



# **Sir P. T. Sarvajani College of Science**

**(Autonomous, Affiliated with VNSGU, Surat)**

**Re-Accredited 'A+' with CGPA 3.35**

## **PROPOSED SYLLABUS**

**FOR**

**SEM V & VI**

**Program: B.Sc.**

**Course: Botany**

**From**

**Academic year**

**2026-2027**

**(NEP-2020)**

**(To be effective from June, 2026)**



## **Acknowledgement**

At the outset, I would like to thank Principal Dr. Pruthul R. Desai for his guidance and support during the curriculum restructuring process. I am also grateful to all the esteemed members of the Board of Studies for their constructive suggestions and contributions.

Above all, I am deeply indebted to all the young and vibrant colleagues in the Department of Botany for the long and arduous work they have put in during the compilation of the restructured syllabus.

**Chairperson**

**Board of Studies in Botany**



## **Graduate Attributes**

After the successful completion of modules in different courses of B.Sc. BOTANY, the learner will be able to:

**GA 1: Understand the basic concepts of botany and structural and functional aspects of plants.**

**GA 2: Perceive the significance of microbes and plants for animal life and human welfare, and structural and functional aspects of plants.**

**GA 3: Demonstrate experiments related to plant sciences, analyze the data, and interpret them using theoretical knowledge.**

**GA 4: Create awareness about the diversity of lower plants, their classification, structure and growth.**

**GA 5: Acquaint with the fundamentals and present understanding of the mechanisms associated with the development, differentiation and structure of different plant organs and the metabolic and physiological changes occurring in them.**

**GA 6: Effectively discuss and communicate scientific ideas both orally and in writing.**

## **Programme Specific Outcomes**

**PO - 1 To build a strong academic bridge between students and stakeholder.**

**PO - 2 To proactively adapt to the changing needs of students and the society.**

**PO - 3 To provide opportunities for multidisciplinary activities.**

**PO -4 To mold individuals who would nurture the cultural heritage of our country and contribute to the betterment of the society.**



## Board of studies in Botany

### Undergraduate & Postgraduate

|                                                                    | Name                        | Designation                  | Institute/Industry                                               |
|--------------------------------------------------------------------|-----------------------------|------------------------------|------------------------------------------------------------------|
| <b>Head of the Department</b>                                      |                             |                              |                                                                  |
| 1                                                                  | Dr. Jayshri D Chaudhari     | Chairperson                  | Sir P T Sarvajani College of Science, Surat                      |
| <b>Faculty of the specialization</b>                               |                             |                              |                                                                  |
| 1                                                                  | Dr. Vibhavari K Vyas        | Adhyapak Sahayak             | Sir P T Sarvajani College of Science, Surat                      |
| 2                                                                  | Dr. Jagruti S Rana          | Adhyapak Sahayak             | Sir P T Sarvajani College of Science, Surat                      |
| <b>Subject Expert nominated by Vice-Chancellor Subject experts</b> |                             |                              |                                                                  |
| 1                                                                  | Dr. Meghna Adhwaryu         | Head of the Department       | Govt Arts, Commerce & Science College, Limbayat, Surat           |
| <b>Representative from Industry/corporate sector/allied area</b>   |                             |                              |                                                                  |
| 1                                                                  | Ms. Prabhuta Patel          | Director – Vision & Robotics | At Po. Ambach, F. Vaghshar, Ta. Pardi, Dist. Valsad, Gujarat     |
| <b>Meritorious Alumnus</b>                                         |                             |                              |                                                                  |
| 1                                                                  | Dr. Minoo H. Parabia        | Start-up                     | Retired professor VNSGU 12/1768 A, Vakil Street, Shahpore, Surat |
| <b>Three experts from other than the parent University</b>         |                             |                              |                                                                  |
| 1                                                                  | Dr Lolly M. Jain            | Professor                    | K. J. Somaiya College of Science and Commerce, Mumbai            |
| 2                                                                  | Prof. Bandu Konde           | Professor                    | Wilson College (Autonomous), Mumbai                              |
| 3.                                                                 | Dr. Bhupendrasinh A. Jadeja | Associate Professor          | M. D. Science College, Porbandar                                 |



| Sr. No                  | Semester  | Course number     | Course Code         | Course Name                               |
|-------------------------|-----------|-------------------|---------------------|-------------------------------------------|
| <b>Core Course (CC)</b> |           |                   |                     |                                           |
| 1.                      | <b>V</b>  | CC XI             | BOTMJ-S5P11-2CR26   | Plant Functional Biology                  |
| 2.                      |           | CC XII            | BOTMJ-S5P12- 2CR26  | Environmental Botany                      |
| 3.                      |           | CC XIII           | BOTMJ-S5P13-2CR26   | Taxonomy and Traditional Plant Knowledge. |
| 4.                      |           | CC IX PRACTICAL   | BOTMJ-S5PR9-2CR26   | Botany Practical (MJ)-IX                  |
| 5.                      |           | CC X PRACTICAL    | BOTMJ-S5PR10- 2CR26 | Botany Practical (MJ)-X                   |
| 6.                      |           | CC XI PRACTICAL   | BOTMJ-S5PR11-2CR26  | Botany Practical (MJ)-XI                  |
| 7.                      |           | MN IV             | BOTMN-S5P4- 2CR26   | Structural and Systematic Botany          |
| 8.                      |           | MN V              | BOTMN-S5P5-2CR26    | Plant Resources and Utilization           |
| 9.                      |           | MN PRACTICAL- IV  | BOTMN-S5PR4-2CR26   | Botany Practical (MN)- IV                 |
| 10.                     |           | MN PRACTICAL- V   | BOTMN-S5PR5-2CR26   | Botany Practical (MN)-V                   |
| 11.                     | <b>VI</b> | CC XIV            | BOTMJ-S6P14-2CR26   | Pollen biology and Plant geography        |
| 12.                     |           | CC XV             | BOTMJ-S615-2CR26    | Structural botany and Plant histology     |
| 13.                     |           | CC XVI            | BOTMJ-S6P16-2CR26   | Systematic Botany                         |
| 14.                     |           | CC XII PRACTICAL  | BOTMJ-S6PR12- 2CR26 | Botany Practical (MJ)- XII                |
| 15.                     |           | CC XIII PRACTICAL | BOTMJ-S6PR13- 2CR26 | Botany Practical (MJ)- XIII               |
| 16.                     |           | CC XIV PRACTICAL  | BOTMJ-S6PR14- 2CR26 | Botany Practical (MJ)- XIV                |
| 17.                     |           | MN VI             | BOTMN-S6P6-2CR26    | Basic Ecology                             |
| 18.                     |           | MN PRACTICAL      | BOTMN-S6PR6-2CR26   | Botany Practical (MN) – VI                |



## Content

### Detailed B.Sc. Botany Syllabus

#### B.Sc. Syllabus with effect from the Academic year 2026-2027

| Course No.              | Course Name                              | Course Code        | Credits | Hour | Module | Lectures per module ( Hr) | Examination    |                |             |
|-------------------------|------------------------------------------|--------------------|---------|------|--------|---------------------------|----------------|----------------|-------------|
|                         |                                          |                    |         |      |        |                           | Internal Marks | External Marks | Total Marks |
| SEMESTER V              |                                          |                    |         |      |        |                           |                |                |             |
| Major Courses THEORY    |                                          |                    |         |      |        |                           |                |                |             |
| XI                      | Plant Functional Biology                 | BOTMJ-S5P11-2CR26  | 2       | 30   | 2      | 15                        | 25             | 25             | 50          |
| XII                     | Environmental Botany                     | BOTMJ-S5P12-2CR26  | 2       | 30   | 2      | 15                        | 25             | 25             | 50          |
| XIII                    | Taxonomy and Traditional Plant Knowledge | BOTMJ-S5P13-2CR26  | 2       | 30   | 2      | 15                        | 25             | 25             | 50          |
|                         | Skill Enhancement Course (SEC)           | SEC-S5P1-2CR26     | 2       | 30   | 2      | 15                        | 25             | 25             | 50          |
| Major Courses PRACTICAL |                                          |                    |         |      |        |                           |                |                |             |
| IX                      | Botany Practical (MJ) –IX                | BOTMJ-S5PR9-2CR26  | 2       | 60   | -      | -                         | 25             | 25             | 50          |
| X                       | Botany Practical (MJ) –X                 | BOTMJ-S5PR10-2CR26 | 2       | 60   | -      | -                         | 25             | 25             | 50          |
| XI                      | Botany Practical (MJ) -XI                | BOTMN-S5PR11-2CR26 | 2       | 60   | -      | -                         | 25             | 25             | 50          |
| Minor Courses THEORY    |                                          |                    |         |      |        |                           |                |                |             |
| IV                      | Structural and Systematic Botany         | BOTMN-S5P4- 2CR26  | 2       | 30   | 2      | 15                        | 25             | 25             | 50          |
| V                       | Plant Resources and Utilization          | BOTMN-S5P5-2CR26   | 2       | 30   | 2      | 15                        | 25             | 25             | 50          |
| Minor Courses PRACTICAL |                                          |                    |         |      |        |                           |                |                |             |
| IV                      | Botany Practical (MN) – IV               | BOTMN-S5PR4-2CR26  | 2       | 60   | -      | -                         | 25             | 25             | 50          |



|               |                            |                           |    |    |   |   |    |    |    |
|---------------|----------------------------|---------------------------|----|----|---|---|----|----|----|
| V             | Botany Practical<br>(MN)-V | BOTMN-<br>S5PR5-<br>2CR26 | 2  | 60 | - | - | 25 | 25 | 50 |
| Total Credits |                            |                           | 22 |    |   |   |    |    |    |



| SEMESTER IV             |                                       |                     |    |     |   |    |    |    |     |
|-------------------------|---------------------------------------|---------------------|----|-----|---|----|----|----|-----|
| Major Courses THEORY    |                                       |                     |    |     |   |    |    |    |     |
| XIV                     | Pollen biology and Plant geography    | BOTMJ-S6P14-2CR26   | 2  | 30  | 2 | 15 | 25 | 25 | 50  |
| XV                      | Structural botany and Plant histology | BOTMJ-S6P15-2CR26   | 2  | 30  | 2 | 15 | 25 | 25 | 50  |
| XVI                     | Systematic Botany                     | BOTMJ-S6P16-2CR26   | 2  | 30  | 2 | 15 | 25 | 25 | 50  |
| Major Courses PRACTICAL |                                       |                     |    |     |   |    |    |    |     |
| XII                     | Botany Practical (MJ) - XII           | BOTMJ-S6PR12-2CR26  | 2  | 60  | - | -  | 25 | 25 | 50  |
| XIII                    | Botany Practical (MJ)- XIII           | BOTMJ-S6PR13-2CR26  | 2  | 60  | - | -  | 25 | 25 | 50  |
| XIV                     | Botany Practical (MJ) - XIV           | BOTMJ-S6PR14- 2CR26 | 2  | 60  | - | -  | 25 | 25 | 50  |
| Minor Courses THEORY    |                                       |                     |    |     |   |    |    |    |     |
| VI                      | Basic Ecology                         | BOTMN-S6P6-2CR26    | 2  | 30  | 2 | 15 | 25 | 25 | 50  |
| Minor Courses PRACTICAL |                                       |                     |    |     |   |    |    |    |     |
| VI                      | Botany Practical (MN) – VI            | BOTMN-S6PR6-2CR26   | 2  | 60  | - | -  | 25 | 25 | 50  |
| Internship              |                                       |                     |    |     |   |    |    |    |     |
| Internship              |                                       | BOTINT-S6P1-4CR26   | 4  | 120 | - | -  | 50 | 50 | 100 |
| Total Credits           |                                       |                     | 20 |     |   |    |    |    |     |



