



Hindi Vidya Prachar Samiti's

Ramniranjan Jhunjhunwala College

of Arts, Science & Commerce

(Autonomous College)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for the F.Y.B.Sc.

Program: B.Sc. BOTANY

Program Code: RJSUBOT

(CBCS 2019-2020)

DISTRIBUTION OF TOPICS AND CREDITS**F.Y.B.Sc. BOTANY SEMESTER I**

Course	Nomenclature	Credits	Topics
RJSUBOT101	Plant Diversity I	02	1. Algae 2. Fungi 3. Bryophyta
RJSUBOTI02	Forms & Functions I	02	4. Cytology 5. Physiology 6. Genetics
RJSUBOTP101 & RJSUBOTP102	Practical I & II	02	

F.Y.B.Sc. BOTANY SEMESTER II

Course	Nomenclature	Credits	Topics
RJSUBOT201	Plant Diversity I	02	1. Pteridophyta 2. Gymnosperms 3. Angiosperms
RJSUBOT202	Forms & Functions I	02	4. Anatomy 5. Ecology 6. Medicinal Botany
RJSUBOTP201 & RJSUBOTP202	Practical I & II	02	

SEMESTER I (THEORY)		L	Cr
Paper-I: Plant Diversity I		Paper Code: RJSUBOT101	
		45	2
UNIT I		15	
ALGAE			
1	Outline classification up to Division as per G.M. Smith (reasons to be specified).		
2	General characters of Chlorophyta based upon - Range of thallus, Cell structure and types of chloroplast, reproduction. Economic importance of Chlorophyta.		
3	<i>Spirogyra</i> - Systematic position, Life cycle, Alternation of generations.		
UNIT II		15	
FUNGI			
1	Outline classification up to Class as per G.M. Smith (reasons to be specified).		
2	General characters of Phycomycetes based upon- Thallus structure and reproduction. Economic importance of Phycomycetes.		
3	<i>Rhizopus</i> - Systematic position, Life cycle, Alternation of generations.		
4	Modes of nutrition in fungi – all types.		
UNIT III		15	
BRYOPHYTA			
1	Outline classification up to class as per G.M. Smith (reasons to be specified).		
2	General characters of Hepaticae based on - Thallus structure, reproduction.		
3	<i>Riccia</i> - Systematic position, Life cycle, Alternation of generations.		

F.Y.BSc	Semester I Theory
RJSUBOT101	Course Outcomes 1.1 :
Paper I	
Plant Diversity I	<ol style="list-style-type: none"> 1. Introduce students to algae and let them explore the diversity in the thallus structure ranging from simple to complex. Learn the taxonomy of Chlorophyta represented by <i>Spirogyra</i>. Also create awareness about utility of algae in industries like production of nutraceuticals, biofuel green fuel technology. 2. Introduction to fungi from simple Phycomycetes represented by <i>Rhizopus</i> life cycle. Modes of nutrition in fungi and economic importance of fungi to enable students to think about strain selection. 3. Bryophytes amphibious habitat progressing towards land habitat features of bryophytes general characters of Hepaticae and life cycle of widely available <i>Riccia</i>. <p>Learning outcomes:</p> <ul style="list-style-type: none"> ➤ Understanding the diversity of lower plants, its life cycle, type of chloroplast and application of algae for commercial purposes. ➤ Detailed study of fungi life cycle, mode of nutrition and its selection for economic products. ➤ Detailed study of bryophytes life cycle, types of thallus and alternation of generations. Plant succession.

SEMESTER I (THEORY)		L	Cr
Paper-II: Forms and Functions-I		Paper Code: RJSUBOT102	
		45	2
UNIT I		15	
CYTOLOGY			
1	General structure of plant cell, Structure of Cell wall, Plasma membrane (bilayer lipid structure, fluid mosaic model).		
2	Ultra structure and functions of the following cell organelles: Mitochondria and Microbodies.		
UNIT II		15	
PHYSIOLOGY			
1	Respiration – Aerobic and Anaerobic, Glycolysis, Krebs's Cycle and ETS. Different Respiratory substrates.		
2	Plant Water Relations- Water Potential, Transport through membrane, Osmosis, Imbibition.		
UNIT III		15	
GENETICS			
1	Phenotype and Genotype.		
2	Mendelian Genetics- Monohybrid cross, Dihybrid cross, Test cross & Back cross with the help of suitable examples.		
3	Multiple alleles- Characters and examples.		
4	Epistatic and Non-epistatic interactions.		

