R. E. Society's

R. P. Gogate College of Arts & Science and R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri

Department of Botany

UG Programme 2024-25

Syllabus for S. Y. B. Sc. (Botany-Major)

Semester III and IV

Under Choice Based Credit System (CBCS)

R. P. Gogate College of Arts and Science and R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri
Board of Studies in Botany
Syllabus for S. Y. B. Sc. Botany effective from the year 2024-25

Name of Programme	**B. Sc.**
Level	UG
No of Semesters	06
Year of Implementation	2024-25
Programme Specific Outcomes (PSO)	**Students will be able to** 1. Recall details and information about the evolution, anatomy, morphology, systematics, genetics, physiology, ecology, and conservation of plants and all other forms of life such as Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms. 2. Recall details of the unique ecological and evolutionary features of the local and Indian flora. 3. Communicate effectively using oral and written communication skills. 4. Generate and test hypotheses, make observations, collect data, analyze and interpret results, derive conclusions, and evaluate their significance within a broad scientific context.
Relevance of PSOs to the local, regional, national, and global developmental needs (200 words)	The students, after completion of the course will be able to understand the diversity of plants from local, regional and national level with respect to various groups like Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.The knowledge of floral diversity gained by the students will be helpful for the sustainable livelihood which is useful from local to global level. The students will also gain knowledge regarding the ecological and economic importance of vegetation throughout the world. The knowledge acquired by the students, regarding cultivation and processing of different varieties of agricultural crops, fruits, vegetables and other plants of commercial importance will be helpful in setting up of small scale industries and seeking jobs which will lead to improve the local , regional and national economy. Study of phytochemical analysis, extraction of essential oils from plant resources and study of microbial technology will make the students able to use the techniques effectively in the industry. The students will be able to analyze the local and regional environmental issues like pollution, waste disposal by studying ecology. The students will be able to establish the relationship between the modern and traditional and indigenous knowledge system of plants of the nation.

The performance of the learners shall be evaluated into two parts. The learner's performance shall be assessed by Internal Assessment with 40% marks in the first part and by conducting the Semester End Examinations with 60% marks in the second part. **The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below-**

A) Internal Assessment: 40 % (20 Marks)

Sr. No.	Particulars	Marks
1.	**One Periodical Class Test / Online Examination**	**10**
2.	**Assignments**	**10**
	Question Paper Pattern for Periodical Class Test/ Online Examination: Maximum Marks: 10 Duration: 20 Minutes Long answer questions/ Multiple Choice Questions	

B) Semester End Examination: 60% (30 Marks)

Duration: The examination shall be of 1 hour duration. Question Paper Pattern
1. There shall be three questions.
2. All questions shall be compulsory with internal options.
3. Questions may be subdivided into sub-questions a, b, c… and the allocation of marks depends on the weightage of the unit.

Standard of Passing

The learner to pass a course shall have to obtain a minimum of 40% marks in aggregate for each course where the course consists of Internal Assessment and Semester End Examination. The learner shall obtain minimum of 40% marks (i.e. 08 out of 20) in the Internal Assessment and 40% marks in Semester End Examination (i.e. 12 out of 30) separately, to pass the course and minimum of Letter Grade "P" in the project component, wherever applicable to pass a particular semester. A learner will be said to have passed the course if the learner passes the Internal Assessment and Semester End Examination together.

Performance grading

Letter grades and grading points:

Semester GPA / Program CGPA Semester/Program	% of Marks	Alpha-Sign/Letter Grade Result
9.00-10.00	90.0-100	O (Outstanding)
8.00 ≤ 9.00	80.0 ≤ 90.0	A+ (Excellent)
7.00 ≤ 8.00	70.0 ≤ 80.0	A (Very Good)
6.00 ≤ 7.00	60.0 ≤ 70.0	B+ (Good)
5.50 ≤ 6.00	55.0 ≤ 60.0	B (Above Average)
5.00 ≤ 5.50	50.0 ≤ 55.0	C (Average)
4.00 ≤ 5.00	40.0 ≤ 50.0	P (Pass)
Below 4.00	Below 40	F (Fail)
Ab (Absent)	-	Absent

Nomenclature of the Course	**Plant Diversity II**
Class	S. Y. B. Sc.
Semester	3
Course Code	USBOT301
No. of Credits	02
Nature	Theory
Type	Major (Mandatory)

Course Outcomes:

CO1: Learn and write the salient features of division Phaeophyta, life cycle patterns and systematic position of *Sargassum* and *Ectocarpus.*
CO2: Understand and enlist the economic importance of division Phaeophyta.
CO3: Learn and write the salient features of Ascomycetae, life cycle patterns and systematic position of *Erysiphe* and *Aspergillus.*
CO4: Understand and enlist the economic importance of Ascomycetae.
CO5: Understand and describe symptoms, causative organism, disease cycle and control measures of Powdery mildew.
CO6: Learn and write the salient features of Anthocerotae and Musci, life cycle patterns and systematic position of *Anthoceros* and *Funaria*.
CO7: Understand and enlist the economic importance of Anthocerotae and Musci.

