

Resolution No.: AC/I(19-20).2.RUS4

S.P. Mandali's
RAMNARAIN RUIA AUTONOMOUS
COLLEGE



Syllabus for: S. Y

Program: B. Sc.

Course Code: Botany (RUSBOT)

(Credit Based Semester and Grading System with
effect from the academic year 2019 – 2020)

SEMESTER III

Course Code	UNIT	TOPICS	Credits	Lectures/ Week	
RUSBOT 301	PLANT DIVERSITY III			02	1
	I	Thallophyta (Algae) & Bryophyta	02		
	II	Angiosperms			
	III	Instrumentation			
RUSBOT 302	FORM AND FUNCTION III			02	1
	I	Cell biology	02		
	II	Cytogenetics			
	III	Molecular Biology			
RUSBOT 303	CURRENT TRENDS IN PLANT SCIENCES I			02	1
	I	Pharmacognosy and Phytochemistry	02		
	II	Economic botany			
	III	Industry based on plant products			
RUSBOTP 301, 302, 303	Practicals	Practical based on all the three courses in theory	03	09	
			09		

SEMESTER IV

Course Code	UNIT	TOPICS	Credits	Lectures/ Week	
RUSBOT 401	PLANT DIVERSITY IV			02	1
	I	Thallophyta: Fungi, Plant Pathology and Lichens	02		
	II	Pteridophyta and Paleobotany			
	III	Gymnosperms			
RUSBOT 402	FORM AND FUNCTION IV			02	1
	I	Anatomy	02		
	II	Plant Physiology and Plant Biochemistry			
	III	Ecology and Environmental Botany			
RUSBOT 403	CURRENT TRENDS IN PLANT SCIENCES II			02	1
	I	Biotechnology	02		
	II	Biostatistics and Bioinformatics			
	III	Research Methodology I			
RUSBOTP 401, 402, 403	Practicals	Practical based on all the three courses in theory	03	09	
			09		

Course Code: RUSBOT 301
Course Title: Plant Diversity III
Academic year 2019 - 20

Learning Objectives –

- The study of higher Algae, Bryophytes and detailed study of plant nomenclature, Angiospermic plant families by Bentham and Hookers system of classification.
- The instruments useful for practicals, learning the techniques and working of different instruments used to study plant diversity.

Learning Outcomes – The students will be able to identify Algae, Bryophytes and Angiosperms. Students will be able to appreciate the influence of various fields on taxonomy. Observation, collection of specimens from the nature by themselves for e.g. by going for excursion or short local visit to the places will enrich their knowledge further. They will also be able to grasp the working and handling of instruments and working on it for the specific practicals.

Detailed Syllabus

RUSBOT 301	Title: Plant Diversity III	Credits – 2
UNIT I	Thallophyta (Algae) & Bryophyta	15 Lectures
	General Characters of Division Chrysophyta and Phaeophyta: Distribution, Cell structure, range of thallus, Economic Importance.	
	Structure, life cycle and systematic position of <i>Vaucheria</i> and <i>Sargassum</i>	
	General Account of Class <i>Anthocerotae</i>	
	Structure, life cycle and systematic position of <i>Pellia</i> and <i>Anthoceros</i>	
UNIT II	Angiosperms	15 Lectures
	Systematics: Categories and taxonomic hierarchy; <ul style="list-style-type: none"> • Plant Nomenclature • Taxonomy in relation to <ul style="list-style-type: none"> ○ Anatomy ○ Chemical constituents 	
	With the help of Bentham and Hooker's system of Classification for flowering plants study the vegetative, floral characters and economic importance of the following families: <ul style="list-style-type: none"> • Brassicaceae • Myrtaceae • Asteraceae • Acanthaceae • Amaranthaceae • Euphorbiaceae • Palmae 	
UNIT III	Instrumentation	15 Lectures
	Preservation methods :Dry and Wet method	
	Microscopy – Principle and working of Light, phase contrast, fluorescent and electron microscope.	
	Chromatography- Principles and techniques of paper and thin	

	layer chromatography.	
	Principles and techniques of Horizontal and Vertical Gel electrophoresis	
PRACTICALS		
RUSBOT 301	Plant Diversity III	Credits - 1
1	Study of stages in the life cycle of <i>Vaucheria</i> and <i>Sargassum</i> from fresh/ preserved material and permanent slides.	
2	Economic importance and range of thallus in Phaeophyta	
3	Study of stages in the life cycle of and <i>Pellia</i> from fresh/ preserved material and permanent slides.	
4	Study of stages in the life cycle of <i>Anthoceros</i> from fresh/ preserved material and permanent slides.	
5	Study of plants for anatomy in relation to taxonomy	
6	Study of plants for Alkaloids, Tannins, Phenols and Flavonoids (chemotaxonomy)	
7	Study of one plant from each family prescribed for theory: <ul style="list-style-type: none"> • Brassicaceae • Myrtaceae • Asteraceae • Acanthaceae • Amaranthaceae • Euphorbiaceae • Palmae 	
8	Morphological peculiarities and economic importance of the members of these families.	
9	Preparation of herbarium and wet preservation technique	

Course Code: RUSBOT 302
Course Title: Form and function III
Academic year 2019 - 20

Learning Objectives–

- The study of the fundamentals of Cell biology, Cytogenetics and Molecular Biology

Learning Outcomes – The students will be able to understand the details of cellular structures, causes and effects of chromosomal aberrations, sex determination and examples of extranuclear genetics. They also will be able to have a detailed understanding of the fundamentals of DNA replication and transcription.