F.Y.BSc	Semester I Theory
<p>RJSUBOT102</p> <p>Paper II</p> <p>Form and Function I</p>	<p>Course Outcomes 1.2 :</p> <ol style="list-style-type: none"> 1. Introduction to cell Biology ultrastructure of cell wall, plasma membrane, to understand the transport mechanisms via these membranes. 2. Describe the ultrastructure of mitochondria and micro bodies so that they are able to correlate with the physiological functions of these organelles in the plant cell. 3. In correlation to study of organelles the biochemical pathway in these organelles will be studied. To make students understand that various substrates can be utilized in respiration – aerobic, anaerobic and fermentation, Concept of anabolism and catabolism. 4. To understand the concept of water transport in plant cells. 5. To understand the concept of Mendelian inheritance selection of model organism. Explanation of monohybrid and dihybrid crosses. Terminologies used in genetics, test cross and backcross. 6. To go beyond Mendelian inheritance and understand the concept of genetic interaction, epistatic interactions, multiple alleles and inheritance of blood groups in man. <p>Learning outcomes:</p> <ul style="list-style-type: none"> ➤ Basic concept of cell and its ultra-microscopic structure of cell organelle. ➤ Detailed study of .aerobic and anaerobic respiration and different respiratory substrates. ➤ Detailed study of Mendelian genetics, multiple alleles and epistatic and non-epistatic interactions. Genetic basis of cultivars.

SEMESTER II (THEORY)		L	Cr
Paper-I: Plant Diversity I		Paper Code: RJSUBOT201	
		45	2
UNIT I		15	
PTERIDOPHYTA			
1	Outline classification up to Division as per G.M. Smith (reasons to be specified).		
2	General characters of Pterophyta based upon – Plant body, Reproduction.		
3	<i>Nephrolepis</i> - Systematic position, Life cycle, Alternation of generations.		
UNIT II		15	
GYMNOSPERMS			
1	Outline classification up to Division as per Chamberlain (reasons to be specified).		
2	General characters of Cycadophyta based upon – Plant body, Reproduction.		
3	<i>Cycas</i> - Systematic position, Life cycle, Alternation of generations.		
4	Economic importance of Gymnosperms.		
UNIT III		15	
ANGIOSPERMS			
1	<u>Morphology-</u> Root- Types and its modifications. Stem- Types and its modifications. Leaf: simple leaf, types of compound leaves, Incisions of leaf, venation, phyllotaxy, types of stipules, leaf apex, leaf margin, leaf base, leaf shapes. Modifications of leaf - spine, tendril, hooks, phyllode, pitcher. Morphology of Seed – Monocot, Dicot and endospermic & non-endospermic seeds. Seed germination types.		
2	<u>Taxonomy -</u> Bentham and Hooker's classification – broad outline up to series (with reasons). Study of plant families: Malvaceae, Amaryllidaceae.		

F.Y.BSc	Theory Semester II : Plant Diversity
RJSUBOT201 Plant Diversity	<p>Course Outcomes 2.1 :</p> <ol style="list-style-type: none"> 1. Land plants, first vascular plants Pteridophytes. Study of <i>Nephrolepis</i> to understand the stages of life cycle and alternation of generations. 2. Gymnosperms identify the characters. Structure life cycle of a commonly grown gymnosperm <i>Cycas</i> to understand the stages of life cycle. 3. Morphological modifications of root leaves and seed morphology and seed germination so as to understand their function and taxonomic relevance. Seed morphology would help them understand the storage of primary metabolites; germination would enable them to develop skills needed for nursery. 4. Bentham and Hooker's system of classification. Introduction to plant families by study of family Malvaceae and Amaryllidaceae. <p>Learning outcomes:</p> <ul style="list-style-type: none"> ➤ Detailed study of first land plants - systematic position, life cycle, and alternation of generations. ➤ Detailed study of gymnosperms Chamberlain classification, life cycle, plant body and alternation of generations. ➤ Understanding the type of modifications of roots, stems, leaves and morphology of seed- monocot and dicot. To apply the gained information to understand plant propagation and nutritional value of plant parts used as food. ➤ Study of Bentham and Hooker's classification for Malvaceae, Amaryllidaceae family.