## B.Sc. (BOTANY) SEMESTER- V

### CORE COURSE- XI

### MAJOR COURSE (THEORY)

### COURSE NAME: PLANT FUNCTIONAL BIOLOGY

COURSE CODE: **BOTMJ-S5P11-2CR26**

[CREDITS - 02]

| Course learning outcome                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                 |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| After the successful completion of the Course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                 |              |
| <ol style="list-style-type: none"><li>1. Acquire comprehensive knowledge on different aspects related to the physiology of plants.</li><li>2. Ascertain latest developments in the field of plant physiology with a practical approach.</li><li>3. Equip students to think independently, critically to discuss different aspects of plant physiology.</li></ol>                                                                           |                                                                                                                                                                                                                                                                                                                 |              |
| <b>Module 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Food synthesis and plant nutrition</b>                                                                                                                                                                                                                                                                       | <b>[15L]</b> |
| <b>Learning objectives:</b><br>The module is intended to <ul style="list-style-type: none"><li>• Understand the fundamentals of plant physiology.</li><li>• Apply knowledge of plant physiology to understand the life process in plants</li></ul>                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                 |              |
| <b>Learning outcomes:</b><br>After the successful completion of the module, the learner will be able to <ol style="list-style-type: none"><li>1. Understand the physiological functions of plants</li><li>2. Evaluate the role of minerals in plant nutrition and their deficiency symptoms.</li><li>3. Critically understand the light reactions and carbon assimilation processes Responsible for synthesis of food in plants.</li></ol> |                                                                                                                                                                                                                                                                                                                 |              |
| 1.1                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>➤ Photosynthesis</b> <ul style="list-style-type: none"><li>• Photosynthetic apparatus, Photosynthetic pigments,</li><li>• Light reaction -Cyclic and non cyclic Photo phosphorylation,</li><li>• Dark reaction pathways - C3 and C4 cycle, CAM pathway</li><li>• Factors affecting photosynthesis.</li></ul> | [9L]         |
| 1.2                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>➤ Mineral nutrition in plants</b> <ul style="list-style-type: none"><li>• Macronutrients and Micronutrients-Definition, deficiency and Importance of it.</li><li>• Heterotrophic nutrition in Plants.</li></ul>                                                                                              | [6L]         |



| Module 2 Cellular respiration and physiology of flowering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                         | [15L] |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Learning objectives:</b><br>This module is intended to <ul style="list-style-type: none"><li>• Understand the mechanism of respiration in plant</li><li>• Understand the physiology of flowering, seed dormancy and germination</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                         |       |
| <b>Learning outcome:</b><br>After the successful completion of the module, the learner will be able to <ol style="list-style-type: none"><li>1. Describe all stages of cellular respiration in detail</li><li>2. Explain the mechanism of flowering and seed germination</li><li>3. Evaluate the respiratory quation</li><li>4. Examine the role of light on flowering and explain physiology of plants under stress conditions.</li></ol>                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                         |       |
| 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>➤ Respiration-mechanism</b> <ul style="list-style-type: none"><li>• Respiratory apparatus</li><li>• Glycolysis,</li><li>• Anaerobic respiration and Aerobic respiration,</li><li>• TCA cycle</li><li>• Electron transfer chain</li><li>• Photorespiration</li><li>• Factors affecting on respiration.</li></ul>                      | [8L]  |
| 2.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>➤ Plant Growth and Physiology of flowering</b> <ul style="list-style-type: none"><li>• Plant Growth –Definition, Process and factor affecting plant growth, Plant growth regulators.</li><li>• Photoperiodism, Photochrome system</li><li>• Vernalization and Devernalization</li><li>• Seed dormancy and Seed germination</li></ul> | [7L]  |
| <b>References:</b> <ul style="list-style-type: none"><li>• Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi</li><li>• Ghosh, A. K., K. Bhattacharya &amp;G. Hait (2011) A Text Book of Botany, Volume-III, New Central Book Agency Pvt. Ltd., Kolkata</li><li>• Aravind Kumar &amp; S.S. Purohit (1998) Plant Physiology – Fundamentals and Applications, Agro Botanica, Bikaner</li><li>• Datta, S.C. (2007) Plant Physiology, New Age International (P) Ltd., Publishers, New Delhi</li><li>• Hans Mohr &amp; P. Schopfer (2006) Plant Physiology, Springer (India) Pvt. Ltd., New Delhi</li><li>• Hopkins, W.G. &amp; N.P.A. Huner (2014)Introduction to Plant Physiology, Wiley India Pvt. Ltd., New Delhi</li></ul> |                                                                                                                                                                                                                                                                                                                                         |       |



- Noggle Ray & J. Fritz (2013) Introductory Plant Physiology, Prentice Hall (India), New Delhi
- Pandey, S.M. & B. K. Sinha (2006) Plant Physiology, Vikas Publishing House, New Delhi
- Salisbury, Frank B. & Cleon W. Ross (2007) Plant Physiology, Thomsen & Wadsworth, Australia & U.S.A
- Sinha, R.K. (2014) Modern Plant Physiology, Narosa Publishing House, New Delhi
- Taiz, L. & E. Zeiger (2003) Plant Physiology, Panima Publishers, New Delhi
- Verma, V. (2007) Text Book of Plant Physiology, Ane Books India, New Delhi

### Mapping of CLOs and PSOs

| Course Learning Outcomes                                                             | Programme Outcomes |   |   |   |   |   |
|--------------------------------------------------------------------------------------|--------------------|---|---|---|---|---|
|                                                                                      | 1                  | 2 | 3 | 4 | 5 | 6 |
| 1 Understand the Concept of physiology and its importance.                           | X                  | X |   |   |   |   |
| 2. Remember the process of food synthesis, and cellular Respiration                  |                    | X | X |   |   |   |
| 3. Explain all phases of plant growth, flowering, seed dormancy and seed germination |                    | X | X | X |   |   |
| 4. Acquire ability to describe the importance of nutrients for healthy plant.        |                    | X | X | X |   |   |

### Question Paper Template

#### B. Sc. (BOTANY) SEMESTER V

#### CORE COURSE - XI

#### MAJOR COURSE (THEORY)

**COURSE NAME: PLANT FUNCTIONAL BIOLOGY**

**COURSE CODE: BOTMJ-S5P11-2CR26**

**[CREDITS - 02]**

| Module | Remembering / Knowledge | Understanding | Applying | Analysing | Evaluating | Creating | Total marks |
|--------|-------------------------|---------------|----------|-----------|------------|----------|-------------|
| I      | 20%                     | 40%           | 40%      |           | -          | -        | 100%        |
| II     | 20%                     | 40%           | 40%      |           | -          | -        | 100%        |



## B.Sc. (BOTANY) SEMESTER- V

### CORE COURSE- XII

### MAJOR COURSE (THEORY)

### COURSE NAME: ENVIRONMENTAL BOTANY

COURSE CODE: **BOTMJ-S5P12-2CR26**

[CREDITS - 02]

| Course learning outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                           |       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| After the successful completion of the Course, the learner will be able to: <ol style="list-style-type: none"><li>1. Acquire comprehensive knowledge on different aspects of Environment factor and plants adaptation.</li><li>2. Ascertain latest developments in the field of Environment management with a practical approach.</li><li>3. Think independently and critically discuss sustainable approach for environment protection with the help of plants.</li></ol> |                                                                                                                                                                                                                                                                                                                                           |       |
| Module -1                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Environment factor and adaptation                                                                                                                                                                                                                                                                                                         | [15L] |
| <b>Learning objectives:</b><br>The module is intended to <ul style="list-style-type: none"><li>• Understand the relationship between plants and environment.</li><li>• Apply knowledge of botany to identify plants and their adaptation.</li><li>• Develop observational and identification skill for adaptation of plant and their habitat.</li></ul>                                                                                                                    |                                                                                                                                                                                                                                                                                                                                           |       |
| <b>Learning outcomes:</b><br>After the successful completion of the module, the learner will be able to <ol style="list-style-type: none"><li>1. Comprehend the effect of pollutant on plants.</li><li>2. Identify and classify plants such as Mesophytes, Xerophytes, Hydrophytes, Lithophytes and Halophytes.</li><li>3. Develop skills in identifying plant species, including their morphological characteristics and uses.</li></ol>                                  |                                                                                                                                                                                                                                                                                                                                           |       |
| 1.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ➤ Environmental factors and adaptation: <ul style="list-style-type: none"><li>• Biomes and its types.</li><li>• Impact of abiotic factors (light, temperature, water, soil) on plant growth.</li><li>• Morphological and anatomical adaptations in Mesophytes, Xerophytes, Hydrophytes, Lithophytes, and Halophytes, Epiphytes.</li></ul> | [7L]  |
| 1.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ➤ Concept of Community structure <ul style="list-style-type: none"><li>• Characteristics of Community (Synecological Studies)</li><li>• Rarer life forms (Phanerophytes, Chamaephytes, Hemicryptophytes, Cryptophytes and Thermophytes)</li><li>• Methods of sampling plant communities</li></ul>                                         | [8L]  |



| Module 2 Applied Environmental Botany                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                      | [15L] |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Learning objectives:</b><br>The module is intended to <ul style="list-style-type: none"><li>• Understand the framework of Environmental Impact Assessment (EIA).</li><li>• Apply knowledge of Remote Sensing and GIS in environment monitoring.</li><li>• Develop skill of Pollution management.</li></ul>                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                      |       |
| <b>Learning outcomes:</b><br>After the successful completion of the module, the learner will be able to <ul style="list-style-type: none"><li>• Understand Environmental monitoring and technology</li><li>• Get knowledge of GIS, Remote sensing technique</li><li>• Develop statistical skill to calculate diversity index, Simpson's diversity index, Shannon's index and Pielou's evenness index,</li></ul>                                                                                                             |                                                                                                                                                                                                                                                                                                      |       |
| 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ➤ Environmental monitoring & technology: <ul style="list-style-type: none"><li>• Remote Sensing</li><li>• GIS,</li><li>• Environmental Impact Assessment (EIA)</li><li>• Species diversity and diversity index<br/>Simpson's diversity index, Shannon's index and Pielou's evenness index,</li></ul> | [7L]  |
| 2.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ➤ Environmental Pollution & Management: <ul style="list-style-type: none"><li>• Effect of pollutant (air, Water, Soil) on Plants.<br/>Bio-indicators, Phytoremediation (using plants to clean Pollution), Biofuel and Bio-monitoring, bio-fertilizer</li></ul>                                       | [8L]  |
| <b>References:</b> <ul style="list-style-type: none"><li>• S. C. Santara , T. P. Chatterjee and A.P. Das (2006) College Botany Volume-1 central.</li><li>• R.S. Ambast (1969) A text book of plant ecology, Students friends and co., Varansi</li><li>• Modern Concepts Of Ecology (2022) - Trivedi PC (Agrobios);</li><li>• Plant Ecology (2021) - Agrawal AK;</li><li>• Ecology And Environment (2025/latest) - PD Sharma (Rastogi Publications</li><li>• Plant Ecology and Phytogeography - Saras Publication;</li></ul> |                                                                                                                                                                                                                                                                                                      |       |



### Mapping of CLOs and PSOs

| Sr. No. | Course Learning Outcomes                                                 | Programme Outcomes |   |   |   |   |   |
|---------|--------------------------------------------------------------------------|--------------------|---|---|---|---|---|
|         |                                                                          | 1                  | 2 | 3 | 4 | 5 | 6 |
| 1       | Classifies plants based on Their habitat                                 |                    | X | X |   |   |   |
| 2       | Describes the Morphological and Anatomical adaptation of plants          | X                  | X |   |   |   |   |
| 3.      | Illustrate the Community structure                                       |                    | X | X |   | X |   |
| 4       | Understand the application of plants in Environment pollution Management | X                  | X |   |   | X |   |
| 5       | Familiarize the use of Remote Sensing, and GIS                           |                    | X |   |   | X |   |

**Question Paper Template**  
**B.Sc. (BOTANY) SEMESTER-V**  
**CORE COURSE- XII**  
**MAJOR COURSE (THEORY)**

**COURSE NAME: ENVIRONMENTAL BOTANY**

**COURSE CODE: BOTMJ-S5P12-2CR26**

**[CREDITS - 02]**

| Module | Remembering / Knowledge | Understanding | Applying | Analysing | Evaluating | Creating | Total marks |
|--------|-------------------------|---------------|----------|-----------|------------|----------|-------------|
| I      | 20%                     | 40%           | 40%      |           | -          | -        | 100%        |
| II     | 20%                     | 40%           | 40%      |           | -          | -        | 100%        |



**B.Sc. (BOTANY) SEMESTER- V**

**CORE COURSE- XIII**

**MAJOR COURSE (THEORY)**

**COURSE NAME: TAXONOMY AND TRADITIONAL PLANT KNOWLEDGE**

**COURSE CODE: BOTMJ-S5P13-2CR26**

**[CREDITS-02]**

| Course learning outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                              |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|--------------|
| <p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"><li>1. Explain the basic principles, scope and significance of plant systematics and taxonomy.</li><li>2. Describe the relationship of taxonomy with other disciplines such as plant morphology, anatomy, cytology, palynology, embryology and phytochemistry.</li><li>3. Apply different types of identification key such as dichotomous, indented and bracketed keys for plant identification.</li><li>4. Identify and explain diagnostic characters of some important angiosperm families.</li><li>5. Demonstrate knowledge of traditional plant uses and the ethnobotanical importance of important plants.</li><li>6. Evaluate the role of traditional plant knowledge in biodiversity conservation and sustainable use of plant resources, including protection of indigenous knowledge.</li></ol> |                                              |              |
| <b>Module 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>History and systems of plant taxonomy</b> | <b>[15L]</b> |
| <p><b>Learning objectives:</b></p> <p>The module is intended to</p> <ul style="list-style-type: none"><li>● Introduce students to the history and development of plant taxonomy.</li><li>● Explain the contributions of early botanists such as Theophrastus, John Ray and Carolus Linnaeus in plant classification.</li><li>● Familiarize students with different systems of plant classification.</li><li>● Provide detailed knowledge of the classification system proposed by Bentham and Hooker with its merits and demerits.</li><li>● Develop understanding of diagnostic characters of important angiosperm families.</li><li>● Help students develop basic skills in plant identification using morphological characters, floral formula and floral diagram.</li></ul>                                                                                                                                               |                                              |              |



