

**Four-year Undergraduate Programme**  
**Subject: Botany**  
**Semester: Third**  
**Course Name: *Laboratory and Field Techniques in Plant Science***  
**Existing Base Syllabus: UG CBCS Syllabus**  
**Course Level: 200-299, and subsequent level as per NEP structure**

<b>THEORY</b> [Total marks: 60] Credit: 03; Total No. of classes: 45			
<b>Unit no.</b>	<b>Unit content</b>	<b>No. of classes</b>	<b>Marks</b>
<b>Unit 1</b>	<b>Laboratory safety and good practices:</b> General laboratory safety: dos and don'ts, lab safety measures, code of conduct in laboratory, safe handling of chemicals, glass apparatus, instruments, electrical appliances; First aid practices (acid spills, burns and other injuries), safety symbols, classes/ grades of chemicals, Laboratory waste management: radioactive, hazardous chemicals and biological wastes.	8	8
<b>Unit 2</b>	<b>Handling and maintenance of instruments:</b> Weighing balance, pipettes and micropipettes, magnetic stirrer, autoclave, laminar air flow, pH and conductivity meter (calibration and use), Incubator (static and shaker), Luxmeter, hemocytometer, micrometer, spectrophotometer, Agarose gel electrophoresis unit, SDS PAGE unit, centrifuge, distillation unit.	8	12
<b>Unit 3</b>	<b>Measurements and calculations:</b> Units of measurements, conversion from one unit to another, Weighing, calculations: scientific notations, powers, logarithm and fractions; measurement of volumes of liquids.	4	8
<b>Unit 4</b>	<b>Solutions and Buffers:</b> Preparation of solutions: stock solution, standard solution. Types of solutions: Normal, Molar, Molal, Percentage, ppm, ppb. Dilution and dilution factors, Acids, Bases, adjustment of pH, Buffers - phosphate, Tris- HCl and Citrate buffer.	6	8
<b>Unit 5</b>	<b>Microscopy and Culture Techniques:</b> Microscopes: working principles and types (Light and Electron microscopes), sample and slide preparation: fixation, staining, mounting, preservation (for light and electron microscopy).  Basic culture media (NA, NB, PDA, MS), selective and differential media, Culture techniques: plating (streak, spread & pour), serial dilution.	8	12

<p><b>Unit 6</b></p>	<p><b>Biostatistics, computing and field skills:</b> Datatypes- primary and secondary, methods of data collection, sample and sampling methods- merits and demerits; technical and biological replicates; Tabulation and presentation of data, Descriptive statistics - Mean, Median, Mode, Variance, Standard Deviation, Standard error, Coefficient of Variation, MS-Word, PowerPoint, Excel, concept on biological databases.</p> <p>Collection, Identification, Preparation and Preservation of Herbarium and Museum specimens.</p>	<p>11</p>	<p>12</p>
<p><b>PRACTICAL [Credit: 01]</b></p>			
<ol style="list-style-type: none"> <li>1. Preparation of solutions- molar, molal, normal, percentage, stock solution and dilution</li> <li>2. Measurement of pH of solutions using pH meter/ pH strip and preparation of buffers (Phosphate /citrate buffer)</li> <li>3. Working with instruments - Centrifuge, autoclave, laminar air flow, hot air oven, incubator, light microscope, spectrophotometer/colorimeter,</li> <li>4. Slide preparation and staining of plant materials.</li> <li>5. Determination of cell/spore size using micrometer.</li> <li>6. Preparation of PDA/NA medium for growth and maintenance of fungal/bacterial cultures.</li> <li>7. Calculation of mean, mode, median, standard deviation using data set.</li> <li>8. Drawing of tables, graphs and to carry out statistical calculation using Microsoft Excel.</li> <li>9. Preparation of herbarium specimen: Collection, processing, mounting, and labelling of plant specimen.</li> </ol>		<p>30</p>	<p>40</p>

**Reading list:**

1. Bisen PS (2014) Laboratory Protocols in Applied Life Sciences, 1<sup>st</sup> Edition. CRC Press.
2. Danniel WW (1987) Biostatistics. New York, NY: John Wiley Sons.
3. Evert RF, Eichhorn SE, Perry JB (2012) Laboratory Topics in Botany. W.H. Freeman and Company.
4. Jones AM, Reed R, Weyers J (2016) Practical Skills in Biology, 6<sup>th</sup> Edition, Pearson
5. Mann SP (2016) Introductory Statistics, 9<sup>th</sup> edition. Hoboken NJ, John Wiley and Sons Inc.
6. Mesh MS, Kebede-Westhead E (2012) Essential Laboratory Skills for Biosciences. John Wiley & Sons, Ltd.

7. Mu P, Plummer DT (2001) Introduction to practical biochemistry. Tata McGraw- Hill Education.
8. Zar ZH (2010) Biostatistical Analysis, 5<sup>th</sup> Edition, Pearson Prentice Hall, New Jersey, USA.

### **Graduate Attributes**

#### ***Course Objective:***

This paper will provide basic knowledge and understanding of good laboratory practices, laboratory waste management, understanding hazards and risks to ensure a safe laboratory environment, measurements, units, and common mathematical calculations, sampling and data collection, and instrument operation and maintenance.

#### ***Learning outcome:***

On successful completion of the course, students will be:

1. Able to learn fundamental skills important for performing laboratory and field experiments.
2. Able to prepare, analysis of data and interpretation of results.

**Theory Credit: 03**

**Practical Credit: 01**

**No. of Required Classes: 75** (Theory: 45; Practical: 30)

**No. of Contact Classes: 75** (Theory: 45; Practical: 30)

**No. of Non-Contact Classes: Nil**

#### **Particulars of Course Designer (Name, Institution, email id):**

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