Syllabus:

Unit No.	Unit Title	Sub titles (Learning Points)
1	**Algae**	Division Phaeophyta: distribution, cell structure, range of thallus, economic importance. Structure, life cycle and systematic position of *Sargassum* and *Ectocarpus.*
2	**Fungi**	Division Ascomycetae: Occurrence, Thallus structure, Nutrition, Reproduction and Economic importance. Structure, life cycle and systematic position of *Erysiphe* and *Aspergillus.* Plant pathology - Symptoms, causative organism, disease cycle and control measures of Powdery mildew.
3	**Bryophyta**	General characters of Anthocerotae and Musci. Structure, life cycle and systematic position of *Anthoceros and Funaria.* Economic importance of Anthocerotae and Musci.

Prescribed Text/s :

- College Botany Volume I and II Gangulee, Das and Dutta. Central Education enterprises, 2001.
- Botany for Degree Students- Algae, Vashishta B. R. S. Chand Publication 2010.
- Botany for Degree Students- Fungi, Vashishta B. R. S. Chand Publication 2010.
- Botany for Degree Students- Bryophyta, Vashishta B. R. S. Chand Publication 2010.
- Diversity of Cryptogams, O. P. Sharma, McGraw-Hill, 2010.
- Cryptogamic Botany, Volume I and II - G M Smith McGrawHill 1955.

Teaching Plan:

Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	Algae	Presentation, Chalk and talk	10
2	Fungi	Presentation, Chalk and talk	10
3	Bryophyta	Presentation, Chalk and talk	10

Evaluation Pattern

A) Continuous Internal Evaluation: Maximum Marks:20

Method	Marks
Class test	10
Assignment (Research methodology or review)	10

B) Semester End Examination: Maximum Marks: 30

Question No. and Sub questions	Unit and sub unit (with number and title)	Type of Question	Marks
1 A	I	Long answer questions (Any 1 out of 2)	06
1 B	I	Answer in brief (Any 1 out of 2)	04
2 A	II	Long answer questions (Any 1 out of 2)	06
2 B	II	Answer in brief (Any 1 out of 2)	04
3 A	III	Long answer questions (Any 1 out of 2)	06
3 B	III	Answer in brief (Any 1 out of 2)	04

Nomenclature of the Course	**Cytology and Molecular Biology**
Class	S. Y. B. Sc.
Semester	3
Course Code	USBOT302
No. of Credits	02
Nature	Theory
Type	Major (Mandatory)

Course Outcomes:

Students will be able to:

CO1: Learn and explain the ultrastructure and functions of prescribed cell organelles and nucleic acids.

CO2: Understand and differentiate between cell organelles such as Mitochondrion, Ribosomes.

CO3: Learn, explain the Cell cycle and cell division and differentiate between Mitosis and Meiosis.

CO4: Learn and describe the chromosome structure.

CO5: Learn and differentiate the chromosomal aberrations.

CO6: UnderstandUnderstand and explain the DNA replication in prokaryotes .

CO7: Understand and describe the DNA replication in eukaryotes.

CO8: Learn and distinguish the Protein synthesis prokaryotes and eukaryotes.

Syllabus:

Unit No.	Unit Title	Sub titles (Learning Points)
1	**Cell Biology**	Ultrastructure and functions of cell organelles: Mitochondrion, and Ribosomes. Structure of Nucleus. Cell Division: Mitosis and Meiosis and its significance.
2	**Cytogenetics**	Structure of chromosome Variation in Chromosome structure Sex determination, sex linked, sex influenced and sex limited traits
3	**Molecular Biology**	Nucleic Acids: Types, structure and functions of DNA and RNA DNA replication (in prokaryotes and eukaryotes) Protein synthesis (in prokaryotes and eukaryotes)

Prescribed Text/s :

- Genetics, Russel, Wesley Longman inc publishers.1998.
- Cell Biology, De Robertis, Lippincott Williams & Wilkins,2011.
- Cell-biology, Genetics, Evolution and Ecology, P.K. Gupta, 2011
- Cell biology, Rastogi S. C., New Age International, 2005
- iGenetics- A Molecular Approach, Russell, Benjamin Cummings, U.S.A.,2009
- Genetics, C. B. Powar, Himalaya Publication, 2011.
- Plant Biotechnology & Genetics: Principles, Techniques and Applications, Stewart C.N., Jr.John Wiley & Sons Inc. U.S.A., 2008.