### Learning outcomes:

After the successful completion of the module, the learner will be able to

1. Describe the historical development of plant taxonomy and the contributions of early botanists such as Theophrastus, John Ray and Carolus Linnaeus.
2. Explain different systems of plant classification and their importance in plant taxonomy.
3. Outline the classification system proposed by Bentham and Hooker.
4. Evaluate different systems of plant classification and their importance in plant taxonomy.
5. Identify important angiosperm families.
6. Apply knowledge of morphological characters, floral formula and floral diagrams for plant identification.

|     |                                                                                                                                                                                                                                                                                                                                                                                    |      |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 1.1 | <p>➤ <b>History of Plant Taxonomy</b></p> <p>Brief contribution of earlier botanists such as Theophrastus, John Ray, Augustin Pyramus de Candolle, George Bentham, Joseph Dalton Hooker, Bassey and Hutchinson.</p>                                                                                                                                                                | [3L] |
| 1.2 | <p>➤ <b>Taxonomy in Relation to Other Disciplines</b></p> <p>Taxonomy and its relationship with</p> <ul style="list-style-type: none"> <li>• Plant morphology</li> <li>• Plant anatomy</li> <li>• Cytology</li> <li>• Palynology</li> <li>• Embryology</li> <li>• Phytochemistry</li> <li>• Importance of these disciplines in plant classification and identification.</li> </ul> | [4L] |
| 1.3 | <p>➤ <b>Identification of Plants</b></p> <ul style="list-style-type: none"> <li>• Principles and methods of plant identification</li> <li>• Types of taxonomic keys: <ul style="list-style-type: none"> <li>Dichotomous keys</li> <li>Indented keys</li> <li>Bracketed keys</li> </ul> </li> </ul>                                                                                 | [4L] |
| 1.4 | <p>➤ <b>Study of some Angiosperm Families</b></p> <p>General characters, floral formula, floral diagram and economic importance of:</p> <ul style="list-style-type: none"> <li>• Combretaceae</li> <li>• Turneraceae</li> <li>• Asteraceae</li> <li>• Verbenaceae</li> <li>• Phytolaccaceae</li> <li>• Euphorbiaceae</li> <li>• Orchidaceae</li> <li>• Liliaceae</li> </ul>        | [4L] |



| Module 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Traditional plant knowledge and ethnobotany                                                                                                                                                                                                                                                                                                                                                                                          | [15L] |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Learning objectives:</b><br>This module is intended to <ul style="list-style-type: none"> <li>• Introduce students to the concept and scope of ethnobotany and traditional plant knowledge.</li> <li>• Develop understanding of the traditional uses of plants in food, medicine and daily life.</li> <li>• Familiarize students with the ethnobotanical importance of selected medicinal and useful plants.</li> <li>• Explain the cultural and ecological significance of wild edible plants and sacred plants.</li> <li>• Create awareness about conservation of traditional plant knowledge.</li> </ul>                             |                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |
| <b>Learning outcome:</b><br>After the successful completion of the module, the learner will be able to <ol style="list-style-type: none"> <li>1. Explain the concept and scope of ethnobotany and traditional plant knowledge.</li> <li>2. Describe the traditional uses of plants and explain their medicinal and economic uses.</li> <li>3. Identify important ethnobotanical plants and explain their medicinal and economic uses.</li> <li>4. Discuss the cultural importance of sacred plants and the role of wild edible plants in human society.</li> <li>5. Explain the importance of conserving traditional knowledge.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |
| 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>➤ Introduction to Ethnobotany</b> <ul style="list-style-type: none"> <li>• Definition and scope of ethnobotany</li> <li>• Importance of traditional plant knowledge</li> <li>• Relationship between plants and human society</li> </ul>                                                                                                                                                                                           | [2L]  |
| 2.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>➤ Traditional uses of plants in daily life</b> <ul style="list-style-type: none"> <li>• Plants used in traditional medicine</li> <li>• Plants used as food and spices</li> <li>• Plants used in agriculture</li> <li>• Role of plants in traditional health care systems (AYUSH)</li> </ul>                                                                                                                                       | [4L]  |
| 2.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>➤ Ethnobotanical uses of Important Plants</b><br>Traditional uses of plants such as: <ul style="list-style-type: none"> <li>• <i>Abrus precatorius</i></li> <li>• <i>Anogeissus latifolia</i></li> <li>• <i>Saraca asoca</i></li> <li>• <i>Andrographis paniculata</i></li> <li>• <i>Butea monosperma</i></li> <li>• <i>Caesalpinia crista</i></li> <li>• <i>Sapindus laurifolius</i></li> <li>• <i>Eucalyptus sp.</i></li> </ul> | [4L]  |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 2.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>➤ <b>Wild edible plants and sacred plants</b></p> <ul style="list-style-type: none"><li>• Wild edible plants used by rural communities</li><li>• Cultural and religious importance of plants (Concept and ecological importance of sacred groves)</li></ul> | [3L] |
| 2.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>➤ <b>Acknowledge and Prospectus of basis plant research</b></p> <ul style="list-style-type: none"><li>• Importance of conserving traditional plant knowledge<ul style="list-style-type: none"><li>- DST, DBT, CSIR</li></ul></li></ul>                      | [2L] |
| <p><b>References:</b></p> <ul style="list-style-type: none"><li>• Sharma, O. P. (2007) Plant Taxonomy: McGraw Hill Education, New Delhi.</li><li>• Singh, Gurcharan. (2004) Plant Systematics: An Integrated Approach-Science Publishers, Enfield (USA) /CRC Press.</li><li>• Jain, S. K. (1995) A Manual of Ethnobotany: Scientific Publishers, Jodhpur, India.</li><li>• Jain, S. K. (1987) A Manual of Ethnobotany (2<sup>nd</sup> Ed): Scientific Publisher, Jodhpur, India.</li><li>• Pandey, B. P. (2010) Economic Botany: S. Chand &amp; Company Ltd., New Delhi.</li><li>• Pulliah, T. (2007) Taxonomy of Angiosperms: Regency Publication, New Delhi.</li><li>• Bhattacharyya, B. (2006) Systematic Botany: Narosa Publishing House, New Delhi.</li></ul> <p><b>Useful Websites:</b></p> <ul style="list-style-type: none"><li>• Botanical Survey of India<br/><a href="https://bsi.gov.in">https://bsi.gov.in</a></li><li>• Indian Biodiversity Portal<br/><a href="https://indiabiodiversity.org">https://indiabiodiversity.org</a></li><li>• Traditional Knowledge Digital Library (TKDL)<br/><a href="https://tkdl.res.in">https://tkdl.res.in</a></li><li>• ENVIS Centre on Medicinal plants<br/><a href="https://envis.frlht.org">https://envis.frlht.org</a></li></ul> |                                                                                                                                                                                                                                                                |      |



### Mapping of CLOs and PSOs

| Course Learning Outcomes                                                                                                                                        | Programme Outcomes |   |   |   |   |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---|---|---|---|---|
|                                                                                                                                                                 | 1                  | 2 | 3 | 4 | 5 | 6 |
| 1. Understand the development of plant taxonomy and the contributions of botanists such as Theophrastus, John Ray, etc.                                         | X                  | X |   |   |   |   |
| 2. Explain the principles, outline, merits and demerits of the classification systems proposed by George Bentham and Joseph Hooker and Adolf Engler and Prantl. |                    | X | X |   |   |   |
| 3. Students will be able to identify and classify angiosperm plants and families such as (Family name) using morphological characters.                          | X                  | X | X |   |   |   |
| 4. Understand the ethnobotanical importance and traditional uses of plants such as ( Plant name).                                                               |                    | X | X |   |   |   |
| 5. Explain the importance of the conservation of traditional plant knowledge.                                                                                   |                    | X | X |   |   |   |

### Question Paper Template

B.Sc. (BOTANY) SEMESTER V

CORE COURSE - XIII

**COURSE NAME: TAXONOMY AND TRADITIONAL PLANT KNOWLEDGE**

**COURSECODE: BOTMJ-S5P13-2CR26**

**[CREDITS-02]**

| Module | Remembering / Knowledge | Understanding | Applying | Analysing | Evaluating | Creating | Total marks |
|--------|-------------------------|---------------|----------|-----------|------------|----------|-------------|
| I      | 20%                     | 40%           | 40%      | -         | -          | -        | 100%        |
| II     | 20%                     | 40%           | 40%      | -         | -          | -        | 100%        |



**B.Sc. (BOTANY) SEMESTER V**  
**COURSE NAME: Botany Practical (MJ)-IX**  
**COURSE CODE: BOTMJ-S5PR9-2CR26 [CREDIT- 02]**

| Course Learning Outcome                                                                                                                                                                                                                                                                      |                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| After the successful completion of the Course, the learner will be able to:                                                                                                                                                                                                                  |                                                                                                  |
| <ol style="list-style-type: none"><li>1. Identify the photosynthetic pigments.</li><li>2. Separate photosynthetic pigments by different method</li><li>3. Evaluate the amount of starch, protein and oil</li><li>4. Calculate the rate of photosynthesis and Respiration in plants</li></ol> |                                                                                                  |
| PRACTICAL – I                                                                                                                                                                                                                                                                                |                                                                                                  |
| 1.                                                                                                                                                                                                                                                                                           | To find out the rate of photosynthesis by Wilmot's bubbler.                                      |
| 2.                                                                                                                                                                                                                                                                                           | To find out the effect of different CO <sub>2</sub> concentration on the rate of photosynthesis. |
| 3.                                                                                                                                                                                                                                                                                           | To find out the effect of different wavelength on the rate of photosynthesis.                    |
| 4.                                                                                                                                                                                                                                                                                           | Estimation of total chlorophyll, chlorophyll a, and b through Spectrophotometry.                 |
| 5.                                                                                                                                                                                                                                                                                           | Separate the photosynthetic pigments by separating funnel.                                       |
| 6.                                                                                                                                                                                                                                                                                           | Extraction of water soluble Anthocyanin pigments and its characterisation.                       |
| 7.                                                                                                                                                                                                                                                                                           | Study the kranz anatomy by leaf section.                                                         |
| 8.                                                                                                                                                                                                                                                                                           | Study the chlorophyll is necessary for photosynthesis.                                           |
| 9.                                                                                                                                                                                                                                                                                           | To study mineral deficiency symptom in plants.                                                   |
| 10.                                                                                                                                                                                                                                                                                          | The qualitative test for presence of respiratory enzymes in plant cell.                          |
| 11.                                                                                                                                                                                                                                                                                          | Determination of respiratory quotient (RQ)                                                       |
| Practical for Demonstration                                                                                                                                                                                                                                                                  |                                                                                                  |
| 12.                                                                                                                                                                                                                                                                                          | Light is necessary for photosynthesis.                                                           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 13.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Carbon dioxide is necessary for photosynthesis(Moll's half leaf experiment). |
| 14.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Energy released in the form of heat during respiration.                      |
| 15.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Experiment of anaerobic respiration.                                         |
| 16.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | CO <sub>2</sub> release during aerobic respiration.                          |
| 17.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Process of fermentation by Kuhne's vessel.                                   |
| 18.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Demonstration of to compare the process of photosynthesis and respiration.   |
| 19.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Mung Straight growth test.                                                   |
| 20.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Measurement of growth using auxanometer                                      |
| 21.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Specimens of insectivorous plants.                                           |
| <ul style="list-style-type: none"> <li>● Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.</li> <li>● Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.</li> <li>● At the end of the semester candidates have to submit a certified journal during the practical examination.</li> </ul> |                                                                              |



**B.Sc. (BOTANY) SEMESTER V**

**COURSE NAME: Botany Practical (MJ)-X**

**COURSE CODE: BOTMJ-S5PR10-2CR26**

**[CREDITS- 02]**

| Course Learning Outcome                                                                                                                                                                                                      |                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| After the successful completion of the Course, the learner will be able to:                                                                                                                                                  |                                                                                                                        |
| <ol style="list-style-type: none"><li>1. Understanding the processes that shape the distribution and abundance of organisms.</li><li>2. Modern tools and techniques and their appropriate use to conduct research.</li></ol> |                                                                                                                        |
| PRACTICAL – I                                                                                                                                                                                                                |                                                                                                                        |
| 1.                                                                                                                                                                                                                           | To study communities by Simpson's diversity index.                                                                     |
| 2.                                                                                                                                                                                                                           | To study communities by Shannon's index.                                                                               |
| 3.                                                                                                                                                                                                                           | To study communities by Pielou's evenness index.                                                                       |
| 4.                                                                                                                                                                                                                           | Demonstrate the gradual floristic changes in two different types of adjacent plant communities.                        |
| 5.                                                                                                                                                                                                                           | Determine the biological spectrum of vegetation depicting Raunkiaer's Life form.                                       |
| 6.                                                                                                                                                                                                                           | Determine the Total Dissolved Solid (TDS) from given sample.                                                           |
| 7.                                                                                                                                                                                                                           | Estimate Sulphate in soil sample.                                                                                      |
| 8.                                                                                                                                                                                                                           | Estimate Organic matter in soil sample.                                                                                |
| 9.                                                                                                                                                                                                                           | Determine the Basal Area of tree in a campus.                                                                          |
| 10.                                                                                                                                                                                                                          | Isolate Microorganism from polluted water/ soil sample.                                                                |
| 11.                                                                                                                                                                                                                          | To study morphological and anatomical structure of hydrophytes: 1) Hydrilla, 2) Nymphaea/Lotus                         |
| 12.                                                                                                                                                                                                                          | To study morphological and anatomical study of xerophytes: 1) Nerium 2) Casuarina.                                     |
| 13.                                                                                                                                                                                                                          | To study morphological and anatomical study of Halophyte Avicennia.                                                    |
| 14.                                                                                                                                                                                                                          | To study morphological and anatomical study of Epiphytes aerial root of Orchid.                                        |
| 15.                                                                                                                                                                                                                          | Study of Environmental Instruments <ol style="list-style-type: none"><li>a. Lux meter</li><li>b. Secchi disc</li></ol> |
| 16.                                                                                                                                                                                                                          | Isolate PGPR from Rhizosphere                                                                                          |



- Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidates have to submit a certified journal during the practical examination.



