranz anatomy, CAM. Photorespiration. Factors affecting photosynthesis - Blackmann's law of limiting factors.

Translocation of solutes: pathway of phloem transport, mechanism - pressure flow, mass flow hypothesis; phloem loading and unloading.

Module 4: Respiration (8 hrs)

Respiration: anaerobic and aerobic; glycolysis, Krebs's cycle, mitochondrial electron transport system - components, oxidative phosphorylation, ATPase, chemiosmotic hypothesis. RQ - significance. Factors affecting respiration.