Teaching Plan:

Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	Cell Biology	Presentation, Chalk and talk	10
2	Cytogenetics	Presentation, Chalk and talk	10
3	Molecular Biology	Presentation, Chalk and talk	10

Evaluation Pattern

A) Continuous Internal Evaluation: Maximum Marks:20

Method	Marks
Class test	10
Assignment	10

B) Semester End Examination: Maximum Marks: 30

Question No. and Sub questions	Unit and sub unit (with number and title)	Type of Question	Marks
1 A	I	Long answer questions (Any 1 out of 2)	06
1 B	I	Answer in brief (Any 1 out of 2)	04
2 A	II	Long answer questions (Any 1 out of 2)	06
2 B	II	Answer in brief (Any 1 out of 2)	04
3 A	III	Long answer questions (Any 1 out of 2)	06
3 B	III	Answer in brief (Any 1 out of 2)	04

Nomenclature of the Course	**Current Trends in Plant Sciences I**
Class	S. Y. B. Sc.
Semester	3
Course Code	USBOT303
No. of Credits	02
Nature	Theory
Type	Major (Mandatory)

Course Outcomes:

Students will be able to

CO1: Learn and describe the Pharmacopoeia and pharmacognostic analysis of some plants.
CO2: Understand and explain the sources, methods of cultivation and uses of fiber- Cotton, *Agave* and spice crops- Nutmeg, Clove and Cardamom.
CO3: Learn and understand the concept and applications of aromatherapy.
CO4: Understand and discuss nutraceuticals - *Spirulina, Garcinia indica, Chlorella*.
CO5: Gain the knowledge regarding enzymes and describe - Cellulases, Papain, Bromelain.
CO6: Understand and differentiate between types of biofuels and their advantages.
CO7: Learn and explain the principle, working and applications of plant preservation methods.
CO8: Learn and explain the principle, working and applications of microscopy.
CO9: Understand and describe the principle, working and applications of electrophoresis
CO10: Learn and explain the principle, working and applications of chromatography.

Syllabus:

Unit No.	Unit Title	Subtitles (Learning Points)
1	**Pharmacognosy and Phytochemistry**	Introduction to Pharmacopoeia: Indian Pharmocopoeia, Indian Herbal Pharmacopoeia and Ayurvedic Pharmacopoeia Study of Monograph from Pharmacopoeia Secondary Metabolites: Sources, properties, uses and adulterants, regional and seasonal variations.
2	**Economic and Industrial Botany**	**Economic Botany:** Fibers: Cotton, *Agave* Spices and condiments: Nutmeg, Clove and Cardamom Commercial market of spices **Aromatherapy** - Introduction, Uses with few examples - Coconut, Lemon, Jasmine **Botanical and nutraceuticals** - *Spirulina, Garcinia indica, Chlorella*. **Enzyme industry:** Cellulases, Papain, Bromelain **Biofuels:** Types and advantages
3	**Instrumentation and Techniques**	**Preservation methods:** Dry and Wet method **Microscopy** - Principle and working of Light, and Electron microscope. **Chromatography** - Principles and techniques in Thin Layer and Column chromatography.

Prescribed Text/s :

- Pharmacognosy - Kokate, Purohit and Gokhale, Nirali Publications, 2019.
- Economic Botany by B. P. Pandey; Seventh Edition; S. Chand and Company Ltd, 2009.
- An introduction to essential oils and their therapeutic uses, Dr. Rajeev Sharma, Manoj Publications, 2022
- Principles and techniques of biochemistry and molecular biology- K. Wilson and J. Walker 2010
- Economic botany by S. L. Kocchar.

Teaching Plan:

Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	**Pharmacognosy and Phytochemistry**	Chalk and talk, AV method	**10**
2	**Economic and Industrial Botany**	Chalk and talk, AV method, Seminar	**10**
3	**Instrumentation and Techniques**	Chalk and talk, AV method, Demonstration	**10**

Evaluation Pattern

A) Continuous Internal Evaluation: Maximum Marks:20

Method	Marks
Class test	**10**
Assignment	**10**

B) Semester End Examination: Maximum Marks: 30

Question No. and Sub questions	Unit and sub unit (with number and title)	Type of Question	Marks
1 A	**I**	**Long answer questions (Any 1 out of 2)**	**06**
1 B	**I**	**Answer in brief (Any 1 out of 2)**	**04**
2 A	**II**	**Long answer questions (Any 1 out of 2)**	**06**
2 B	**II**	**Answer in brief (Any 1 out of 2)**	**04**
3 A	**III**	**Long answer questions (Any 1 out of 2)**	**06**
3 B	**III**	**Answer in brief (Any 1 out of 2)**	**04**