## B.Sc. (BOTANY) SEMESTER V

COURSE NAME: Botany Practical (MJ)- XI

COURSE CODE: **BOTMJ-S5PR11-2CR26**

[CREDIT-02]

### Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Identify important medicinal and traditional plants based on their morphological characters.
2. Prepare herbarium specimens of medicinal and ethno botanically important plants following standard herbarium techniques.
3. Document traditional medicinal remedies and ethnobotanical uses of plants.
4. Draw and interpret floral formula and floral diagrams for the identification of angiosperm families.

### PRACTICAL-I

|    |                                                                                                                                                                                                                                                                                                                                                 |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Study morphological characters and economic importance of Family <b>Combretaceae</b> .                                                                                                                                                                                                                                                          |
| 2  | Study morphological characters and economic importance of Family <b>Turneraceae</b> .                                                                                                                                                                                                                                                           |
| 3  | Study morphological characters and economic importance of Family <b>Asteraceae</b> .                                                                                                                                                                                                                                                            |
| 4  | Study morphological characters and economic importance of Family <b>Vernaceae</b> .                                                                                                                                                                                                                                                             |
| 5  | Study morphological characters and economic importance of Family <b>Phytolacaceae</b> .                                                                                                                                                                                                                                                         |
| 6  | Study morphological characters and economic importance of Family <b>Euphorbiaceae</b> .                                                                                                                                                                                                                                                         |
| 7  | Study morphological characters and economic importance of Family <b>Orchidaceae</b> .                                                                                                                                                                                                                                                           |
| 8  | Study morphological characters and economic importance of Family <b>Liliaceae</b> .                                                                                                                                                                                                                                                             |
| 9  | Identification of 5 local plants based on vegetative and floral characters.                                                                                                                                                                                                                                                                     |
| 10 | Study of Ethnobotanical plants such as: <ul style="list-style-type: none"> <li>• <i>Abrus precatorius</i></li> <li>• <i>Anogeissus latifolia</i></li> <li>• <i>Saraca ashoka</i></li> <li>• <i>Terminalia catappa</i></li> <li>• <i>Butea monosperma</i></li> <li>• <i>Caesalpinia crista</i></li> <li>• <i>Sapindus laurifolius</i></li> </ul> |
| 11 | Identification and documentation of wild edible plants found in the locality.                                                                                                                                                                                                                                                                   |



|    |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12 | Study of Sacred Plants<br>Observation and documentation of sacred plants such as: <ul style="list-style-type: none"><li>• <i>Ficus religiosa</i></li><li>• <i>Ocimum sanctum</i></li></ul>                                                                                                                                                                                                                                                  |
| 13 | Survey of plants in the college campus and preparation of a plant list with family names.                                                                                                                                                                                                                                                                                                                                                   |
| 14 | Students will collect and document information on traditional medicinal remedies used in daily life for common health problems such as cough, cold, fever, skin infection and digestive disorders. Students should record the following details: <ul style="list-style-type: none"><li>• Botanical name</li><li>• Family</li><li>• Local name</li><li>• Plant part used</li><li>• Method of preparation</li></ul> Traditional medicinal use |
| 15 | To prepare at least 5 herbarium specimens of medicinal or economically important plants.                                                                                                                                                                                                                                                                                                                                                    |

- Every candidate shall complete a laboratory course as per the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.

At the end of the semester, candidates have to submit a certified journal during the practical examination.



## B.Sc. (BOTANY) SEMESTER- V

### MN- IV

### MINOR COURSE (THEORY)

### COURSE NAME: STRUCTURAL AND SYSTEMATIC BOTANY

COURSE CODE: **BOTMN-S5P4-2CR26**

[CREDITS-02]

| Course learning outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                          |              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand, explain, and analyze the characteristics, classification, and functions of meristematic tissues based on their origin, position, and function, and relate them to plant growth and development.</li> <li>2. Describe and evaluate the principles of plant taxonomy, including its history, aims, fundamental components, binomial nomenclature, and major systems of classification, with special reference to Bentham and Hooker system of classification (up to series).</li> <li>3. Identify, classify, and apply taxonomic principles to common angiosperm families viz. Malvaceae, Apocynaceae, Nyctaginaceae, and Amaryllidaceae using general characters, floral formulae, and botanical nomenclature.</li> <li>4. Analyze and interpret plant anatomical structures, including permanent tissues, vascular bundles, stele, dicotyledonous and monocotyledonous root, stem, and leaf anatomy, as well as explain the structure and occurrence of ergastic (non-living) cell inclusions.</li> </ol> |                                                                                                                                                                                                                                                                          |              |
| <b>Module 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Plant anatomy</b>                                                                                                                                                                                                                                                     | <b>[15L]</b> |
| <p><b>Learning objectives:</b></p> <p>The module is intended to</p> <ul style="list-style-type: none"> <li>● To impart basic knowledge about plant cells and tissue organization in plant parts.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                          |              |
| <p><b>Learning out comes:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Understand the organization of tissues and tissue systems in plants.</li> <li>2. Evaluate and appreciate the different anatomical features in plants.</li> <li>3. Understand the difference between Dicotyledons and Monocotyledons plants.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                          |              |
| 1.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>➤ <b>Meristematic Tissues:</b></p> <ul style="list-style-type: none"> <li>● Characteristics of Meristematic tissues.</li> <li>● Types of Meristematic tissues.</li> </ul> <p><b>a. On the basis of origin:</b> Promeristem, Primary meristem, Secondary meristem.</p> | [6L]         |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                         |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p><b>b. On the basis of position:</b> Apical, Intercalary and lateral.</p> <p><b>c. On the basis of function:</b> Protoderm, Procambium and Ground.<br/>Function of Meristematic tissue.</p> <p>➤ <b>Permanent tissue (Simple and Complex):</b></p> <ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Types, its function and Significance.</li> </ul> |              |
| 1.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>➤ <b>Vascular Bundle:</b> Definition and types and structure.</p> <p>➤ <b>Stele:</b> Definition and types and structure.</p>                                                                                                                                                                                                                                         | [3L]         |
| 1.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>➤ <b>Anatomy of Dicotyledon and Monocotyledon:</b></p> <ul style="list-style-type: none"> <li>• Root</li> <li>• Stem</li> <li>• Leaf</li> </ul> <p>➤ <b>Difference between dicot and monocot plants.</b></p> <p>➤ <b>Non- living cell inclusions (Ergastic material):</b> Definition, structure and occurrence.</p>                                                  | [6L]         |
| <b>Module 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Plant systematic</b>                                                                                                                                                                                                                                                                                                                                                 | <b>[15L]</b> |
| <p><b>Learning objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>• Discuss naming of plants and the binomial nomenclature.</li> <li>• Describe the morphological characteristics of flowers and their variations. Understand characters good and bad characters.</li> </ul>                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                         |              |
| <p><b>Learning outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Compare different methods of classification.</li> <li>2. Gain Knowledge on the botanical survey of India, importance and functions of gardens and herbaria.</li> <li>3. Prepare Herbarium specimens.</li> <li>4. Classify plants as per Bentham and Hooker's system of classification and know their economic importance.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                         |              |
| 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>➤ <b>Plant taxonomy:</b></p> <ul style="list-style-type: none"> <li>• Introduction, History, Fundamental components of taxonomy, and Aims of taxonomy.</li> <li>• Binomial Nomenclature.</li> </ul>                                                                                                                                                                  | [11L]        |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                         |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"><li>➤ Types of Classification (Artificial, Natural and Phylogenetic).</li><li>➤ Bentham and Hooker System of classification (upto series).</li><li>➤ Herbarium technique.</li><li>➤ Botanical Gardens in India.</li><li>➤ Botanical Survey of India (BSI).</li></ul>                                                  |      |
| 2.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"><li>➤ <b>Classification as per Bentham &amp; Hooker's system, general characters and floral formula, Botanical name of very common plants of the following families.</b><ul style="list-style-type: none"><li>• Malvaceae</li><li>• Apocynaceae</li><li>• Nyctaginaceae</li><li>• Amaryllidaceae.</li></ul></li></ul> | [4L] |
| <ul style="list-style-type: none"><li>• <b>References:</b><ol style="list-style-type: none"><li>1. Gangulee, et, al. (1990) College Botany Vol. I- III, 5<sup>th</sup> Edi. New central book agency Calcutta.</li><li>2. V. Singh (1981), Taxonomy of Angiosperms 1<sup>st</sup> Edi. Rastogi pub.</li><li>3. V. Singh (1981). 1<sup>st</sup> Edi Taxonomy of Angiosperms: Rastogi pub.</li><li>4. B. P. Panday (2001). Taxonomy of Angiosperm: S. Chand.</li><li>5. A. C. Datta (1964). Botany for Degree Student. Oxford University press.</li><li>6. Das Datta and Gangulee, (1990). College Botany Volume- I. 5<sup>th</sup> Edi. New central book agency Calcutta.</li><li>7. Gangulee and Kar (1990). College Botany Volume-II. New central book agency Calcutta</li><li>8. Mukharjee (1990). College Botany Volume-III. New central book agency Calcutta</li><li>9. A. C. Datta (1989). College Botany 3<sup>rd</sup> Edi. Oxford Bombay.</li><li>10. B. P. Pandey (2001) Plant Anatomy: S. Chand and Co.</li></ol></li></ul> |                                                                                                                                                                                                                                                                                                                                                         |      |



### Mapping of CLOs and PSOs

| Sr. No. | Course Learning Outcomes                                                                                                                           | Programme Outcomes |   |   |   |   |   |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---|---|---|---|---|
|         |                                                                                                                                                    | 1                  | 2 | 3 | 4 | 5 | 6 |
| 1.      | Understand and explain meristematic tissues—their types, origin, and role in plant growth.                                                         | X                  | X | X |   |   |   |
| 2.      | Describe plant taxonomy, including its principles, history, nomenclature, and classification systems (especially Bentham and Hooker up to series). |                    | X | X |   |   |   |
| 3.      | Identify and classify key angiosperm families (Malvaceae, Apocynaceae, Nyctaginaceae, Amaryllidaceae) using their characters and floral formulae.  | X                  | X |   |   |   |   |
| 4.      | Understand and explain plant anatomy, including tissues, vascular systems, root, stem, leaf structure, and ergastic cell inclusions.               | X                  | X | X |   |   |   |

### Question Paper Template

**B.Sc. (BOTANY) SEMESTER V**

**MN IV**

**COURSE NAME: STRUCTURAL AND SYSTEMATIC BOTANY**

**COURSECODE: BOTMN-S5P4-2CR26**

**[CREDITS-02]**

| Module | Remembering / Knowledge | Understanding | Applying | Analysing | Evaluating | Creating | Total marks |
|--------|-------------------------|---------------|----------|-----------|------------|----------|-------------|
| I      | 20%                     | 40%           | 40%      | -         | -          | -        | 100%        |
| II     | 20%                     | 40%           | 40%      | -         | -          | -        | 100%        |