SEMESTER II (THEORY)		L	Cr
Paper-II: Forms and Functions-I		Paper Code: RJSUBOT202	
		45	2
UNIT I		15	
ANATOMY			
1	Plant tissues:- Simple tissues, Complex tissues.		
2	Anatomy of primary structures – dicot and monocot root, stem and leaf.		
3	Epidermis and Epidermal tissue system.		
UNIT II		15	
ECOLOGY			
1	Ecological pyramids: Based on energy, biomass and number		
2	Energy flow in an ecosystem.		
3	Types of ecosystems – aquatic and terrestrial.		
4	Biogeochemical cycles – Carbon and Nitrogen Hydrological cycle - Water.		
UNIT III		15	
MEDICINAL BOTANY			
1	Concept of primary and secondary metabolites.		
2	Grandma's pouch: Following plants have to be studied with respect to botanical source, part of the plant used, active constituents present and medicinal uses: <i>Ocimum sanctum</i> , <i>Adathoda vasica</i> , <i>Zingiber officinale</i> , <i>Curcuma longa</i> , <i>Santalum album</i> , <i>Aloe vera</i> .		

F.Y.BSc	Theory Semester II : Plant Diversity
RJSUBOT202	Course Outcomes 2.2 :
Paper II	
Form and Function	<ol style="list-style-type: none"> 1. Anatomy of plants, cells, tissues, salient characters of simple and complex tissues. Explain the primary structure of dicot and monocot root, stem and leaf. To allow the students to understand the difference in the anatomy of dicot and monocot, learn to apply this knowledge in identification of isolated plant organs. 2. Study of epidermal outgrowths and stomata of dicot and monocot leaves. 3. Ecology: Study of flow of energy at different trophic levels. Study of aquatic and terrestrial ecosystems, biogeochemical cycles. 4. Medicinal Botany: To understand the concept of primary and secondary metabolites. Ingredients of grandma's pouch and its medicinal uses. <p>Learning outcomes:</p> <ul style="list-style-type: none"> ➤ Detailed study of anatomical structures of plant tissues, root, stem, leaf and types of epidermis. ➤ Ecological study of energy pyramid, energy flow, types of ecosystem and biogeochemical cycles. ➤ Study of difference of primary and secondary metabolites, some medicinal use of secondary products.

F.Y.B.Sc Botany Syllabus Semester I & II

Semester I (PRACTICALS)		L	Cr
Practical-I: Plant Diversity I		Paper Code: RJSUBOTP101	
1	Study of stages in the life cycle of <i>Spirogyra</i> from fresh/ preserved material and permanent slides.		1
2	Range of thallus in Chlorophyta.		
3	Types of chloroplast in Chlorophyta.		
4	Economic importance of Green algae.		
5	Study of stages in the life cycle of <i>Rhizopus</i> from fresh/ preserved material and permanent slides.		
6	Examples of Saprophytic and Parasitic fungi to explain mode of nutrition.		
7	Study of stages in the life cycle of <i>Riccia</i> with the help of permanent slides/ Fresh material.		
Practical-II: Forms and Functions I		Paper Code: RJSUBOTP102	
1	Study of mitotic stages in onion root tip.		1
2	Study of Cell inclusions: Starch grains (Potato, Pea and Rice); Aleurone Layer (Maize) Cystolith (<i>Ficus</i>), Raphides (<i>Pistia</i>), Sphaeraphides (<i>Opuntia</i>)		
3	Identification of cell organelles with the help of photomicrograph: Mitochondria, Peroxisomes and Glyoxysomes,		
4	To study Plasmolysis using suitable plant material.		
5	To study Q ₁₀ using germinating seeds.		
6	Effect of change of pH on color of anthocyanin pigment and its applications.		
7	Calculation of mean, median and mode.		
8	Calculation of standard deviation.		
9	Frequency distribution, graphical representation of data- frequency polygon, histogram, pie chart.		
10	Study of Karyotypes: Human: Normal male and female, <i>Allium cepa</i> .		