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Nomenclature of the Course	**Practical Based On USBOT 301, 302, 303**
Class	S. Y. B. Sc.
Semester	3
Course Code	USBOTP3
No. of Credits	02
Nature	Practical
Type	Major

Course Outcomes:

Students will be able to

CO1: Identify, draw and label the sketches of stages in the life cycle of *Sargassum.*
CO2: Identify, draw and label the sketches of stages in the life cycle of *Ectocarpus.*
CO3: Identify, draw and label the sketches of stages in the life cycle of *Erysiphe.*
CO4: Identify, draw and label the sketches of stages in the life cycle of *Aspergillus.*
CO5: Identify, draw and label the sketches of stages in the life cycle of *Anthoceros.*
CO6: Identify, draw and label the sketches of stages in the life cycle of *Funaria.*
CO7: Perform estimation of DNA and RNA from given plant material.
CO8: Identify the inheritance pattern with reference to plastid inheritance.
CO9: Differentiate various stages of Mitosis and Meiosis practically.
CO10: Perform DNA sequencing and differentiate prokaryotic and eukaryotic mRNA.
CO11: Analyze the secondary metabolites in prescribed plants with reference to pharmacognosy.
CO12: Perform various techniques like dry and wet preservation, thin layer chromatography.
CO13: Estimate vitamin C and proteins from a given plant sample.

Syllabus:

Practical Paper I

Unit No.	Unit Title	Subtitles (Learning Points)
1	**Algae**	Study of stages in the life cycle of *Sargassum* from fresh/ preserved material and permanent slides.
1	**Algae**	Study of stages in the life cycle of *Ectocarpus* from fresh/ preserved material and permanent slides.
1	**Fungi**	Study of stages in the life cycle of *Erysiphe* from fresh/preserved material and permanent slides.
2	**Fungi**	Study of stages in the life cycle of *Aspergillus* from fresh/preserved material and permanent slides.
3	**Bryophyta**	Study of stages in the life cycle of *Anthoceros* from fresh/ preserved material and permanent slides.
3	**Bryophyta**	Study of stages in the life cycle of *Funaria* from fresh/ preserved material and permanent slides.
3	**Instrumentation and Techniques**	Study of dry and wet preservation techniques.

3	**Instrumentation and Techniques**	Separation of carotenoids by thin layer chromatography
Practical Paper II		
1	**Cell Biology**	Estimation of DNA from plant material (one Standard and one Unknown, No Standard Graph).
1	**Cell Biology**	Estimation of RNA from plant material (one Standard and one Unknown, No Standard Graph).
2	**Genetics**	Study of inheritance pattern with reference to Plastid Inheritance.
2	**Genetics**	Study of mitosis and meiosis from suitable plant material.
2	**Molecular Biology**	DNA sequencing by Sanger's method.
3	**Molecular Biology**	Determining the sequence of amino acids in the protein molecule synthesized from the given m-RNA strand (prokaryotic and eukaryotic)
1	**Pharmacognosy and Phytochemistry**	Study of macro and microscopic characters and tests for secondary metabolites in - *Saraca asoca* - *Eclipta prostrata*
3	**Economic and Industrial Botany**	Estimation of vitamin C from plant sample.

Evaluation Pattern

A) Continuous Internal Evaluation: Maximum Marks: 20 marks

Method	Marks
Q. 1. Perform any 1 or 2 experiments from following - Perform the chromatography experiment for separation of carotenoids (TLC of carotenoids) / Make a squash/smear preparation of given specimen to show the stages of mitosis/meiosis, draw a diagram and comment on your observations(Mitosis) / Determine the sequence of bases in a DNA strand by Sanger's method from the given data (DNA sequence) / Determine the sequence of amino acids for the polypeptide synthesis from the given mRNA strand (Amino acid sequence) / Study of macro and microscopic characters and tests for secondary metabolites in given specimen (*Saraca asoca / Eclipta prostrata*) / Estimation of vitamin C from plant sample (Vitamin C). **Q. 2. Identify and describe the given specimen.** (Herbarium/ Wet preservation/Plastid inheritance)	**10**
Class test	**10**

B) Semester End Examination: Maximum Marks: 30

S.Y. B.Sc. BOTANY MAJOR PRACTICAL EXAMINATION

Semester III

Time: 3 Hours **Total Marks: 30**

Note - Show all the slides/observations/results to the examiner.
Mobile phones are not allowed in the examination hall.