## B.Sc. (BOTANY) SEMESTER- V

### MN- V

#### MINOR COURSE (THEORY)

#### COURSE NAME: PLANT RESOURCES AND UTILIZATION

COURSE CODE: **BOTMN-S5P5-2CR26**

[CREDITS - 02]

| Course learning outcome                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                      |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| After the successful completion of the Course, the learner will be able to: <ol style="list-style-type: none"><li>1. Acquire comprehensive knowledge on different aspects related to the economic importance of plants.</li><li>2. Ascertain latest developments in the field of plant-based products with a practical approach.</li><li>3. Think independently and critically discuss sustainable vitality of plants.</li></ol>               |                                                                                                                                                                                                                                                                                                                                                                                                                      |              |
| <b>Module 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Food drugs and Industrial products</b>                                                                                                                                                                                                                                                                                                                                                                            | <b>[15L]</b> |
| <b>Learning objectives:</b><br>The module is intended to <ul style="list-style-type: none"><li>● Highlight the relationship between plants and human.</li><li>● Apply knowledge of economic botany to identify plant products and their uses.</li><li>● Develop observational and identification skill for food plant species and their uses.</li></ul>                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                      |              |
| <b>Learning outcomes:</b><br>After the successful completion of the module, the learner will be able to <ol style="list-style-type: none"><li>1. Comprehend the economic importance of plants in different industries.</li><li>2. Identify and classify various plant products such as Food, drugs, fibre and paper.</li><li>3. Develop skills in identifying plant species, including their morphological characteristics and uses.</li></ol> |                                                                                                                                                                                                                                                                                                                                                                                                                      |              |
| 1.1                                                                                                                                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"><li>➤ <b>Introduction of Millets and Economic Botany</b></li><li>➤ Cereals, Millets and Small Grains: plants-products- used as Food.</li><li>● Cereals: Major (Wheat, Maize &amp; Rice), Minor (Oat, Barley &amp; Rye) and Sorghum morphology and uses.</li><li>● Millets (Foxtail millet, Kodo millet &amp; Finger millet morphology and uses.</li></ul>                          | [8L]         |
| 1.2                                                                                                                                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"><li>➤ <b>Plants and plants products of industrial value:</b></li><li>● <b>Fiber and Fiber yielding plants:</b> Types &amp; Classification Textile fiber: Cotton, Jute.</li><li>● <b>Rubber and its Products:</b> Properties and uses of rubber.</li><li>● <b>Medicinal Plants and Drugs:</b> Classification of drugs and drugs obtained from whole plant and plant parts</li></ul> | [7L]         |



| Module 2 Oils, Gum, Resin and Dyes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | [15L] |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Learning objectives:</b><br>This module is intended to <ul style="list-style-type: none"><li>• Know the chemical composition, properties and uses of different oils, gums and resins.</li><li>• Discuss the different plants parts which are used in the preparation of Dyes</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |
| <b>Learning outcome:</b><br>On the successful completion of the module, the learner will be able to <ol style="list-style-type: none"><li>1. Evaluate the economic and social impact of Fatty oils and essential oils</li><li>2. Identify plant sources of fatty oils, Vegetables oils, Essential oils, gum resins and dyes.</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |
| 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"><li>➤ <b>Fatty oils and Vegetable fats</b><ul style="list-style-type: none"><li>• Drying and Semi Drying oil: Linseed</li><li>• Non-drying oil: Castor, Ground nut, Sesame</li><li>• Vegetable oil (Fixed oil)</li></ul></li><li>➤ <b>Essential oils:</b> extraction and applications<ul style="list-style-type: none"><li>• Sandalwood oil</li><li>• Clove oil</li><li>• Eucalyptus oil</li></ul></li></ul>                                                                                                                                             | [7L]  |
| 2.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"><li>➤ <b>Gum and Resins:</b><ul style="list-style-type: none"><li>• Gum: <i>Acacia nilotica</i>, <i>Butea monosperma</i></li><li>• Resin: Asafoetida (<i>Ferula assfoetida</i>),<br/><i>Dipterocarpus turbinatus</i>.</li></ul></li><li>➤ <b>Dyes:</b><ul style="list-style-type: none"><li>• Dyes obtained from bark: <i>Madhuca indica</i></li><li>• Dyes obtained from wood: <i>Acacia catechu</i>,</li><li>• Dyes obtained from leaves: <i>Indigofera tinctoria</i></li><li>• Dyes obtained from flower: <i>Butea monosperma</i></li></ul></li></ul> | [8L]  |
| <b>References:</b> <ul style="list-style-type: none"><li>• Singh, Pandeya and Jain (2017). Economic Botany, Rastogi Publication Meerut</li><li>• Kochher S.L. (2012). Economic Botany in Topic Macmillan &amp; Co New Delhi.</li><li>• Wicken G.E. (2001). Economic Botany: Principal &amp; Practices. Kulwer Academic publishers, The Netherlands.</li><li>• Das, Gangulee and Mukhrjee (2011) College Botany 6th Edition.</li><li>• B Baruah (2017) Economic Botany, Kalyani Publisher. New Delhi.</li><li>• Samba Murty and Subrahmanyam (2011). Text Book of Modern Economic Botany, CBS Publishers and Distributors, New Delhi.</li><li>• Hill, Albert F (2016) Economic Botany: A Text book of useful plants and Plant.</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |

## Mapping of CLOs and PSOs

| Course Learning Outcomes                                                                                   | Programme Outcomes |   |   |   |   |   |
|------------------------------------------------------------------------------------------------------------|--------------------|---|---|---|---|---|
|                                                                                                            | 1                  | 2 | 3 | 4 | 5 | 6 |
| 1 Understand the Concept of economic botany and its importance in human societies.                         | X                  | X |   |   |   |   |
| 2. Explain the role of plants in human economies, including their uses agriculture, industry and trade.    |                    | X | X |   |   |   |
| 3. Identify and describe plants that economically important for food, fibre, medicine, and other products. |                    | X | X | X |   |   |
| 4 Develop sustainable practices for plant use and conservation.                                            |                    | X | X | X |   |   |

## Question Paper Template

**B. Sc. (BOTANY) SEMESTER V**

**MN- V**

**COURSE NAME: PLANT RESOURCES AND UTILIZATION**

**COURSE CODE: BOTMN-S5P5-2CR26**

**[CREDITS - 02]**

| Module | Remembering/<br>Knowledge | Understanding | Applying | Analysing | Evaluating | Creating | Total<br>marks |
|--------|---------------------------|---------------|----------|-----------|------------|----------|----------------|
| I      | 20%                       | 40%           | 40%      | -         | -          | -        | 100%           |
| II     | 20%                       | 40%           | 40%      | -         | -          | -        | 100%           |



## B.Sc. (BOTANY) SEMESTER V

### COURSE NAME: Botany Practical (MN)-IV

COURSE CODE: **BOTMN-S5PR4-2CR26**

[CREDIT-02]

#### Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Demonstrate practical skills and relate their Botany the concepts through practical.
2. Differentiate the types of Dicot and Monocot plants.

#### PRACTICAL-I

|     |                                                                                                                  |
|-----|------------------------------------------------------------------------------------------------------------------|
| 1.  | Study different types of tissues by permanent slides.                                                            |
| 2.  | Study different types of vascular bundle.                                                                        |
| 3.  | Study different types of stele.                                                                                  |
| 4.  | Study the internal structure of Monocotyledon stem.                                                              |
| 5.  | Study the internal structure of Dicotyledon stem.                                                                |
| 6.  | Study the internal structure of Monocotyledon root.                                                              |
| 7.  | Study the internal structure of Dicotyledon root.                                                                |
| 8.  | Study the internal structure of Monocotyledon leaf.                                                              |
| 9.  | Study the internal structure of Dicotyledon leaf.                                                                |
| 10. | Study ergastic matters in different plant materials.                                                             |
| 11. | Study of morphological characters, floral dissection, T.S of ovary and floral formula of <b>Malvaceae</b> .      |
| 12. | Study of morphological characters, floral dissection, T.S of ovary and floral formula of <b>Apocynaceae</b> .    |
| 13. | Study of morphological characters, floral dissection, T.S of ovary and floral formula of <b>Nyctaginaceae</b> .  |
| 14. | Study of morphological characters, floral dissection, T.S of ovary and floral formula of <b>Amaryllidaceae</b> . |
| 15. | To prepare 5 herbarium specimens.                                                                                |

- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At end of the semester candidate have to submit a certified journal during the practical examination.



## B.Sc. (BOTANY) SEMESTER V

COURSE NAME: Botany Practical (MN) -V

COURSE CODE: **BOTMN-S5PR5-2CR26**

[CREDITS- 02]

### Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Identify cereals, legumes, spices, fiber and oil crop plants and their useful parts on the basis of their characteristic morphological features through herbarium specimens
2. Specify the type of nutritive content such as proteins, sugars, fats, cellulose present in provided plant sample such as seed, fruit and leaves via Biochemical tests
3. Differentiate between mitosis and meiosis.

### PRACTICAL – I

|    |                                                                                                                                                                                                              |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <b>Study of Food plants through Specimens:</b> <ol style="list-style-type: none"><li>i. Wheat</li><li>ii. Rice</li><li>iii. Maize</li><li>iv. Sorghum</li><li>v. Bajra</li></ol>                             |
| 2. | <b>Biochemical Test for cereals:</b> <ol style="list-style-type: none"><li>i. Carbohydrate Test</li></ol>                                                                                                    |
| 3. | Study of legumes through Specimens.                                                                                                                                                                          |
| 4. | Biochemical Test for Protein.                                                                                                                                                                                |
| 5. | <b>Study of Fiber Yielding Crops:</b> <ol style="list-style-type: none"><li>i. Cotton (kapas)</li><li>ii. Jute(Titapat)</li><li>iii. Sunn hemp (Sann)</li><li>iv. Coire (Coconut)</li><li>v. Kapok</li></ol> |
| 6. | <b>Macro &amp; Microscopic Study of Fibers:</b> <ol style="list-style-type: none"><li>i. Biochemical Test for Cellulose</li></ol>                                                                            |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Study of Oil Yielding Crops:</b><br>i. Mustard<br>ii. Groundnut<br>iii. Sesame<br>iv. Coconut<br>v. Castor                                                                 |
| 8.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Biochemical Test for Oil:</b><br>i. Qualitative test for lipid.<br>ii. A test for iodine number in given oil sample.                                                       |
| 9.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Study of Gums and Resins</b>                                                                                                                                               |
| 10.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Study of chemical nature of vegetable tannin:</b><br>i. <i>Acacia nilotica</i> (Babool)<br>ii. <i>Camellia sinensis</i> (Tea)<br>iii. <i>Terminalia bellirica</i> (Baheda) |
| 11.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Biochemical test for tannin.</b>                                                                                                                                           |
| 12.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Chemical Nature of Natural Dyes:</b><br>i. <i>Curcuma longa</i> (Turmeric)<br>ii. <i>Indigofera tinctoria</i> (Indigo)<br>iii. <i>Bixa orellana</i> (Sindoori)             |
| 13.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Study of Black Pepper, Clove , Cinnamon, Nutmeg, Star anise through Specimens.</b>                                                                                         |
| <ul style="list-style-type: none"><li>● All the candidates shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.</li><li>● All the candidates shall record observations directly in the laboratory journal. The journals shall be signed periodically.</li><li>● At the end of the semester candidates have to submit a certified journal at the time of practical examination.</li></ul> |                                                                                                                                                                               |