F.Y.B.Sc	Semester I
RJSUBOTP101 Practical I	<p>Course Outcomes: Experiential learning, identification of algae and fungi by observing them under microscope</p> <ol style="list-style-type: none"> 1. Experiential learning of mounting and identification with the help of fresh/preserved material and permanent slides of <i>Spirogyra</i>. Vegetative and reproductive lateral and scalariform conjugation. 2. Range of thallus in green algae single cell, coenobium, filamentous, branched, unbranched, parenchymatous. 3. Economic importance of green algae 4. Microscopic observation, mounting and identification of fresh/preserved material and permanent slides of <i>Rhizopus</i>. 5. Material of saprophytic and parasitic fungi to explain mode of nutrition concept of extracellular enzymes, haustoria. 6. Study of morphological features and internal structure of <i>Riccia</i> with help of fresh /preserved material and permanent slides. <p>Learning outcomes: Use of microscope, application of technique of microscopy</p> <ul style="list-style-type: none"> ➤ Understanding the diversity of lower plants, its life cycle, type of thallus and chloroplast and application of green algae for commercial purposes. ➤ Detailed study of fungi life cycle, mode of nutrition and its selection for economical products. ➤ Detailed study of bryophyte's life cycle, types of thallus and gametophytes.

F.Y.B.Sc	Semester I
<p>RJSUBOT</p> <p>P102</p> <p>Practical II</p>	<p>Course Outcome:</p> <ol style="list-style-type: none"> 1. Squash preparation to study various stages of mitosis learning the technique of chromosomal staining observation of stages of cell division. 2. Slide preparation to study types of starch grains in potato, pea and rice. Mounting of aleurone layer from maize grain. 3. Students would take transverse section of <i>Ficus elastica</i> leaf and observe under light microscope to look at cystolith similarly other mineral crystals like raphides and sphaeraphides would be observed by taking transverse section of <i>Pistia</i> leaf and <i>Opuntia</i> phylloclade respectively. This would enable students to explore the diversity of cell inclusions in plants. Bio mineralization in plants 4. Cell organelles would be studied using photomicrographs. 5. Water relations of plants using coloured leaves like <i>Tradescantia</i> to explain concept of plasmolysis, incipient plasmolysis, hyper, hypo and isotonic solution. Water potential. 6. Introduction to biostatistics, sampling, central tendency calculation of mean, median and mode, graphical representation of data, frequency polygon, histogram, pie chart. Calculation of standard deviation. 7. Karyotype analysis of human normal male and female and <i>Allium cepa</i>. <p>Learning outcomes:</p> <ul style="list-style-type: none"> ➤ Detailed study of different stages of mitosis, plasmolysis and cell inclusions. ➤ Basic concept and functions of cell organelles. ➤ Detailed study of respiration with Q₁₀. ➤ Study the effect of change of pH on colour of anthocyanin pigment and its applications for other natural indicators. ➤ Biostatistical analysis of mean, median, mode and standard deviation. ➤ Data presentation with the help of frequency distribution, graphical representation of data- frequency polygon, histogram, pie chart. ➤ Detailed study of Karyotypes

Semester II (PRACTICALS)		L	Cr
Practical-I: Plant Diversity I	Paper Code: RJSUBOTP201		1
1	Study of stages in the life cycle of <i>Nephrolepis</i> : Mounting of ramentum, hydathode, T.S. of rachis.		
2	T.S. of pinna of <i>Nephrolepis</i> passing through sorus, Structure of Sporangium and spore		
3	Cycas: T.S of leaflet (<i>Cycas</i> pinna), Megasporophyll, microsporophyll, coralloid root, microspore, L.S. of ovule of <i>Cycas</i> – all specimens to be shown.		
4	Morphology of Root.		
5	Morphology of Stem.		
6	Morphology of Leaf – Part I.		
7	Morphology of Leaf- Part II.		
8	Types of seed and seed germination.		
9	Malvaceae		
10	Amaryllidaceae.		
Practical-II: Forms and Functions I	Paper Code: RJSUBOTP202		1
1	Primary structure of dicot and monocot root.		
2	Primary structure of dicot and monocot stem.		
3	Primary structure of Dicot & Monocot leaf (photograph/slide) & Study of dicot and monocot stomata.		