Q.1	Identify, classify and describe specimen **'A' 'B'** and **'C'**. Sketch neat and labeled diagram.	**(15)**
Q. 2	Perform the estimation of DNA/RNA from the given sample **D.**	**(06)**
Q. 3	Viva	**(04)**
Q. 4	Journal	**(05)**

Key:

A: *Sargassum/ Ectocarpus*

B: *Erysiphe* / *Aspergillus*

C: *Anthoceros*/*Funaria*

D: DNA/ RNA

Nomenclature of the Course	**Plant Diversity II**
Class	S. Y. B. Sc.
Semester	4
Course Code	USBOT401
No. of Credits	02
Nature	Theory
Type	Major (Mandatory)

Course Outcomes:

Students will be able to

CO1: Learn the salient features of division Psilophyta and Lepidophyta

CO2: Understand and explain structure, life cycle and systematic position of *Selaginella.*

CO3: Learn and describe the formation and types of fossils.

CO4: Understand and discuss structure and systematic position of form genus *Rhynia.*

CO5: Describe the salient features, economic importance and classification of Coniferophyta.

CO6: Understand and explain structure, life cycle and systematic position of *Pinus.*

CO7: Learn and describe the objectives and goals of plant systematics

CO8: Understand and explain CLassification, morphological peculiarities and economic importance of family Leguminosae, Asteraceae and Palmae.

ILO

Students will be able to

ILO1: Salient features and classification upto orders (with examples of each) of Psilophyta and Lepidophyta

ILO 2: Elaborate Structure, life cycle of *Selaginella*

ILO2A : Justify systematic position of *Selaginella.*

ILO 3: Differentiate Formation and types of fossils in Paleobotany –

ILO 3 A:Justify Structure of form genus *Rhynia.*

ILO 4: Understand systematic position of form genus *Rhynia.*

ILO 5:Elaborate Salient features and classification upto orders (with examples of each) and

ILO 6: Justify economic importance of Coniferophyta

ILO 7: Elaborate Structure, life cycle and systematic position of *Pinus.*

ILO 8:Apply Objectives and Goals of Plant systematics

ILO 9: Apply Plant Nomenclature

ILO 10 Justify Taxonomy in relation to Cytology,

ILO 11: Analyse Use of characters of chemical constituents in taxonomy.

ILO 12:Analyse Classification, Morphological Peculiarities and

ILO 13: Justify Economic Importance of Family Leguminosae, Asteraceae and Palmae.

Syllabus:

Unit No.	Unit Title	Sub titles (Learning Points)
1	**Pteridophyta and Paleobotany**	Salient features and classification upto orders (with examples of each) of Psilophyta and Lepidophyta Structure, life cycle and systematic position of *Selaginella.* Paleobotany – Formation and types of fossils; Structure and systematic position of form genus *Rhynia.*
2	**Gymnosperms**	Salient features and classification upto orders (with examples of each) and economic importance of Coniferophyta Structure, life cycle and systematic position of *Pinus.*
3	**Angiosperms**	Objectives and Goals of Plant systematics Plant Nomenclature Taxonomy in relation to Cytology, Use of characters of chemical constituents in taxonomy. Classification, Morphological Peculiarities and Economic Importance of Family Leguminosae, Asteraceae and Palmae.

Prescribed Text/s :

- College Botany Volume I and II Gangulee, Das and Dutta. Central Education enterprises, 2009.
- Cryptogamic Botany Volume I and II - G M Smith, McGraw Hill Book company,1955
- Botany for Degree Students: Pteridophyta, Vashishta B.R., 2010.
- Botany for Degree Students: Gymnosperms, Vashishta P.C., 2010.
- Plant Systematics - Gurcharan Singh, Oxford and IBH Publ. 2004

Teaching Plan:

Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	**Pteridophyta and Paleobotany**	**Presentation, Chalk and talk, Seminar**	**10**
2	**Gymnosperms**	**Presentation, Chalk and talk**	**10**
3	**Angiosperms**	**Presentation, Chalk and talk, Seminar**	**10**

Evaluation Pattern

A) Continuous Internal Evaluation: Maximum Marks:20

Method	Marks
Class test	10
Assignment	10

B) Semester End Examination: Maximum Marks: 30

Question No. and Sub questions	Unit and sub unit (with number and title)	Type of Question	Marks
1 A	I	Long answer questions (Any 1 out of 2)	06
1 B	I	Answer in brief (Any 1 out of 2)	04
2 A	II	Long answer questions (Any 1 out of 2)	06
2 B	II	Answer in brief (Any 1 out of 2)	04
3 A	III	Long answer questions (Any 1 out of 2)	06
3 B	III	Answer in brief (Any 1 out of 2)	04

Nomenclature of the Course	**Basics of Botany**
Class	S. Y. B. Sc.
Semester	4
Course Code	USBOT402
No. of Credits	02
Nature	Theory
Type	Major (Mandatory)

Course Outcomes:

Students will be able to

CO1: Learn and differentiate between the normal secondary growth and related anatomical changes in dicotyledonous stem and root.
CO2: Understand and describe the mechanical tissue system and types of vascular bundles.
CO3: Understand and write light dependent and light independent processes in plants.
CO4: Learn and draw the biogeochemical cycles.
CO5: Understand and discuss the concept of ecological factors and edaphic factor.