## B.Sc. (BOTANY) SEMESTER- VI

### CORE COURSE- XIV

### MAJOR COURSE (THEORY)

#### COURSE TITLE: POLLEN BIOLOGY AND PLANT GEOGRAPHY

COURSE CODE: **BOTMJ-S6P14-2CR26**

[CREDITS - 02]

| Course learning outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                           |       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"><li>1. Acquire comprehensive knowledge about Palynology and Plant geography.</li><li>2. Ascertain latest trends to identify the useful pollen grains and harmful pollen grains.</li><li>3. Equip students to think independently, critically to discuss different aspects of Pollen biology and Plant geography.</li><li>4. Acquire knowledge about the morphology of pollen spores.</li><li>5. Evaluate the vegetation of Gujarat and protected area of India.</li></ol> |                                                                                                                                                                                                                                                                                                                                                                                                                           |       |
| Module 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Basics of Palynology and pollen morphology                                                                                                                                                                                                                                                                                                                                                                                | [15L] |
| <p><b>Learning objectives:</b></p> <p>The module is intended to</p> <ul style="list-style-type: none"><li>• Learn about Palynology and its importance in plant taxonomy.</li><li>• Acquire knowledge about various branches of Palynology</li><li>• Acquire deep knowledge of the morphology of the spores and pollen grains</li><li>• Learn about collection and preservation of pollen sample.</li></ul>                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                           |       |
| <p><b>Learning outcomes:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"><li>1. Understand about future scope of Palynology</li><li>2. Evaluate and identify the allergic and useful pollen through characters.</li><li>3. Critically understand the pollen-pistil interaction and its importance.</li><li>4. Understand the application of Palynology in various field.</li><li>5. Distinguish plant pollen according their structure.</li><li>6. Understand the role of pollen grain in biodiversity.</li></ol>  |                                                                                                                                                                                                                                                                                                                                                                                                                           |       |
| 1.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>➤ <b>Palynology:</b></p> <ul style="list-style-type: none"><li>• Introduction, definition, scope of Palynology</li><li>• Importance of Pollen morphology in Taxonomy.</li><li>• Pollen-Pistil interaction and its importance.</li><li>• <b>Definition and importance of following branches:</b><br/>Neo - Palynology, Paleopalynology, Palynotaxonomy, Aeropalynology, Melissopalynology/ Melittopalynology,</li></ul> | [6L]  |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Forensic Palynology, Copropalynology, Entomopalynology, Latropalynology, Geopalynology.<br>• Palynodebris and Biostratigraphy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |
| 1.2                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>➤ <b>Pollen morphology:</b></p> <ul style="list-style-type: none"> <li>• Difference between spores and pollen</li> <li>• Composition and structure of spores and pollen</li> <li>• Definition, structure and types of pollen units</li> <li>• Definition, structure and types of polarity, symmetry.</li> <li>• Definition, structure, classification and types of Pollen shape based on the ratio of PA/ED by G. Erdmann.</li> <li>• Different pollen size classes according to Erdmann</li> <li>• Definition and types of Aperture.</li> <li>• Types of pollen based on Exine stratification and Ornamentation.</li> <li>• Uses and Harmful effects of Pollen grain (Allergy, high fever).</li> </ul> | [9L]         |
| <b>Module 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Plant geography</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>[15L]</b> |
| <p><b>Learning objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>• Understand the scope and importance of phytogeography.</li> <li>• Remember about Descriptive or static phytogeography</li> <li>• Acquire the knowledge of hot spots, protected area and national parks In India.</li> <li>• Learn about vegetation types of Gujarat.</li> </ul>                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |
| <p><b>Learning outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Describes scope and importance of Phytogeography.</li> <li>2. Explain the Different types of soil and climate in India</li> <li>3. Discuss about the bio conservation.</li> <li>4. Types of vegetation's in Gujarat.</li> <li>5. Prepare the world map with hotspots and national parks.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |
| 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>➤ <b>Phytogeography Introduction</b></p> <ul style="list-style-type: none"> <li>• Scope, aims and importance of phytogeography.</li> <li>• Descriptive or static phytogeography</li> <li>• Soil and Climate of India and Gujarat.</li> <li>• Interpretative or Dynamic phytogeography</li> </ul> <p>➤ <b>Distribution on the basis of area of the earth surface</b></p> <p>Wides</p> <p>Endemics</p> <p>Discontinuous species</p>                                                                                                                                                                                                                                                                       | [7L]         |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 2.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <ul style="list-style-type: none"><li>➤ <b>Vegetation of Gujarat</b><ul style="list-style-type: none"><li>• Forest vegetation, desert vegetation, grassland vegetation and mangrove vegetation.</li></ul></li><li>➤ <b>Biodiversity and Conservation:</b><ul style="list-style-type: none"><li>• Hotspots of India.</li><li>• Botanical regions of India.</li><li>• Protected areas, national parks and biosphere reserves.</li></ul></li></ul> | [8L] |
| <p><b>References:</b></p> <ul style="list-style-type: none"><li>• K. Bhattacharya, M.R. Majumdar, S. Gupta Bhattacharya. A Textbook of Palynology New Central Book Agency P. Ltd</li><li>• Studies in Botany Vol I - Mitra, Mitra, Choudhury. Moulik Library, Kolkata.</li><li>• Erdtman, G. 1952. Pollen morphology and Plant Taxonomy. Angiosperms (An introduction to Palynology I). Almquist &amp; Wiksell, Stockholm.</li><li>• Agashe, S.N., &amp; Caulton, E. (2009). Pollen and Spores: Applications with Special Emphasis on Aerobiology and Allergy. Enfield, NH: Science Publishers.</li><li>• Erdtman, G. ( 2008). An introduction to pollen analysis. New York: Morison Press.</li><li>• Nair, P.K. Pollen Morphology of Angiosperms, Latest Ed., Scholar Publications</li><li>• MOORE, P.D, WEBB, J.A. 1978. An Illustrated guide to pollen analysis. Hodder and Stoughton, London.</li><li>• Faegri, K. &amp; Iversen, Text Book of Pollen Analysis, Latest Ed., Munksgor, Copenhagen</li><li>• WODEHOUSE, R.P. 1935. Pollen grain - their structure, identification and significance in Science and Medicine. Hafner Publishing Co. New York.</li><li>• Plant-geography Upon a Physiological Basis by A. F. W. Schimper (1903) – A foundational text that established the physiological approach to plant geography.</li><li>• Manual of Phytogeography: An Account of Plant-Dispersal Throughout the World by Léon Croizat (1952) – A critical work on plant distribution and dispersal.</li><li>• The Life Forms of Plants and Statistical Plant Geography by C. Raunkiaer (1934) – Focuses on classifying plants by life form and analyzing their distribution.</li><li>• Plant Ecology and Phyto geography ; ISBN : 9789384826703 ; Author : N. Arumugam, V. Kumaresan, ; Number of Pages : 580 ; Edition : Fourth.</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |



## Mapping of CLOs and PSOs

| Course Learning Outcomes                                                                                  | Programme Outcomes |   |   |   |   |   |
|-----------------------------------------------------------------------------------------------------------|--------------------|---|---|---|---|---|
|                                                                                                           | 1                  | 2 | 3 | 4 | 5 | 6 |
| 1. Understand the pollen structure and composition.<br>And the Uses and harmful effects of pollen grains. | X                  | X |   |   |   |   |
| 2. Remember the vegetation, botanical regions , hotspots<br>and protected area of India.                  | X                  | X |   |   |   |   |
| 3. Compare the types of soil and climatic factors of<br>different regions of India                        | X                  | X | X |   |   |   |
| 4. Analyse the different types of plants groups according<br>to vegetation of Gujarat.                    | X                  | X |   | X |   |   |

## Question Paper

### B. Sc. (BOTANY) SEMESTER VI

#### CORE COURSE - XIV

#### COURSE NAME: POLLEN BIOLOGY AND PLANT GEOGRAPHY

COURSE CODE: **BOTMJ-S6P14-2CR26**

[CREDITS - 02]

| Module | Remembering<br>/ Knowledge | Understanding | Applying | Analysing | Evaluating | Creating | Total<br>marks |
|--------|----------------------------|---------------|----------|-----------|------------|----------|----------------|
| I      | 20%                        | 40%           | 40%      |           | -          | -        | 100%           |
| II     | 20%                        | 40%           | 40%      |           | -          | -        | 100%           |



**B.Sc. (BOTANY) SEMESTER-VI  
CORE COURSE- XV  
MAJOR COURSE (THEORY)**

**COURSE NAME: STRUCTURAL BOTANY AND PLANT HISTOLOGY  
COURSE CODE: BOTMJ-S6P15-2CR26 [CREDITS - 02]**

| Course learning outcome                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                    |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| After the successful completion of the Course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                    |              |
| <ol style="list-style-type: none"> <li>1. Acquire comprehensive knowledge on Anatomical Structure of plants.</li> <li>2. Ascertain latest developments in the field of plants development.</li> <li>3. Get knowledge of microscopic characters of plants.</li> </ol>                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                    |              |
| <b>Module -1</b>                                                                                                                                                                                                                                                                                                                                                                                                | <b>Plant Development</b>                                                                                                                                                                                                                                                                                                                                           | <b>[15L]</b> |
| <b>Learning objectives:</b><br>The module is intended to <ul style="list-style-type: none"> <li>• Develop skills in sectioning, staining, and using microscopes to identify plant structures.</li> <li>• Understand the Structure of stomata and trichome Importance and functions of stomata</li> <li>• Understand secondary growth, including the activity of vascular cambium and wood formation.</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                    |              |
| <b>Learning outcomes:</b><br>After the successful completion of the module, the learner will be able to <ol style="list-style-type: none"> <li>1. Illustrate the types of stomata, trichome, Epidermal tissue.</li> <li>2. Get knowledge of Mechanical tissue</li> <li>3. Develop skills in identifying plant species, according to their anatomical characteristics.</li> </ol>                                |                                                                                                                                                                                                                                                                                                                                                                    |              |
| 1.1                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>➤ Types of stomata: Structure of stomata, Importance and functions of stomata</li> <li>➤ Trichome: Types, Structure Importance</li> <li>➤ Epidermal tissue system types</li> <li>➤ Mechanical Tissue</li> </ul>                                                                                                             | [9L]         |
| 1.2                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>➤ Floral development               <ul style="list-style-type: none"> <li>• Anatomy of floral parts</li> <li>• Anatomy of the Embryo and young Seedling</li> </ul> </li> <li>➤ Fruit Anatomy               <ul style="list-style-type: none"> <li>• Fruit</li> <li>• Fruit wall</li> <li>• Seed Coat</li> </ul> </li> </ul> | [6L]         |
| <b>Module 2</b>                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Plants Histology</b>                                                                                                                                                                                                                                                                                                                                            | <b>[15L]</b> |
| <b>Learning objectives:</b> The module is intended to <ul style="list-style-type: none"> <li>• Understand Ergastic Substances of plants</li> <li>• Apply knowledge of Histo-chemistry for identification of phytochemical</li> <li>• Illustrate the classification and properties of wood</li> </ul>                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                    |              |
| <b>Learning outcomes:</b><br>After the successful completion of the module, the learner will be able to <ol style="list-style-type: none"> <li>1. Understand about histochemistry of plants and its application</li> </ol>                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                    |              |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 2. Get knowledge of Excretory material and Micrometry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |
| 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"><li>➤ Histo-chemistry of plants and its application</li><li>➤ Ergastic Substances: Reserve Material, Seceratory Material , Excretory material</li><li>➤ Microscopy and Micrometry<ul style="list-style-type: none"><li>• Light microscope</li><li>• Electron microscope</li><li>• Micrometry</li></ul></li></ul>                                                                                                                    | [7L] |
| 2.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"><li>➤ Properties of wood<ul style="list-style-type: none"><li>• Surface characteristics, physical properties, other properties, Mechanism of wood formation Anatomical characteristics of wood.</li></ul></li><li>➤ Classification of wood<ul style="list-style-type: none"><li>• Classification based on seasons,</li><li>• Classification based on location,</li><li>• Classification based on type of plant.</li></ul></li></ul> | [8L] |
| <b>References :</b> <ul style="list-style-type: none"><li>• Coutler E. G. ( 1969). Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London.</li><li>• Dickenson, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA.</li><li>• Esau, K. (1990).</li><li>• Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi</li><li>• Evert, R.F. (2006) Esau's Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc</li><li>• Fahn, A.(1992) Plant Anatomy, Pergamon Press, USA.</li><li>• Pijush Roy((2006) Plant Anatomy New Central Book Agency</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |



## Mapping of CLOs and PSOs

| Sr. No. | Course Learning Outcomes                                                                                                          | Programme Outcomes |   |   |   |   |   |
|---------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------|---|---|---|---|---|
|         |                                                                                                                                   | 1                  | 2 | 3 | 4 | 5 | 6 |
| 1       | Classify wood according to their different properties                                                                             | X                  | X |   |   |   |   |
| 2       | Describes the Anatomical character of plants                                                                                      | X                  | X |   |   |   |   |
| 3.      | Compare internal structures among plant groups to understand evolutionary trends.                                                 |                    | X |   | X |   |   |
| 4       | Develop hands-on skills in cutting plant sections, staining techniques, and microscopic analysis to identify and describe tissues | X                  |   |   | X |   | X |
| 5       | Utilize anatomical features in the identification and classification of angiosperms and other plant groups                        |                    |   | X |   | X |   |

### Question paper Template

**B.Sc. (BOTANY) SEMESTER-VI**

**CORE COURSE- XV**

**MAJOR COURSE (THEORY)**

**COURSE NAME: STRUCTURAL BOTANY AND PLANT HISTOLOGY**

**COURSE CODE: BOTMJ-S6P15-2CR26 [CREDITS - 02]**

| Module | Remembering / Knowledge | Understanding | Applying | Analysing | Evaluating | Creating | Total marks |
|--------|-------------------------|---------------|----------|-----------|------------|----------|-------------|
| I      | 20%                     | 40%           | 40%      |           | -          | -        | 100%        |
| II     | 20%                     | 40%           | 40%      |           | -          | -        | 100%        |



