



**Janardan Bhagat Shikshan Prasarak Sanstha's**  
**CHANGU KANA THAKUR**  
**ARTS, COMMERCE & SCIENCE COLLEGE, NEW**  
**PANVEL (AUTONOMOUS)**

**Re-accredited 'A+' Grade by NAAC (3<sup>rd</sup> cycle – CGPA 3.61)**  
**'College with Potential for Excellence' Status Awarded by UGC**  
**'Best College Award' by University of Mumbai**

**Program: B.Sc.**

**Revised Syllabus of S.Y.B.Sc. Botany**  
**Choice Based Credit & Grading System (75:25)**  
**w.e.f. Academic Year 2020-21**

<b>Sr. No.</b>	<b>Heading</b>	<b>Particulars</b>
1	Title of Course	Botany
2	Eligibility for Admission	F.Y.B.Sc. with Botany as one of the subject.
3	Passing marks	40%
4	Ordinances/Regulations (if any)	
5	No. of Semesters	Two
6	Level	U.G.
7	Pattern	Semester (75:25)
8	Status	Revised
9	To be implemented from Academic year	2020-2021

## **Preamble of the syllabus**

Revised syllabus for S.Y.B.Sc. Botany has been prepared to enhance the existing syllabus so as to make it more contextual, relevant and commensurate with the learning capabilities of the learners of second year Botany. This syllabus has been designed to build on the understanding of various aspects of Plant Sciences developed after completion of F.Y.B.Sc. Course.

Plant Sciences today are an amalgamation of traditional Botany and various applied aspects such as modern concepts in Phytochemistry, Molecular biology, Plant biotechnology, Environmental studies etc.

The well-organized curriculum including basic as well as advanced concepts in plant sciences shall further the interest in the minds of the learners and inspire them to pursue higher studies in Botany. The curriculum would expose the learners to the entrepreneurial potential of plant sciences so as to become self-employed or obtain gainful employment in Plant Sciences based industries.

### **Objectives of the Course:**

1. To further enhance the understanding of various plant groups from simple to the most advanced, among the learners
2. To continually augment awareness among the learners about the urgency of environmental conservation and sustainable use of plants
3. To expose the students to various applications of different plant systems, processes and products in various industries
4. To highlight the entrepreneurial potential of plant sciences to become self-employed in the future.
5. To equip the learners with skills of analytical and logical reasoning, keen observation, collection of scientific data, objective recording of results, drawing conclusions etc. and other such fundamental skills associated with the study of any science subject.
6. To create a sound foundation for further studies in Botany.
7. To facilitate career building in Botany.

**Course Outcome:** A student of S.Y.B.Sc. Botany upon completion of the course will be equipped with following skill sets:

1. A basic proficiency in identification of various plant groups, their specific role in the ecosystem with reference to food chains, recycling of nutrients etc.
2. Enhanced awareness and increased understanding of environmental balance and the necessity for conservation.
3. Understanding of the internal structures of plant organs and its applications in various allied processes.
4. Basic proficiency and knowledge about handling plant specimen, their preservation, sectioning etc.
5. Augmented and deeper knowledge about plant physiology and its applications in various industrial processes.
6. Increased understanding of secondary metabolites and their role in health care.
7. Deeper understanding about plant taxonomy and field studies.
8. Augmentation of analytical and logical reasoning, observational skills, objective recording of results etc. and other such fundamental skills associated with the study of any science subject.

### **S. Y. B. Sc. Botany**

For the subject of botany there shall be three papers for 45 lectures each comprising of three units of 15 L each.

