

GENERIC ELECTIVES (BOT-GE-4)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/Practice		
Basic Laboratory and Field Skills in Plant Biology and Allied Sciences BOT-GE-4	4	2	0	2	-	Nil

Learning Objectives

The Learning Objectives of this course are as follows:

To learn fundamental skills important for performing laboratory and field experiments.

Learning outcomes

After completion of this course the student will learn:

- Good Lab Practices, management of laboratory waste, understanding hazards and risks to ensure a safe laboratory environment.
- Basics of measurements, units and common mathematical calculations, sampling and data collection.
- Handling and maintenance of instruments
- Presentation, analysis and interpretation of results.

SYLLABUS OF BOT-GE-4

Unit 1: Lab safety and good lab practices

Weeks: 02

General laboratory safety, good laboratory practices, biosafety measures (first-aid practices to be followed in case of burn, acid and injury), safety symbols, lab safety

equipment (Fire extinguisher, fume hood, safety glasses), classes of laboratory chemicals, maintenance and handling of chemicals (Labels, Quality - LR/ AR/ Molecular biology grade/ HPLC grade/Tissue culture grade; Expiry date; Precautions for use), Disinfectants, Biocontainment, Disposal of hazardous chemicals, radioactive and biological waste, Laboratory waste management

Unit 2: Use and maintenance of Laboratory equipment **Weeks: 02**

Weighing balance (Top loading and Analytical), pH meter (calibration and use), magnetic stirrer, pipettes, autoclave, laminar airflow, BOD incubator, incubator shaker, micrometer, haemocytometer, spectrophotometer, Agarose gel electrophoresis unit, SDS PAGE unit, centrifuge, distillation unit, conductivity meter, Lux meter.

Unit 3: Microscopy, sample and slide preparation **Weeks: 2.5**

Microscopes (Dissecting, compound, electron microscope), Fixation and Preservation (for light and electron microscopy); staining, mounting; basic introduction to other types of microscopes (confocal, fluorescence)

Unit 4: Measurements and calculations **Week: 01**

Units of measurements and conversion from one unit to another, measurement of volumes of liquids, Weighing, calculations: scientific notations, powers, logarithms and fractions

Unit 5: Solutions and Buffers **Week: 01**

Molarity, Molality, Normality, percent solution, stock solution, standard solution, dilution, dilution series, pH, acid and bases, buffers- Phosphate, Tris- acetate, Tris- Cl and Citrate buffer

Unit 6: Basic culturing techniques **Weeks: 1.5**

Basic culture media (LB, YEB, MS)- Liquid and solid, Culture techniques : plating (streak, spread & pour), replica plating, serial dilution

Unit 7: Data collection, statistical analysis and interpretation **Weeks: 02**

Fundamentals of data collection, data types - primary and secondary, methods of data collection, sample, sampling methods - merits and demerits, technical and biological replicates, classification - tabulation and presentation of data, Descriptive statistics - Mean, mode, median, Variance, Standard Deviation, Standard error, Coefficient of Variation, difference between sample and population mean.

Unit 8: Basic computer skills for biology

Weeks: 02

MS- Word, PowerPoint, Excel, introduction to biological databases

Unit 9: Field Skills

Week: 01

Identification, collection, cataloguing and preservation of plant specimens, Herbarium and Museum

Practicals:

1. Preparation of solutions - molar, molal, normal, percentage, stock, standard and serial dilution
(Week: 01)
2. Determining pH of solutions (pH paper, Universal indicator, pH meter) and preparation of buffers (Phosphate, Tris-Cl, Electrophoresis buffers- TBE/TAE)
(Week: 01)
3. Working of instruments - light microscope, autoclave, laminar air flow, spectrophotometer, centrifuge, gel electrophoresis unit (Agarose & Poly acrylamide gels)
(Week: 02)
4. Temporary peel mount slide preparation and staining (safranin and acetocarmine).
(Week: 01)
5. Calculate cell size using micrometer.
(Week: 01)
6. To calculate number of cells per unit volume (using pollen/spores) using haemocytometer **(Week: 01)**
7. Preparation of LB medium, growth and maintenance of bacterial cultures (liquid -serial dilution method; and semi-solid cultures - streak, spread and

pour plates) **(Weeks:02)**

8. Isolation of genomic DNA from *E. coli* and plant leaf material, Agarose gelectrophoresis. **(Weeks: 02)**
9. Calculation of mean, mode, median, standard deviation using data set (collected from experiments 5 and 6) **(Week: 01)**
10. Using software to draw tables, graphs and calculating descriptive statistics (Microsoft Excel) **(Week: 01)**
11. Laboratory safety equipment (Fire extinguisher, Fume hood, safety glasses) **(Week: 01)**
12. Mounting of a properly dried and processed plant specimen with herbarium label **(Week: 01)**

Essential/recommended readings:

- Evert, R. F., Eichhorn, S. E., Perry, J.B. (2012). Laboratory Topics in Botany. W.H. Freeman and Company.
- Mesh, M.S., Kebede-Westhead, E. (2012). Essential Laboratory Skills for Biosciences. John Wiley & Sons, Ltd.
- Mu, P., Plummer, D. T. (2001). Introduction to practical biochemistry. Tata McGraw-Hill Education.
- Mann, S. P. (2016). Introductory Statistics, 9th edition. Hoboken, NJ, John Wiley and Sons Inc.
- Danniel, W.W. (1987). Biostatistics. New York, NY: John Wiley Sons.
- Jones, A., Reed, R., Weyers, J. (2016) Practical Skills in Biology, 6th Edition, Pearson.
- Bisen, P.S. (2014). Laboratory Protocols in Applied Life Sciences (1st edition). CRC Press.

Suggestive readings:

- Zar, Z. H. (2010). Biostatistical Analysis, 5th edition, Pearson Prentice Hall, New Jersey, USA.