**B.Sc. (BOTANY) SEMESTER- VI**

**CORE COURSE: XVI**

**MAJOR COURSE (THEORY)**

**COURSE NAME: SYSTEMATIC BOTANY**

**COURSE CODE: BOTMJ-S6P16-2CR26**

**[CREDITS-02]**

| Course learning outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                             |       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------|
| After the successful completion of the Course, the learner will be able to: <ol style="list-style-type: none"><li>1. Explain the historical development of plant taxonomy and the contributions of scientists.</li><li>2. Describe different plant classification systems, including the natural classification proposed by Bentham and Hooker.</li><li>3. Discuss the origin and evolution of angiosperms and recognize primitive and advanced characters in angiosperms.</li><li>4. Identify and describe important angiosperm families based on their diagnostic morphological characters and economic importance.</li></ol> |                                             |       |
| Module1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Principles and approaches in plant taxonomy | [15L] |
| <b>Learning objectives:</b> <p>The module is intended to</p> <ul style="list-style-type: none"><li>● Introduce students to the fundamental concepts, scope and importance of plant systematics and taxonomy.</li><li>● Familiarize students with different methods of plant identification.</li></ul>                                                                                                                                                                                                                                                                                                                           |                                             |       |
| <b>Learning outcomes:</b> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"><li>1. Explain the basic concepts, scope and importance of plant systematics and taxonomy.</li></ol>                                                                                                                                                                                                                                                                                                                                                                              |                                             |       |



|                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 4. Explain the concept and principles of numerical taxonomy used in plant classification.<br>5. Identify important angiosperm families.<br>6. Apply knowledge of morphological characters, floral formula and floral diagrams for plant identification.                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |
| 1.1                                                                                                                                                                                                                                                                                                                                                                                         | <b>➤ Introduction to Systematic Botany</b><br>Definition, scope and significance of plant systematics and taxonomy.                                                                                                                                                                                                                                                                                                                                                                                                                                                           | [2L]         |
| 1.2                                                                                                                                                                                                                                                                                                                                                                                         | <b>➤ Detailed Study of Bentham and Hooker Classification</b> <ul style="list-style-type: none"> <li>• Basis and principles of classification</li> <li>• Outline of the system</li> <li>• Major groups               <ul style="list-style-type: none"> <li>• Dicotyledons</li> <li>• Monocotyledons</li> </ul> </li> <li>• Dicotyledons divided into:               <ul style="list-style-type: none"> <li>• Polypetalae</li> <li>• Gamopetalae</li> <li>• Monochlamydeae/Apetalae</li> </ul> </li> <li>• Merits and demerits of Bentham and Hooker classification</li> </ul> | [6L]         |
| 1.3                                                                                                                                                                                                                                                                                                                                                                                         | <b>➤ Detailed Study of Englar and Prantl Classification</b> <ul style="list-style-type: none"> <li>• Basis of phylogenetic classification</li> <li>• Outline of the system</li> <li>• Division of angiosperms into monocots and dicots</li> <li>• Archichlamydeae and Metachlamydeae groups</li> <li>• Merits and demerits of Englar and Prantl classification</li> </ul>                                                                                                                                                                                                     | [4L]         |
| 1.4                                                                                                                                                                                                                                                                                                                                                                                         | <b>➤ Use of DNA coding methods in plant taxonomy to identify plant correctly, classify species, study relationship and help in conservation of plants.</b>                                                                                                                                                                                                                                                                                                                                                                                                                    | [3L]         |
| <b>Module 2</b>                                                                                                                                                                                                                                                                                                                                                                             | <b>Evolution and study of angiosperms</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>[15L]</b> |
| <b>Learning objectives:</b><br>This module is intended to <ul style="list-style-type: none"> <li>• Introduce students to the theories and concepts related to the origin and evolution of angiosperms.</li> <li>• Develop understanding of primitive and advanced characters in angiosperms.</li> </ul> Familiarize students with the diagnostic characters, floral formula, floral diagram |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                  |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <p>and economic importance of important angiosperm families.</p> <ul style="list-style-type: none"><li>● Explain the phylogenetic relationships among angiosperms.</li><li>● Highlight the importance of systematic botany in plant identification, biodiversity studies and conservation.</li></ul>                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                  |      |
| <p><b>Learning outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"><li>1. Explain the theories related to the origin and evolution of angiosperms.</li><li>2. Distinguish between primitive and advanced characters in angiosperms.</li><li>3. Identify and describe important angiosperm families.</li><li>4. Explain the phylogenetic relationships among angiosperms.</li><li>5. Recognize the importance of systematic botany in plant identification, biodiversity studies and conservation.</li></ol> |                                                                                                                                                                                                                                                                                                                                                                  |      |
| 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p>➤ <b>Origin and Evolution of Angiosperms</b></p> <ul style="list-style-type: none"><li>● Theories regarding the origins of angiosperms</li><li>● Primitive and advanced characters in angiosperms</li></ul>                                                                                                                                                   | [4L] |
| 2.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p>➤ <b>Importance of Systematic Botany in Biodiversity Conservation</b></p> <ul style="list-style-type: none"><li>● Role of taxonomy in plant identification and biodiversity studies.</li><li>● Importance of systematic botany in conservation of plant diversity.</li></ul>                                                                                  | [3L] |
| 2.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p>➤ <b>Study of Important Angiosperm Families</b></p> <p>General characters, floral formula, floral diagram and economic importance of:</p> <ul style="list-style-type: none"><li>● Meliaceae</li><li>● Cucurbitaceae</li><li>● Asclepiadaceae</li><li>● Solanaceae</li><li>● Polygonaceae</li><li>● Moraceae</li><li>● Cannaceae</li><li>● Iridaceae</li></ul> | [8L] |

**References:**

- T. Pullaiah & S. Karuppusamy (2018) Taxonomy of Angiosperms: IK International Publishing/ IBP Books.
- A.V.S.S.Sambamurty (2019) Taxonomy of Angiosperms: Dreamtech Press.
- S.N.Pandey & S.P.Misra (2008) Taxonomy of Angiosperm: Ane Books.
- Annie Regland & V. Kumaresan (2014) (2<sup>nd</sup> Ed): Taxonomy of Angiosperms, Systematic Botany, Economic Botany & Ethenobotany: Saras Publication.
- A. Baruah (2011) Handbook of Angiosperm Taxonomy and Useful plants: Aavishkar Publisher.
- Arun K.pandey & Shruti Kasan (2020) Plant Systematics: Scientific Publishers (India)

**Useful Websites:**

- Botanical Survey of India  
<https://bsi.gov.in>
- Angiosperm Phylogeny Group  
<https://www.mobot.org/APweb/>
- International Plant Names Index <https://www.ipni.org>
- The Plant List  
<https://www.theplantlist.org>

**Mapping of CLOs and PSOs**

| Course Learning Outcomes                                                                                               | Programme Outcomes |   |   |   |   |   |
|------------------------------------------------------------------------------------------------------------------------|--------------------|---|---|---|---|---|
|                                                                                                                        | 1                  | 2 | 3 | 4 | 5 | 6 |
| 1. Understand the principles, scope and importance of plant systematics and taxonomy.                                  | X                  | X |   |   |   |   |
| 2. Explain the relationship of taxonomy with morphology, anatomy, cytology, palynology, embryology and phytochemistry. |                    | X | X |   |   |   |
| 3. Apply taxonomic keys for identification of plants.                                                                  | X                  | X |   |   |   |   |
| 4. Explain the origin and evolution of angiosperms and phylogenetic relationships.                                     | X                  | X |   |   |   |   |
| 5. Identify and describe important angiosperm families.                                                                |                    | X | X |   |   |   |



**Question Paper Template**  
**B.Sc. (BOTANY) SEMESTER VI**

**CORE COURSE: XVI**

**COURSE NAME: SYSTEMATIC BOTANY**

**COURSECODE: BOTMJ-S6P16-2CR26**

**[CREDITS-02]**

| Module | Remembering / Knowledge | Understanding | Applying | Analysing | Evaluating | Creating | Total marks |
|--------|-------------------------|---------------|----------|-----------|------------|----------|-------------|
| I      | 20%                     | 40%           | 40%      | -         | -          | -        | 100%        |
| II     | 20%                     | 40%           | 40%      | -         | -          | -        | 100%        |



## B.Sc. (BOTANY) SEMESTER VI

### COURSE NAME: BOTANY PRACTICAL (MJ) -XII

COURSE CODE: **BOTMJ-S6PR12-2CR26**

[Credit- 02]

#### Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Acquire deep knowledge of the morphology of the spore and pollen grain.
2. Gain knowledge about use of pollen and harmful effects.
3. Learn about collection and preservation of pollen sample.
4. Identify spore and pollen type with help of morphological characters.
5. Understand application of Palynology in various field.
6. Understand the diversity and role of pollen grain in biodiversity.
7. Analyse the different types of vegetation by field visits.
8. Identify the hotspots, biosphere reserves and botanical regions through map.

#### PRACTICAL – XII

|     |                                                                                                                                       |
|-----|---------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | Techniques for collecting anther and pollen spores from flowers, soil and honey.                                                      |
| 2.  | Techniques for collecting anther and pollen s Spores from Soil.                                                                       |
| 3.  | Techniques for collecting anther and pollen s Spores from Honey.                                                                      |
| 4.  | Slide preparation of pollen by Erdtman's Acetolysis method.                                                                           |
| 5.  | Slide preparation of pollen by Wodehouse method.                                                                                      |
| 6.  | Study of different types of pollen grains                                                                                             |
| 7.  | Study of different size and shape of pollen grains.                                                                                   |
| 8.  | Study the different types of apertures in pollen grains.                                                                              |
| 9.  | Study the different types of exine ornamentations in pollen grains                                                                    |
| 10. | Study the different types of Monocolpate, Tricolpate and Monoporate pollen grains.                                                    |
| 11. | Palynological study of honey sample and detection of type of honey. [Uni, bi, or malty floral.]                                       |
| 11. | Study the allergic effects of pollens of <i>Parthenium</i> , <i>Chin0-Amaranthus</i> , <i>Carica papaya</i> , <i>Cocos nucifera</i> , |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 12.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Study of pollen viability                                                           |
| 13.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Study of pollen viability test.                                                     |
| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | To study the pollen viability and germination.by different methods                  |
| 15.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Preparation of a map of the showing hotspots in India.                              |
| 16.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Preparation of a map of the showing Biosphere reserves and national parks in India. |
| 17.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Field visit to study the type of vegetation in different area.                      |
| <ul style="list-style-type: none"><li>• A candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.</li><li>• Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.</li><li>• At the end of the semester candidates have to submit a certified journal during the practical examination.</li></ul> |                                                                                     |



## B.Sc. (BOTANY) SEMESTER VI

COURSE NAME: BOTANY PRACTICAL (MJ) -XIII

COURSE CODE: **BOTMJ-S6PR13-2CR26**

[CREDITS- 02]

| Course Learning Outcome                                                                                                                                                                                                         |                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| After the successful completion of the Course, the learner will be able to:                                                                                                                                                     |                                                                                                                                                                                                       |
| <ol style="list-style-type: none"> <li>1. Understanding the processes that shape the distribution and abundance of organisms.</li> <li>2. Modern tools and techniques and their appropriate use to conduct research.</li> </ol> |                                                                                                                                                                                                       |
| PRACTICAL – XIII                                                                                                                                                                                                                |                                                                                                                                                                                                       |
| 1.                                                                                                                                                                                                                              | To study different types of Stomata.                                                                                                                                                                  |
| 2.                                                                                                                                                                                                                              | To Study different types of trichomes                                                                                                                                                                 |
| 3.                                                                                                                                                                                                                              | Micrometry of mesurment of Guard cell                                                                                                                                                                 |
| 4.                                                                                                                                                                                                                              | To study different types of epidermal Tissue<br>1) Multiple Epidermis (Ficus benghalensis)<br>2) Epidermis of Sugar cane<br>3) Epidermis of Aloe and Musa<br>4) Bulliform motar cells in grains Cells |
| 5.                                                                                                                                                                                                                              | To prepare permanent slides of the given stem showing secondary growth.                                                                                                                               |
| 6.                                                                                                                                                                                                                              | To prepare permanent slides of the given root showing secondary growth.                                                                                                                               |
| 7.                                                                                                                                                                                                                              | To study anomalous secondary growth <b>Tinospora</b> stem.                                                                                                                                            |
| 8.                                                                                                                                                                                                                              | To study anomalous secondary growth of <b>Bignonia</b> stem.                                                                                                                                          |
| 9.                                                                                                                                                                                                                              | To study anomalous secondary growth of <b>Salvadora</b> stem.                                                                                                                                         |
| 10.                                                                                                                                                                                                                             | Histochemical study of Primary metabolites in plants<br>1) Carbohydrate 2) Starch                                                                                                                     |
| 11.                                                                                                                                                                                                                             | Histochemical study of Primary metabolites in plants<br>1) Protein 2) Lipid 3) Amino acid                                                                                                             |
| 12.                                                                                                                                                                                                                             | Histochemical study of Secondary metabolites in plants<br>1) Alkaloid 2) Phenol                                                                                                                       |
| 13.                                                                                                                                                                                                                             | Histochemical study of Secondary metabolites in plants<br>1) Tanin 2) Flavenoids                                                                                                                      |
| 14.                                                                                                                                                                                                                             | Micro chemical test for 1) Cutin 2) Suberin 3) latex                                                                                                                                                  |
| 15.                                                                                                                                                                                                                             | To study Nodal anatomy Unilacunar Node – <i>Nerium</i> , Trilacunar Node – <i>Hibiscus</i> .                                                                                                          |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 16.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>Study the Instruments following:</p> <ul style="list-style-type: none"><li>• Microtome</li><li>• Digital microscope</li></ul> |
| <ul style="list-style-type: none"><li>• Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.</li><li>• Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.</li><li>• At the end of the semester candidates have to submit a certified journal during the practical examination.</li></ul> |                                                                                                                                  |



## B.Sc. (BOTANY) SEMESTER VI

**COURSE NAME: BOTANY PRACTICAL(MJ) -XIV**

**COURSECODE: BOTMJ-S6PR14-2CR26**

**[CREDIT-02]**

### Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Document plant biodiversity present in the college campus with proper taxonomic details.
2. Identify plant species using morphological characters.
3. Apply digital tools such as QR/barcodes for plant identification and information sharing.
4. Promote awareness about plant diversity and conservation through digital documentation.