### **Semester-III**

#### **Paper I: Plant Diversity II**

1. Unit I : Algae
2. Unit II: Fungi and Lichens
3. Unit III: Bryophytes

#### **Paper II: Form and Function II**

1. Unit I : Instrumentation and Techniques
2. Unit II: Cell Biology
3. Unit III: Cytogenetics

#### **Paper III: Current Trends in Plant Sciences I**

1. Unit I : Pharmacognosy and Phytochemistry
2. Unit II : Economic Botany, Forestry and Industries based on Plant products
3. Unit III : Molecular Biology

### **Semester-IV**

#### **Paper I: Plant Diversity I**

1. Unit I : Pteridophyta and Palaeobotany
2. Unit II: Gymnosperms
3. Unit III: Angiosperms

#### **Paper II: Form and Function I**

1. Unit I : Anatomy
2. Unit II: Physiology
3. Unit III: Ecology and Environmental Botany

#### **Paper III: Current Trends in Plant Sciences I**

1. Unit I : Horticulture
2. Unit II : Biotechnology
3. Unit III : Biostatistics and Bioinformatics

### **Scheme of Examination for Each Semester:**

Internal Evaluation: 25 (20 marks internal test and 05 marks for attendance)

Semester End Examination: 75 Marks will be as follows -:

I	<b>Theory:</b>	
	Each theory paper shall be of two and half hour duration.	
	All questions are compulsory and will have internal options.	
	Q-1	From Unit – I (having internal options.) 20 M
	Q-2	From Unit – II (having internal options.) 20M
	Q-3	From Unit – III (having internal options.) 20M
II	Q-4	Questions from all the THREE Units with equal weightage of marks Allotted to each Unit. 15 M
	Practical	The External examination per practical course will be conducted as per the Following scheme.
<b>Sr. No.</b>	<b>Particulars of External Practical Examination</b>	<b>Marks%</b>
1	Laboratory Work	35+35 =70
2	Journal	5+5 = 10
3	Viva	5+5 = 10
4	Field Report	5+5 = 10
	<b>TOTAL</b>	<b>100</b>

S.Y.B.Sc. Botany Semester III		L	CR
USC3BO1Paper I Plant Diversity II		45	2
Unit I		15	
Algae			
1.	General Characters of Division Phaeophyta: Distribution, cell structure, pigments and reserve food, range of thallus, reproduction, life cycle patterns and economic importance.		
2.	Structure, life cycle and systematic position of <i>Sargassum</i> and <i>Dictyota</i> . (G.M.Smith's system of classification to be followed)		
3.	Pigments in Algae.		
Unit II		15	
Fungi and Lichens			
1.	General characters of Ascomycetae: Thallus structure, cell structure, reproduction and economic importance.		
2.	Structure, life cycle and systematic position of <i>Aspergillus</i> and <i>Xylaria</i> (G.M.Smith's system of classification to be followed)		
3.	Plant Pathology- Causal organism, symptoms, disease cycle and control measures of Powdery Mildew disease and Late blight of potato.		
4.	Lichens- Classification, Structure, Method of Reproduction, Economic importance and Ecological significance of Lichens.		
Unit III		15	
Bryophyta			
1.	General Account of Class Anthocerotae and Musci , thallus structure, reproduction, alternation of generations and economic importance		
2.	Structure, life cycle and systematic position of <i>Anthoceros</i> and <i>Funaria</i> (G.M.Smith's system of classification to be followed)		

S.Y.B.Sc. Botany Semester III		L	CR
USC3BO2Paper II Form and Function II		45	2
Unit I		15	
Instrumentation and Techniques			
1.	<b>Plant Preservation techniques:</b> Wet preservation and Dry preservation		
2.	<b>Microscopy:</b> Principle and working of Light, and electron microscope.		
3.	<b>Chromatography:</b> Principles and techniques in paper and thin layer chromatography.		
4.	<b>Electrophoresis:</b> Principles and techniques of Horizontal and Vertical electrophoresis.		
Unit II		15	
Cell Biology			
1.	<b>Ultra Structure and functions of the following cell organelles:</b> Peroxisomes, Glyoxysomes, Ribosomes, Interphase nucleus (Nuclear membrane, nucleoplasm, nucleolus and chromatin), organization and types of chromatin.		
2.	<b>Cell Division and its significance:</b> Cell Cycle, Mitosis & Meiosis, Differences between Mitosis and Meiosis		
3.	<b>Nucleic Acids:</b> Types, structure and functions of DNA and RNA.		
Unit III		15	
Cytogenetics			
1.	<b>Variation in Chromosome structure (Chromosomal Aberrations)</b> Definition, Origin, Cytological and Genetic Effects of the following: Deletions, Duplications, Inversions and Translocations.		
2.	<b>Sex determination, Sex linked, sex influenced and sex limited traits :</b> <b>Sex determination-</b> Chromosomal Methods: heterogametic males and heterogametic females. Sex determination in monoecious and dioecious plants. Genic Balance Theory of sex determination in <i>Drosophila</i> , Lyon's Hypothesis of X chromosome inactivation. <b>Sex linked-</b> eye colour in <i>Drosophila</i> , Haemophilia, colour blindness <b>Sex influenced-</b> baldness in man		
3.	<b>Extranuclear Genetics</b>		