ILO

Students will be able to

ILO 1:Analyse Normal Secondary Growth in Dicotyledonous stem and root.
ILO2: Apply knowledge of Growth rings, Periderm, Lenticels, Tyloses, Heart wood and Sap wood.
ILO3: Differentiate types of Vascular Bundles.
ILO4: Elaborate process of Respiration.
ILO5:Elaborate process of Photorespiration.
ILO6: Elaborate process of Photoperiodism.
ILO7: Elaborate process of Vernalization mechanisms and applications.
ILO8: Justify processes in cell organelles: Mitochondrion.
ILO9: Differentiate Biogeochemical Cycles - Carbon and Water.
ILO10: Analyse Ecological factors: Concept of environmental factors.
ILO11: Differentiate Soil as an edaphic factor,Soil composition,
ILO12: Analyse types of soil,
ILO13: Elaborate the process of soil formation,
ILO14:Justify soil profile

Syllabus:

Unit No.	Unit Title	Subtitles (Learning Points)
1	**Anatomy**	Normal Secondary Growth in Dicotyledonous stem and root. Growth rings, Periderm, Lenticels, Tyloses, Heart wood and Sap wood. Types of Vascular Bundles.

2	**Plant Physiology and Plant Biochemistry**	Respiration. Photorespiration. Photoperiodism. Vernalization mechanisms and applications. Ultrastructure and functions of cell organelles: Mitochondrion.
3	**Ecology**	Ecological factors: Concept of environmental factors. Soil as an edaphic factor, Soil composition, types of soil, soil formation, soil profile

Prescribed Text/s :

- Plant Physiology - Taiz and Zeiger Sinauer Associates, 2006.
- Fundamentals of Ecology - E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore, 2001.
- Ecology and environment - P. D. Sharma, Rastogi publications, 2007.
- Fundamentals of plant physiology - Dr. V. K. Jain , S Chand Publication, 2010.
- A textbook of plant physiology and biochemistry - S. K. Verma, S.Chand Publication, 2005
- A textbook of plant physiology - V Verma, Ane books India, 2007.
- Plant anatomy- B P Pandey, S. Chand Publication,2011

Teaching Plan:

Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	**Anatomy**	**Presentation, Chalk and talk, Seminar**	**10**
2	**Plant Physiology and Plant Biochemistry**	**Presentation, Chalk and talk**	**10**
3	**Ecology**	**Presentation, Chalk and talk, Seminar**	**10**

Evaluation Pattern

A) Continuous Internal Evaluation: Maximum Marks:20

Method	Marks
Class test	10
Assignment	10

B) Semester End Examination: Maximum Marks: 30

Question No. and Sub questions	Unit and sub unit (with number and title)	Type of Question	Marks
1 A	I	Long answer questions (Any 1 out of 2)	06
1 B	I	Answer in brief (Any 1 out of 2)	04
2 A	II	Long answer questions (Any 1 out of 2)	06
2 B	II	Answer in brief (Any 1 out of 2)	04
3 A	III	Long answer questions (Any 1 out of 2)	06
3 B	III	Answer in brief (Any 1 out of 2)	04

Nomenclature of the Course	Botany III- Current Trends in Plant Sciences I

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Class	S. Y. B. Sc.
Semester	4
Course Code	USBOT403
No. of Credits	02
Nature	Theory
Type	Major (Mandatory)

Course Outcomes:

Students will be able to

CO1: Understand and explain the concept and applications of biotechnology with respect to plant tissue culture and R-DNA technology.

CO2: Learn and analyze the data by prescribed tests.

CO3: Study the tools in Information technology and apply them for data retrieval.

ILO

Students will be able to

ILO 1: Apply the technique of plant tissue culture
ILO 2: Elaborate Laboratory organization and
ILO 3: Justify techniques in plant tissue culture; Totipotency; Organogenesis;
Organ culture- root cultures, meristem cultures, anther and pollen culture, embryo culture.
ILO 4: Apply R-DNA technology - Gene cloning; Enzymes involved in Gene cloning; Vectors used for Gene cloning
ILO 5: Apply Biostatistics tests- Arithmetic mean, mode and median.
ILO 6: analyse Chi square test and Correlation - Calculation of coefficient of correlation
ILO 7: Apply Bioinformatics tools of IT, Internet and its uses;
ILO 8: Analyse Databases used in bioinformatics
ILO 9: Applytools for web search, Data retrieval tools - Entrez; BLAST.