### PRACTICAL-I

|    |                                                                                                                                                 |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Study morphological characters and economic importance of Family <b>Meliaceae</b> .                                                             |
| 2  | Study morphological characters and economic importance of Family <b>Cucurbitaceae</b> .                                                         |
| 3  | Study morphological characters and economic importance of Family <b>Asclepiadaceae</b> .                                                        |
| 4  | Study morphological characters and economic importance of Family <b>Solanaceae</b> .                                                            |
| 5  | Study morphological characters and economic importance of Family <b>Polygonaceae</b> .                                                          |
| 6  | Study morphological characters and economic importance of Family <b>Moraceae</b> .                                                              |
| 7  | Study morphological characters and economic importance of Family <b>Canaceae</b> .                                                              |
| 8  | Study morphological characters and economic importance of Family <b>Iridaceae</b> .                                                             |
| 9  | Identification of monocot and dicot plants based on morphological characters.                                                                   |
| 10 | Observation of floral characters of Polypetalae, Gamopetalae and Apetalae.                                                                      |
| 11 | Preparation of herbarium specimens of selected families.                                                                                        |
| 12 | To explore and document plant diversity within the campus and integrate digital tools for effective identification and knowledge dissemination. |
| 13 | To study preserved herbarium specimens and organize them systematically according to Bentham and Hooker classification systems.                 |



- Every candidate shall complete a laboratory course as per the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester, candidates have to submit a certified journal during the practical examination.



## B.Sc. (BOTANY) SEMESTER- VI

### MN- VI

### MINOR COURSE (THEORY)

### COURSE NAME: BASIC ECOLOGY

COURSE CODE: **BOTMN-S6P6-2CR26**

[CREDITS-02]

| Course learning outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| After the successful completion of the Course, the learner will be able to <ol style="list-style-type: none"><li>1. Discuss the ecological principles, the community structure and ecosystem function.</li><li>2. Elaborate on the different types of ecosystems and plant communities.</li></ol>                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |
| <b>Module 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Plant Ecology</b>                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>[15L]</b> |
| <b>Learning objectives:</b> <p>This module is intended to introduce:</p> <ul style="list-style-type: none"><li>• The scope of ecology.</li><li>• Review the nature of science and ecology as a branch of natural sciences.</li><li>• Outline the history and expansion of ecology.</li></ul>                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |
| <b>Learning outcome:</b> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"><li>1. Identify the distinguishing physical properties of soil.</li><li>2. Analyse the main types and adaptations of hosts to minimize impacts of parasites.</li><li>3. Identify characteristics of mutualism and discuss this as a type of symbiosis beneficial to both species.</li><li>4. Investigate the differences and similarities between symbiotic and non-symbiotic mutualisms.</li></ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |
| 1.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>➤ Ecology-</b> <ul style="list-style-type: none"><li>• Definition and significance of ecology.</li><li>• Ecology and its divisions, different fields of ecology, Plant ecology and other branches of science.</li><li>• Application of plant ecology.</li></ul>                                                                                                                                                                          | [4L]         |
| 1.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>➤ Ecological factors:</b> <p><b>a. Abiotic factors:</b></p> <ul style="list-style-type: none"><li>• <b>Climatic factors:</b> light, temperature, air.</li><li>• <b>Topographic Factors:</b> Height of mountain, direction of mountain and valleys, Steepness of slope, Exposure of slope.</li><li>• <b>Edaphic factors:</b> Soil components, soil profile, formation of soil, soil classification, soil complex, soil erosion,</li></ul> | [11L]        |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                  |              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>soil conservation and their effects on vegetation, importance of soil.</p> <p><b>b. Physiographic factors.</b></p> <p><b>c. Biotic factors:</b> Interaction between plants, animals and micro-organisms.</p> <p>• <b>Symbiotic interaction:</b> Positive interactions, Negative Interactions.</p>                                                                             |              |
| <b>Module 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Ecosystem and plants Succession</b>                                                                                                                                                                                                                                                                                                                                           | <b>[15L]</b> |
| <p><b>Learning objectives:</b></p> <p>This module is intended to:</p> <ul style="list-style-type: none"> <li>• Discuss the principles of Ecosystem</li> <li>• Analyse the interactions among organisms within an ecosystem.</li> <li>• Elaborate on climate and distribution of global tropical and temperate biomes, their diversity, ecosystem functioning and conservation needs.</li> <li>• Elaborate the different types of aquatic and terrestrial environment, interaction of living and non-living things and adaptations.</li> </ul>                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                  |              |
| <p><b>Learning outcome:</b></p> <p>After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Discuss the climate and distribution of global tropical and temperate biomes, their diversity, ecosystem functioning and conservation needs.</li> <li>2. Elaborate the different types of aquatic environment, interaction of living and non-living things and adaptations.</li> <li>3. Outline the different ecosystems, components and interactions and the energy flows through an ecosystem</li> <li>4. Distinguish the living and non-living components that makeup an ecosystem.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                  |              |
| 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>➤ <b>Ecosystem:</b> Definition, Structure, Concept and components.</p> <ul style="list-style-type: none"> <li>• Food chain, food web and ecological pyramids and Energy flow in ecosystem.</li> </ul> <p>➤ <b>Ecosystem types:</b> Grass land ecosystem, Forest ecosystem, Pond ecosystem, Desert ecosystem.</p> <p>➤ <b>Biogeochemical cycles-</b> Water, C, N, O, P, S.</p> | [8L]         |
| 2.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>➤ <b>Ecological succession:</b> Definition, Succession and its type, process of succession.</p> <p>➤ <b>Plant succession:</b> Hydrosere and xerosere.</p> <p>➤ <b>Methods of vegetation sampling:</b> Quadrature method, transect method, plot less method.</p> <p>➤ <b>Phytogeographical zone of India.</b></p>                                                              | [7L]         |



- |  |                                                                                                                                                                |  |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | <p>➤ <b>Vegetation of Gujarat:</b> Desert vegetation of Gujarat, Costal vegetation of Gujarat, Forest vegetation of Gujarat, Endangered plants of Gujarat.</p> |  |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

**REFERENCES:**

1. Smith, T. M. and Smith, R. L. (2015). Elements of Ecology, Pearson Education, India.
2. Cain, M. L., Bowman, W. D. and Hacker S. D. (2011). Ecology, 2<sup>nd</sup> Edition, Sinauer Associates Inc.
3. Odum, E.P. (2004). Fundamentals of Ecology, Oxford and IBH Publishing Co. Pvt. Ltd.
4. Miller, G.T., Jr. (2014). Environmental Science. 14<sup>th</sup> Edition, Thomson, California.
5. Singh, J. S., Singh, S.P. & Gupta, S. R. (2014). Ecology, Environmental Science and Conservation. S. Chand & Company Pvt. Ltd., New Delhi. 929p.
6. Archibold, O.W. (1995). Ecology of World Vegetation. Chapman & Hall, London.
7. Verma & Agarwal (1995). Environmental Biology (Principles of ecology) Chand & co., New Delhi.
8. Ambhast, R. S. (1998) A Text Book of Plant Ecology. (9<sup>th</sup> edition),
9. Barbour, M. G., Pits, W. D., and Burk, J. H. (1967) Terrestrial Plant Ecology, Addison- Wesley Publisher.
10. Sharma, P. D. Ecology and Environment: Rastogi Publication
11. Pandya, Puri and Singh (1968) Research Methods in Plant Ecology, Asia publishing House, New Delhi.
12. Subrahmanyam and Sambamurthy (2000) Ecology, Narosa Publishing House, New Delhi.
13. Yadav, P.R., and Mishra, S. R. (2004) Environmental biology, Discovery publication, New Delhi.



### Mapping of CLOs and PSOs

| Course Learning Outcomes                                                                                       | Programme Outcomes |   |   |   |   |   |
|----------------------------------------------------------------------------------------------------------------|--------------------|---|---|---|---|---|
|                                                                                                                | 1                  | 2 | 3 | 4 | 5 | 6 |
| 1. Understand the ecological principles, effects of ecological factors on ecosystems.                          | X                  | X |   |   |   |   |
| 2. Remember the biogeochemical cycles, structure and components of ecosystem.                                  | X                  | X |   |   |   |   |
| 3. Compare the effect of biological factors on vegetation.                                                     | X                  | X | X |   |   |   |
| 4. Compare the different types of plant communities according to ecosystem type and geographical distribution. | X                  | X | X |   |   |   |

### Question Paper

**B.Sc. (BOTANY) SEMESTER VI**

**MN- VI**

**COURSE NAME: BASIC ECOLOGY**

**COURSE CODE: BOTMN-S6P6-2CR26**

**[CREDITS-02]**

| Module | Remembering/<br>Knowledge | Understanding | Applying | Analysing | Evaluating | Creating | Total<br>marks |
|--------|---------------------------|---------------|----------|-----------|------------|----------|----------------|
| I      | 20%                       | 40%           | 40%      |           | -          | -        | 100%           |
| II     | 20%                       | 40%           | 40%      |           | -          | -        | 100%           |



## B.Sc. (BOTANY) SEMESTER VI

### COURSE TITLE: PRACTICAL MN-VI

COURSE CODE: **BOTMN-S6PR6-2CR26**

[CREDITS- 02]

| Course Learning Outcome                                                                                                                                                                                                      |                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| After the successful completion of the Course, the learner will be able to:                                                                                                                                                  |                                                                                                                                                    |
| <ol style="list-style-type: none"><li>1. Understanding the processes that shape the distribution and abundance of organisms.</li><li>2. modern tools and techniques and their appropriate use to conduct research.</li></ol> |                                                                                                                                                    |
| PRACTICAL – I                                                                                                                                                                                                                |                                                                                                                                                    |
| 1.                                                                                                                                                                                                                           | To study communities by quadrat method and to determine % frequency, Density and Abundance.                                                        |
| 2.                                                                                                                                                                                                                           | To study the texture of soil sample.                                                                                                               |
| 3.                                                                                                                                                                                                                           | To estimate the porosity of given soil samples.                                                                                                    |
| 4.                                                                                                                                                                                                                           | To find out the moisture content of the soil.                                                                                                      |
| 5.                                                                                                                                                                                                                           | To determine water-holding capacity of a different types of soil sample.                                                                           |
| 6.                                                                                                                                                                                                                           | To determine pH of a different types of soil.                                                                                                      |
| 7.                                                                                                                                                                                                                           | To study the biotic components of a pond.                                                                                                          |
| 8.                                                                                                                                                                                                                           | To determine the amount of total dissolved solids (TDS) in water.                                                                                  |
| 9.                                                                                                                                                                                                                           | To estimate the amount of chloride of different water samples.                                                                                     |
| 10.                                                                                                                                                                                                                          | To measure the amount of dissolved oxygen in pond water.                                                                                           |
| 11.                                                                                                                                                                                                                          | To determine the total hardness of the water.                                                                                                      |
| 12.                                                                                                                                                                                                                          | To study ecological adaptation of some common hydrophytes and xerophytes.                                                                          |
| 13.                                                                                                                                                                                                                          | To study the effect of polluted water on seed germination of any crop.                                                                             |
| 14.                                                                                                                                                                                                                          | Study of ecological Instruments <ol style="list-style-type: none"><li>a. Psychrometer</li><li>b. Prismatic compass</li><li>c. Rain Gauge</li></ol> |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | d. Soil thermometer |
| <ul style="list-style-type: none"><li>● Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.</li><li>● Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.</li><li>● At the end of the semester candidates have to submit a certified journal during the practical examination.</li></ul> |                     |