	Organelle heredity- Chloroplast determines heredity - Plastid transmission in plants, Streptomycin resistance in <i>Chlamydomonas</i> . Male sterility in maize		
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S.Y.B.Sc. Botany Semester III		L	CR
USC3BO3Paper III Current Trends in Plant Sciences I		45	2
Unit I		15	
Pharmacognosy and Phytochemistry			
1.	<b>Pharmacopoeia:</b> Introduction to pharmacopoeia, Significance of Pharmacopoeia		
2.	<b>Secondary Metabolites:</b> Sources, properties, types and uses of Alkaloids, Tannins, Glycosides, Volatile Oils, Gums and Resins.		
3.	<b>Aromatherapy:</b> Introduction, scope, different essential oils used and their sources.		
Unit II		15	
Economic Botany, Forestry and Industry based on plant products			
1.	<b>Economic Botany: Fibres</b> - Types of fibers, Botanical Source, types, Cultivation and uses of <b>Jute, Coir and Cotton</b> .		
2.	<b>Forestry:</b> Agro-forestry, Urban forestry, Organic farming, Silviculture.		
3.	<b>Industry based on plant products: Nutraceuticals and Herbals:</b> Botanical source nutraceutical properties and uses of: <i>Spirulina</i> and <i>Garcinia</i> . <b>Enzyme industry</b> Sources, properties and uses of: Papain, Bromelain and Cellulases.		
Unit III		15	
Molecular Biology			
1.	<b>DNA replication:</b> Modes of Replication, Messelson and Stahl Experiment, DNA replication in prokaryotes and eukaryotes-enzymes involved and molecular mechanism of replication.		
2.	<b>RNA Transcription:</b> Transcription in prokaryotes and eukaryotes: promoter sites, initiation, elongation and termination.		
3.	<b>RNA processing:</b> Adenylation & Capping.		



<b>S.Y.B.Sc. Botany Semester III</b>		<b>L</b>	<b>CR</b>
<b>USC3BOP PRACTICAL Paper I – Plant Diversity II</b>		<b>30</b>	<b>1</b>
1.	Study of stages in the life cycle of <i>Sargassum</i> from fresh/ preserved material and permanent slides.		
2.	Study of stages in the life cycle of <i>Dictyota</i> from fresh/ preserved material and permanent slides.		
3.	Economic importance and range of thallus in Phaeophyta		
4.	Study of stages in the life cycle of <i>Aspergillus</i> from fresh/ preserved material and permanent slides.		
5.	Study of stages in the life cycle of <i>Xylaria</i> from fresh/ preserved material and permanent slides.		
6.	Study of plant diseases, Powdery Mildew and Late Blight of Potato		
7.	Study of Lichens (crustose, foliose, & fruticose).		
8.	Study of stages in the life cycle of <i>Anthoceros</i> from fresh/ preserved material and permanent slides.		
9.	Study of stages in the life cycle of <i>Funaria</i> from fresh/ preserved material and permanent slides.		