Syllabus:

Unit No.	Unit Title	Subtitles (Learning Points)
1	**Biotechnology**	Introduction to plant tissue culture Laboratory organization and techniques in plant tissue culture; Totipotency; Organogenesis; Organ culture- root cultures, meristem cultures, anther and pollen culture, embryo culture. R-DNA technology - Gene cloning; Enzymes involved in Gene cloning; Vectors used for Gene cloning
2	**Biostatistics**	Introduction to Biostatistics - Arithmetic mean, mode and median. Chi square test Correlation - Calculation of coefficient of correlation
3	**Bioinformatics**	Introduction to Bioinformatics: Information technology: History and tools of IT, Internet and its uses; Databases used in bioinformatics Introduction to Bioinformatics - goal, need, scope and

		limitation; Aims of Bioinformatics, tools for web search, Data retrieval tools - Entrez; BLAST.

Prescribed Texts :

- Plant Biotechnology and Genetics: Principles, Techniques and Applications, Stewart C.N. Jr., John Wiley & Sons Inc. U.S.A.,2008.
- Plant Biotechnology - K. Ramawat, S.Chand Publications,2008 .
- Fundamentals of Biostatistics, Veer Bala Rastogi; Ane Books Pvt. Ltd. 2009.
- Elements of Biostatistics, S. Prasad; Rastogi Publications,2018.
- Bioinformatics Methods and Applications Genomics, Proteomics and Drug Discovery, S.C. Rastogi, Namita Mendiratta and Parag Rastogi; PHI Learning Pvt. Ltd., 2013.

Teaching Plan:

Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	Biotechnology	Presentation, Chalk and talk, Seminar	10
2	Biostatistics	Presentation, Chalk and talk	10
3	Bioinformatics	Presentation, Chalk and talk, Seminar	10

Evaluation Pattern

A) Continuous Internal Evaluation: Maximum Marks:20

Method	Marks
Class test	10
Assignment	10

B) Semester End Examination: Maximum Marks: 30

Question No. and Sub questions	Unit and sub unit (with number and title)	Type of Question	Marks
1 A	**I**	**Long answer questions (Any 1 out of 2)**	**06**
1 B	**I**	**Answer in brief (Any 1 out of 2)**	**04**
2 A	**II**	**Long answer questions (Any 1 out of 2)**	**06**
2 B	**II**	**Answer in brief (Any 1 out of 2)**	**04**
3 A	**III**	**Long answer questions (Any 1 out of 2)**	**06**
3 B	**III**	**Answer in brief (Any 1 out of 2)**	**04**

Nomenclature of the Course	**Practical Based On USBOT 401, 402, 403**
Class	S. Y. B. Sc.
Semester	4
Course Code	USBOTP4
No. of Credits	02
Nature	Practical
Type	Major

Course Outcomes:

Students will be able to:

CO1: Identify, classify and draw sketches of stages in life cycle of *Selaginella.*

CO2: Identify, classify and draw sketches of stages in life cycle of *Rhynia.*

CO3: Identify, classify and draw sketches of stages in life cycle of *Pinus*

CO4: Perform tests for detection of phenols and flavonoids from given material

CO5: Identify, classify and describe Study of morphological peculiarities and economic importance of families: Leguminosae, Asteraceae, Palmae

CO6: Identify, draw and label the sketches of the normal secondary growth and related anatomical changes in dicotyledonous stem and root.

CO7: Identify, draw and label the types of Vascular Bundles

CO8: Identify, draw and label the growth rings, Periderm, Lenticels, Tyloses, Heart wood and Sap wood.

CO9: Estimate In vitro NR activity and Proteins from given sample.

CO10: Identify and use the Soil thermometer, Soil testing kit, Soil pH meter, Wind anemometer.

CO11: Perform mechanical analysis of soil by sieve method, and estimate organic matter content from given soil sample.

CO12: Perform various sterilization techniques and prepare stock solutions and MS medium.

CO13: Perform Chi square analysis and calculate the coefficient of correlation.

CO14: Perform web search using Google and Entrez.