4	Epidermal outgrowths: With the help of mountings- Unicellular: <i>Gossypium</i> /Radish, Multicellular: <i>Lantana</i> /Sunflower. Glandular: <i>Drosera</i> and Stinging: <i>Urtica</i> – only identification with the help of permanent slides. Peltate: <i>Thespesia</i> , Stellate: <i>Erythrina</i> / <i>Sida acuta</i> / <i>Solanum</i> / <i>Helicteres</i> . T-shaped: <i>Avicennia</i> .		
5	Study of plants from terrestrial and aquatic ecosystems – morphological adaptations		
6	Test for tannins: tea powder/catechu.		
7	Identification of plants or plant parts for grandma's pouch as per theory.		

F.Y.B.Sc	Practicals Semester II
<p>RJSUBOTP201</p> <p>Practical I</p> <p>Plant Diversity I</p>	<p>Course Outcomes: Experiential learning, skill development</p> <ol style="list-style-type: none"> 1. Students would learn to observe specimens, identify with the help of morphological and anatomical characters. Learn the technique of sectioning and differentiate the tissues based on cell wall characteristics. Learn to observe different stages in the life cycle of <i>Nephrolepis</i>, <i>Cycas</i>. 2. Study of root, stem leaf and seed morphology and types of seed germination. 3. An introduction to classification of flowering plants and study of families Malvaceae and Amaryllidaceae. <p>Learning outcomes:</p> <ul style="list-style-type: none"> ➤ Detailed study <i>Nephrolepis</i> ramentum, hydathode, T.S. of rachis, structure of sporangium and spore. ➤ Detailed study of <i>Cycas</i> pinna, Megasporophyll, Microsporophyll, Coralloid root, Microspore structure. ➤ Understanding the morphology of roots, stems, leaves and morphology of seed for monocot and dicot. ➤ Study of angiosperm families (Malvaceae and Amaryllidaceae)

F.Y.BSc	Practicals Semester II
RJSUBOTP202 Practical II Forms and Functions I	<p>Course Outcomes: Skill development</p> <ol style="list-style-type: none"> 1. Sectioning of dicot and monocot root, stem and leaves to study the primary structure. Mounting of epidermal outgrowths. Learner would learn technique of sectioning, staining. Types of epidermal outgrowth and its role in a plants life cycle. 2. Based on observations of morphological characters plants would be identified as hydrophytes, mesophytes and xerophytes. Characters to be observed for hydrophytes would thin wiry stem, absence of roots (submerged), absence of root hair, roots with root pockets, lateral roots present, stem modified as offset, swollen petiole, leaves coated with wax (free floating), roots with root hair, long petiole coated with mucilage, floating leaves coated with wax. 3. Simple test for tannin's identification and botanical names of plants in everyday life to cure common ailments and scientific explanation for their curative properties. <p>Learning outcomes:</p> <ul style="list-style-type: none"> ➤ Detailed study of anatomical structures of root, stem, leaf, types of stomata and epidermal outgrowths. ➤ Ecological study of plants. Morphological adaptations from terrestrial and aquatic ecosystems. ➤ Assessment of tannins and identification of some medicinal plant products.

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Scheme of Examinations

1. Two Internals of 20 marks each. Duration 20 minutes for each.
2. One External (Semester End Examination) of 60 marks. Duration 2 hours.
3. One Practical at the end of Semester consisting of practical I-50 marks and Practical II-50 marks but passing combined out of 100.
4. Minimum marks for passing Semester End Theory and Practical Exam is 40 %.
5. Student must appear for at least one of the two Internal Tests to be eligible for the Semester End Examination
6. Two short field excursions for habitat studies are compulsory.
7. Field work of not less than eight hours duration is equivalent to one period per week for a batch of 15 students.
8. A candidate will be allowed to appear for the practical examinations if he/she submits a certified journal of F.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 F.Y.B.Sc. Botany as per the minimum requirements.
9. 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.
10. HOD's decision, in consultation with the Principal, shall remain final and abiding to all.