<b>S.Y.B.Sc. Botany Semester III</b>		<b>L</b>	<b>CR</b>
<b>USC3BOP PRACTICAL Paper II – Form and Function II</b>		<b>30</b>	<b>1</b>
1	Study of preservation techniques: Herbarium and wet preservation.		
2	Chromatography: Separation of amino acids by circular paper chromatography		
3	Separation of Carotenoids by thin layer chromatography		
4	Horizontal and Vertical Gel Electrophoresis – Demonstration		
5	Study of the ultra-structure of cell organelles prescribed for theory from Photomicrographs		
6	Estimation of DNA from plant material (one Std & one Unknown, No Std Graph)		
7	Estimation of RNA from plant material (one Std & one Unknown, No Std Graph)		
8	Study of mitosis and meiosis from suitable plant material		
9	Study of cytological consequences of chromosomal aberrations (Laggards, Chromosomal Bridge, Ring chromosome, Chromosomal ring) from permanent slides or photomicrographs.		
10.	Study of inheritance pattern with reference to Plastid Inheritance		

<b>S.Y.B.Sc. Botany Semester III</b>		<b>L</b>	<b>CR</b>
<b>USC3BOP PRACTICAL Paper III – Current Trends in Plant Sciences I</b>		<b>30</b>	<b>1</b>
1.	Macroscopic and microscopic characters of Adhatoda, <i>Aloe</i> and <i>Eucalyptus</i> leaves.		
2.	Study of Stomatal Index of suitable leaf material.		
3.	Identification of any five plants (leaves / flowers) used for aromatherapy		
4.	Identification of fibres: Cotton, Jute and Coir		
5.	Evaluation of nutraceutical value from given plant material (Estimation of Vitamin C content from suitable plant material)		
6.	Evaluation of nutraceutical value from given plant material (Estimation of Calcium and Magnesium from polished and unpolished rice)		
7.	Evaluation of probiotic food. (MBRT method for quality of milk/curds)		
8.	DNA sequencing- Sanger's method		
9.	Determining the sequence of amino acids in the protein molecule synthesized from the given m-RNA strand (prokaryotic and eukaryotic)		

S.Y.B.Sc. Botany Semester IV		L	CR
USC4BO1 Paper I Plant Diversity II		45	2
Unit I		15	
Pteridophytes and Palaeobotany			
1.	Salient features and classification upto orders (with examples of each) of Psilophyta and Lepidophyta (G M Smith's system of classification to be followed)		
2.	Structure, life cycle and systematic position of <i>Selaginella</i>		
3.	Palaeobotany- The geological time scale; Formation and types of fossils; Structure and systematic position of form genus <i>Rhynia</i>		
Unit II		15	
Gymnosperms			
1.	Salient features, classification up to orders (with examples of each) and economic importance of Coniferophyta (Chamberlain's system of classification to be followed)		
2.	Structure life cycle and systematic position of <i>Pinus</i>		
3.	Structure and systematic position of the form genus <i>Cordaites</i>		
Unit III		15	
Angiosperms			
1.	<b>Systematics:</b> Objectives and Goals of Plant systematics , Plant Nomenclature Taxonomy in relation to <ul style="list-style-type: none"> <li>Anatomy</li> <li>Palynology</li> <li>Chemical constituents</li> <li>Embryology</li> <li>Cytology</li> <li>Ecology</li> </ul>		
2.	With the help of <b>Bentham and Hooker's</b> system of classification for flowering plants study the vegetative, floral characters and economic importance of the following families: <ul style="list-style-type: none"> <li>Leguminosae</li> </ul>		

	<ul style="list-style-type: none"> <li>• Rubiaceae</li> <li>• Nyctaginaceae</li> <li>• Palmae</li> </ul>		
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<b>S.Y.B.Sc. Botany Semester IV</b>		<b>L</b>	<b>CR</b>
<b>USC4BO2Paper II Form and Function II</b>		<b>45</b>	<b>2</b>
<b>Unit I</b>		<b>15</b>	
<b>Anatomy</b>			
1.	Normal Secondary Growth in Dicotyledonous stem and root.		
2.	Growth rings, periderm, lenticels, tyloses, heart wood and sap wood.		
3.	Mechanical Tissue system <ul style="list-style-type: none"> <li>• Tissues providing mechanical strength and support and their disposition</li> <li>• I-girders in aerial and underground organs</li> </ul>		
4.	Types of Vascular Bundles.		
<b>Unit II</b>		<b>15</b>	
<b>Physiology</b>			
1.	<b>Photosynthesis:</b> Light reactions, photolysis of water, photophosphorylation (cyclic and non cyclic), carbon fixation phase (C <sub>3</sub> , C <sub>4</sub> and CAM pathways).		
2.	<b>Respiration: Aerobic:</b> Glycolysis, TCA Cycle, ETS & Energetics of respiration; Anaerobic respiration.		
3.	<b>Photorespiration</b>		
<b>Unit III</b>		<b>15</b>	
<b>Ecology and Environmental Botany</b>			
1.	Biogeochemical Cycles- Carbon, Nitrogen and Water.		
2.	Ecological factors: Concept of environmental factors. Soil as an edaphic factor, Soil composition, types of soil, soil formation, soil profile.		
3.	Community ecology- Characters of community - Quantitative characters and qualitative characters, EIA, Phytoremediation.		