CO15: Retrieve and analyze the data using BLAST

Syllabus:

Practical Paper I

Unit No.	**Unit Title**	**Subtitles (Learning Points)**
1	**Pteridophyta and Paleobotany**	Study of stages in the life cycle of *Selaginella* from fresh/preserved material and permanent slides.
1	**Pteridophyta and Paleobotany**	Study of form genera *Rhynia* with the help of permanent slides / photomicrographs
1	**Gymnosperms**	Study of stages in the life cycle of *Pinus* from fresh/preserved material and permanent slides
2	**Angiosperms**	Tests for Phenols and Flavonoids from suitable plant material.
3	**Angiosperms**	Study of morphological peculiarities and economic importance of following families:

		Leguminosae Asteraceae Palmae
1	**Biotechnology**	Study of sterilization techniques: Dry and wet heat, chemical and ultrafiltration method of sterilization.
1	**Biotechnology**	Seed sterilization, callus induction.
2	**Biostatistics**	Chi square test
2	**Biostatistics**	Calculation of coefficient of correlation
Practical Paper II		
1	**Anatomy**	Study of normal secondary growth in the stem and root of a Dicotyledonous plant.
1	**Anatomy**	Study of different types of vascular bundles.
1	**Anatomy**	Growth rings, Periderm, Lenticels, Tyloses, Heart wood and Sap wood.
2	**Plant Physiology and Plant Biochemistry**	NR activity - in-vitro
2	**Plant Physiology and Plant Biochemistry**	Estimation of proteins by Lowry's method (Prepare standard graph).
3	**Ecology**	Study of the working of the following Ecological Instruments - Soil thermometer, Soil testing kit, Soil pH meter, Wind anemometer
3	**Ecology**	Mechanical analysis of soil by the sieve method and pH of soil.
3	**Ecology**	Quantitative estimation of organic matter of the soil by Walkley and Blacks Rapid titration method.
3	**Bioinformatics**	Web Search - Google, Entrez.Data retrieval and analysis using BLAST.

Evaluation Pattern

A) Continuous Internal Evaluation: Maximum Marks: 20 marks

Method	Marks
Q. 1. Perform any 1 or 2 experiments from following - Perform Chi- square test **OR** Coefficient of Correlation using the given data **'D'** and analyze the results (Chi-square test/ Coefficient of Correlation) /Perform seed sterilization technique / Callus induction/ Test for Phenols / Flavonoids from given material/ Make a temporary stained preparation of T.S. of given specimen and comment on the secondary growth (Dicot Stem /Root) / Perform the Ecological experiment allotted to you (Mechanical analysis of Soil/Soil organic matter) / Perform the experiment related to Web search (Google search/Entrez/ BLAST). **Q. 2 Identify and describe the given specimen** (Autoclave /Oven /Laminar air flow/Type of vascular bundle Periderm/Lenticel/Tylosis/ Growth ring /Heart wood/ sap wood/Ecological instruments: Soil thermometer /Soil Testing kit/ pH meter /Wind anemometer)	**10**
Class test	**10**

B) Semester End Examination: Maximum Marks: 30

S.Y. B.Sc. BOTANY MAJOR PRACTICAL EXAMINATION

Semester IV

Time: 3 Hours **Total Marks: 30**

Note - Show all the slides/observations/results to the examiner.
Mobile phones are not allowed in the examination hall.

Q. 1	Identify, classify and describe specimen **'A' 'B'** and **'C'**. Sketch neat and labeled diagram.	**(15)**
Q. 2	Perform the Physiological experiment **'D'** allotted to you.	**(06)**
Q. 3	Viva	**(04)**
Q. 4	Journal	**(05)**

Key:

A: *Selaginella*

B: *Pinus*

C: Leguminosae *(*Sub families), Asteraceae, Palmae

D: NR/Protein

Note:

- For Algae, Fungi, Bryophyta and Pteridophyta G. M. Smith's classification system should be followed.
- For Gymnosperms Chamberlain's classification system should be followed.
- For Angiosperms Bentham and Hooker's system of classification should be followed.

Scheme of Examinations

1. One external -Semester End Examination of 30 marks. of duration: 1 hours.
2. One Practical at the end of semester consisting of practical I: 30 marks, and Practical II-30 marks with a certified field report but passing combined out of 60.
3. Two short field excursions for habitat studies are compulsory.
4. Field work of not less than eight hours' duration is equivalent to one period per week for a batch of 15 students.
5. A candidate will be allowed to appear for the practical examinations if he/she submits a certified journal of S.Y.B.Sc. Botany or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course of S.Y.B.Sc. Botany as per the minimum requirements.
6. In case of loss of journal, a candidate must produce a certificate from the Head of the department /Institute that the practicals for the academic year were completed by the student. However, such a candidate will be allowed to appear for the practical examination, but the marks allotted for the journal will not be granted.
7. HOD's decision, in consultation with the Principal, shall remain final and abiding to all.

R. P. Gogate College of Arts and Science and R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri
Board of Studies in Botany
Syllabus for S. Y. B. Sc. Botany effective from the year 2024-25

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Date: 16/04/24
Place: Ratnagiri

Signature
Chairperson and HoD