<b>S.Y.B.Sc. Botany Semester IV</b>		<b>L</b>	<b>CR</b>
<b>USC4BO3Paper III Current Trends in Plant Sciences I</b>		<b>45</b>	<b>2</b>
<b>Unit I</b>		<b>15</b>	
<b>Horticulture and Gardening</b>			
1.	<b>Introduction to Horticulture:</b> Branches of Horticulture <b>Gardening:</b> Locations in the garden- edges, hedges, lawn, flower beds, avenue, and water garden (with names of two plants for each category).		
2.	Focal point.		
3.	<b>Types of garden</b> <ul style="list-style-type: none"> <li>• Formal and informal gardens</li> <li>• National Park: Sanjay Gandhi National Park.</li> <li>• Botanical Garden: Veer Mata Jijabai Bhosale Udyan (Victoria Garden).</li> </ul>		
<b>Unit II</b>		<b>15</b>	
<b>Plant Biotechnology</b>			
1.	<b>Introduction to plant tissue culture</b> <ul style="list-style-type: none"> <li>• Laboratory organization and techniques in plant tissue culture</li> <li>• Totipotency</li> <li>• Organogenesis</li> <li>• Organ culture – root cultures, meristem cultures, anther and pollen culture, embryo culture.</li> </ul>		
2.	<b>R-DNA technology-</b> <ul style="list-style-type: none"> <li>• Gene cloning</li> <li>• Enzymes involved in Gene cloning</li> <li>• Vectors used for Gene cloning.</li> </ul>		
<b>Unit III</b>		<b>15</b>	
<b>Biostatistics and Bioinformatics</b>			
1.	<b>Biostatistics:</b> <ul style="list-style-type: none"> <li>• The chi square test.</li> </ul>		

	<ul style="list-style-type: none"> <li>Correlation – Calculation of coefficient of correlation.</li> </ul>		
2.	<p><b>Bioinformatics:</b> Information technology: History and tools of IT, Internet and its uses.</p> <p>Introduction to Bioinformatics- goal, need, scope and limitation, Aims of Bioinformatics: Data organization, Tools of Bioinformatics- tools for web search, Data retrieval tools- Entrez, BLAST</p> <ul style="list-style-type: none"> <li>Bioinformatics programme in India.</li> </ul>		

S.Y.B.Sc. Botany Semester IV		L	CR
USC4BOP PRACTICAL Paper I – Plant Diversity II		30	1
1.	Study of stages in the life cycle of <i>Selaginella</i> from fresh/ preserved material and permanent slides.		
2.	Study of form genera <i>Rhynia</i> with the help of permanent slides/ photomicrographs.		
3.	Study of stages in the life cycle of <i>Pinus</i> from fresh/ preserved material and permanent slides.		
4.	Study of the form genus <i>Cordaitea</i> with the help of permanent slide/ photomicrographs.		
5.	Study of Anatomy in relation to Taxonomy – Types of stomata, types of trichomes.		
6.	Study of Chemotaxonomy: Test for phenols and flavonoids		
7.	Study of one plant from each family, morphological peculiarities and economic importance of the members of these families. Leguminosae (Papilionaceae, Caesalpinae)		
8.	Study of one plant from each family, morphological peculiarities and economic importance of the members of these families. Leguminosae (Mimosae), Rubiaceae.		
9.	Study of one plant from each family, morphological peculiarities and economic importance of the members of these families. Nyctaginaceae, Palmae		

<b>S.Y.B.Sc. Botany Semester IV</b>		<b>L</b>	<b>CR</b>
<b>USC4BOP PRACTICAL Paper II – Form and Function II</b>		<b>30</b>	<b>1</b>
1.	Study of normal secondary growth in the stem and root of a Dicotyledonous plant		
2.	Types of mechanical tissues, mechanical tissue system in aerial, underground organs.		
3.	Study of conducting tissues- Xylem and phloem elements in Gymnosperms and Angiosperms as seen in LS and through maceration technique.		
4.	Study of different types of vascular bundles, growth rings, periderm, lenticels, tyloses, heart wood and sap wood.		
5.	Determination of Q10 – germinating seeds using Phenol red indicator		
6.	Study of NR activity – <i>in-vivo</i>		
7.	Extraction, estimation of total chlorophyll and study of absorption pattern of chlorophyll.		
8.	Separation of photosynthetic pigments by paper chromatography.		
9.	Mechanical analysis of soil by the sieve method		
10.	Quantitative estimation of organic matter of the soil by Walkley and Blacks Rapid titration method.		
11.	Study of vegetation by the list quadrat method		



<b>S.Y.B.Sc. Botany Semester IV</b>		<b>L</b>	<b>CR</b>
<b>USC4BOP PRACTICAL Paper III – Current Trends in Plant Sciences I</b>		<b>30</b>	<b>1</b>
1.	Study of five examples of plants for each of the garden locations as prescribed for theory		
2.	Preparation of garden plans – formal and informal gardens		
3.	Bottle and dish garden preparation.		
4.	Various sterilization techniques		
5.	Preparation of Stock solutions, Preparation of MS medium.		
6.	Seed sterilization, callus induction, regeneration of plantlet from callus.		
7.	Identification of the cloning vectors – pBR322, pUC 18, Ti plasmid.		
8.	Chi square test for goodness of fit.		
9.	Calculation of coefficient of correlation		
10.	Web Search – Google, Entrez.		
11.	BLAST		

### **References Books:**

#### **Semester III**

#### **Paper I: Plant Diversity II**

#### **Unit I: Algae**

1. College Botany Volume I and II Gangulee, Das and Dutta latest edition. Central Education enterprises

2. Cryptogamic Botany Volume I and II by G M Smith McGraw Hill.
3. Botany for Degree Students, Algae by B.R.Vasishtha S. Chand Publications

### **Unit II: Fungi**

1. Botany for Degree Students, Fungi by B.R.Vasishtha S. Chand Publications
2. College Botany Volume I and II Gangulee, Das and Dutta latest edition. Central Education enterprises

### **Unit III: Bryophytes**

1. Botany for Degree Students, Bryophyta by B.R.Vasishtha S. Chand Publications
2. College Botany Volume I and II Gangulee, Das and Dutta latest edition. Central Education enterprises

## **Paper II: Form and Function II**

### **Unit I: Instrumentation and Techniques**

1. Practical Biochemistry by Wilson and Walker, latest edition, Cambridge low price Editions
2. Experimental Biochemistry by Beedu Shashidhar Rao, Vijay Deshpande, IK International Pvt. Ltd.

### **Unit II: Cell Biology**

1. Cell Biology by De Robertis, Wolters, Kluver
2. Cell Biology by Channarayappa, Universities Press
3. Cell Biology by C. B. Powar, Himalaya Publishing House.

### **Unit III: Cytogenetics**

1. Genetics by Russel. Wesley Longman inc. publishers. ( 5<sup>th</sup> edition)
2. Genetics by Strickberger, Latest Edition, Prentice Hall, India
3. Principles of Genetics, E.J. Gardner, Wiley, Latest Edition.
4. Genetics, Hartl, Ruvolo, Jones and Bartlett Learning.

## **Paper III: Current Trends in Plant Sciences I**

### **Unit I: Pharmacognosy and Phytochemistry**

1. Pharmacognosy by C.K.Kokate, A.P.Purohit, Nirali prakashan, latest Edition
2. Shah and Qadry's, Pharmacognosy, Shah Prakashan
3. Handbook of Medicinal Ayurvedic Plants by Kapoor, Herbal Reference Library, Latest Edition.
4. Plant Physiology by Taiz and Zeiger Sinauer Associates Inc. publishers

## **Unit II: Economic Botany, Forestry, Industry based on Plant Products**

1. Economic Botany by B.P. Pandey, S. Chand Publications, Latest Edition.
2. Economic Botany, Wickens G, Springer Publications, latest Edition.
3. Textbook of Economic Botany, Verma V, Ane Books Pvt. Ltd. Latest Edition.
4. Forests and Forestry, Sagreiya K.P., NBT India.
5. Sustainable Forestry –Handbook, Higman, Meyers, Bass and Judd.

## **Unit III: Molecular Biology**

1. Essentials of Molecular Biology by Friefelder, Latest Edition, Jones Bartlett Learning
2. Fundamentals of Molecular Biology by VeerBala Rastogi, Anes Student Edition, Latest Edition
3. Molecular Biotechnology, Glick and Pasternak, Panima Publ. Corp.

## **Semester IV**

### **Paper I: Plant Diversity II**

#### **Unit I: Pteridophyta and Palaeobotany**

1. Botany for Degree Students, Pteridophyta by B.R.Vasishtha S. Chand Publications
2. Palaeobotany and the Evolution of Plants, Stewart and Rothwell, Cambridge Foundation
3. College Botany Volume I and II Gangulee, Das and Dutta latest edition. Central Education enterprises

#### **Unit II: Gymnosperms**

1. Botany for Degree Students, Gymnosperms by P.C.Vasishtha S. Chand Publications
2. Gymnosperms Structure and Evolution, Chamberlain C J
3. College Botany Volume I and II Gangulee, Das and Dutta latest edition. Central Education enterprises

#### **Unit III: Angiosperms**

1. Taxonomy of Angiosperms by B.P. Pandey S. Chand Publications
2. Taxonomy of Angiosperms, AVSS Sambamurthy,
3. Text Book of Botany, Angiosperms, B.P. Pandey, S. Chand Publications

### **Paper II: Form and Function II**

### **Unit I: Anatomy**

1. Plant Anatomy by B. P. Pandey, S. Chand Publications
2. Plant Anatomy and Embryology by S.N. Pandey and Chadha, Vikas Publications, latest Edition.
3. Introduction to Plant anatomy, Eames A J, Mc Graw Hill publications, latest Edition.
4. Physioogical Plant Anatomy, Haberlandt G
5. Plant Anatomy, Katherine Esau

### **Unit II: Physiology**

1. Plant Physiology by V. Verma, Athena Academics
2. Plant Physiology by Taiz and Zeiger Sinauer Associates inc. publishers
3. Introductory Pant Physiology, Noggle and Fritz, PHI, Eastern Economy Edition.

### **Unit III: Ecology**

1. Fundamentals of Ecology by E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore.
2. Ecology and Environment, P. D. Sharma, latest edition, Rastogi Publications

## **Paper III: Current Trends in Plant Sciences I**

### **Unit I: Horticulture**

1. Horticulture, Rao, Mc Millan India, Latest Edition.
2. Complete Gardening, Edited by C. E. Pearson, Treasure Press.
3. Principles of Horticulture, Prasad and Kumar.

### **Unit II: Biotechnology**

1. Textbook of Biotechnology by R. C. Dubey, S. Chand Publications, Latest Edition
2. Modern Concepts of Biotechnology by H.D. Kumar, Vikas Publications, Latest Edition
3. Basic Biotechnology by Rev Fr Dr S. Ignacimuthu, Tata Mc Graw Hill Publications, Latest Edition
4. Gene Biotchnology by S. N. Jogdand, Himalaya Publications, Latest Edition
5. Plant Biotechnology by K.G. Ramavat, S. Chand Publications, Latest Edition

### **Unit III: Biostatistics and Bioinformatics**

1. The New Handbook of Bioinformatics by Puneet Mehrotra, Dr. Kumud Sarin, Swapna K. Srivastava, Vikas Publications.

2. Intelligent Bioinformatics by Edward Keedwell and Ajit Narayanan, Wiley Publications.

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