Detailed syllabus

RUSBOT 302	Title: Form and function III	Credits – 2
UNIT I	Cell biology	15 Lectures
	Ultra Structure and functions of the following cell organelles: Mitochondrion (membranes, cristae, F1 particles and matrix) Peroxisomes and Glyoxysomes, Ribosomes (prokaryotic, eukaryotic and subunits)	
	Cell Division and its significance: Cell Cycle, structure of Interphase Nucleus(nuclear envelope, chromatin network, nucleolus and nucleoplasm) Meiosis, Differences between Mitosis and Meiosis	

	Nucleic Acids: Types, structure and functions of DNA and RNA	
UNIT II	Cytogenetics	15 Lectures
	Variation in Chromosome structure (Chromosomal aberrations) Definition, Origin, Cytological and Genetic effects of the following: Deletions, Duplications, Inversions and Translocations.	
	Variation in Chromosome number: Origin and production, morphological and cytological features, applications in crop improvement and evolution of aneuploids and euploids (monoploids, autopolyploids and allopolyploids)	
	Extra nuclear Genetics -Organelle heredity- <ul style="list-style-type: none"> • Chloroplast determines heredity - Plastid transmission in plants, Streptomycin resistance in <i>Chlamydomonas</i>. • Male sterility in maize 	
UNIT III	Molecular Biology	15 Lectures
	DNA replication : Modes of Replication, Messelson and Stahl experiment	
	DNA replication in prokaryotes and eukaryotes- enzymes involved and molecular mechanism of replication.	
	Protein Synthesis: <ul style="list-style-type: none"> • Central dogma of protein synthesis • Transcription in prokaryotes and eukaryotes: promoter sites, initiation, elongation and termination. 	
	RNA processing: Adenylation and Capping	
PRACTICALS		
RUSBOTP 302	Form and function III	Credits - 1
1	Study of the ultra-structure of cell organelles prescribed for theory from photomicrographs	
2	Estimation of DNA from plant material (one standard and one unknown)	
3	Estimation of RNA from plant material (one standard and one unknown)	
4	Chromatography: Separation of amino acids by circular paper chromatography	
5	Separation of Carotenoids by thin layer chromatography (projects/ assignments)	
6	Study of inheritance pattern with reference to Plastid inheritance	
7	Study of cytological consequences of chromosomal aberrations (Laggards, Chromosomal Bridge, Ring chromosome, Chromosomal ring) from permanent slides or photomicrographs.	
8	Study of meiosis from suitable plant material	
9	Determining the sequence of amino acids in the protein molecule synthesised from the given m-RNA strand (prokaryotic and eukaryotic)	
10	Horizontal and Vertical Gel Electrophoresis – Demonstration	

Course Code: RUSBOT 303
Course Title: Current trends in Plant Sciences I
Academic year 2019 - 20

Learning Objectives-

- The study of the pharmacognosy and phytochemistry using monographs from pharmacopoeia.
- The study of secondary metabolites and adulterants.
- To study economic botany.
- The applied usage of botanicals and understand industry applications of the same.

Learning outcomes -

Creating awareness about various pharmacopoeias and understanding the importance of pharmacopoeias in plant identification and standardization. Understanding forestry and the use of various forest products. Understanding the economic and commercial value of botanical products. Understanding the industrial relevance of botanicals with respect to current demands of industry.

Detailed Syllabus

RUSBOT 303	Title: Current trends in Plant Sciences I	Credits – 2
UNIT I	Pharmacognosy and phytochemistry	15 Lectures
	Introduction to pharmacopoeia	
	Indian pharmacopoeia, India Herbal pharmacopoeia, Ayurvedic pharmacopoeia	
	Study of monograph from pharmacopoeia; any one example.	
	Secondary metabolites: Sources, properties, uses and adulterants, regional and seasonal variations	
	Genuine and spurious drugs: <i>Saraca asoca</i> , <i>Phyllanthus amarus</i> and other species	
UNIT II	Economic Botany	15 Lectures
	Fibre yielding plants	
	Types of fibers: Jute and cotton	
	Paper yielding plants	
	Types of paper	
	Spices and condiments: Cardamom (<i>Elettaria cardamomum</i> and <i>Amomum subulatum</i>), Jaivetri and Jaiphal (<i>Myristica fragrans</i>)	
	Commercial market of spices.	
UNIT III	Industry based on plant products	15 Lectures
	Aromatherapy- Introduction, Uses with few examples: <i>Calendula</i> , lemon, jasmine	
	Botanical and nutraceuticals - <i>Spirulina</i> , Vanillin, <i>Garcinia indica</i> / <i>Garcinia cambogia</i> , <i>Stevia</i> , and Kale.	
	Industrial enzymes: Extraction methods and application: Cellulases, Papain, Bromelain – Biofuels.	
PRACTICALS		
RUSBOTP 303	Current trends in Plant Sciences I	Credits - 1

1	Pharmacognostic evaluation of the following genuine and spurious drugs with reference to adulteration: <i>Phyllanthus amarus</i> , <i>Phyllanthus debilis</i> , , <i>Saraca asoca</i> , <i>Polyalthia longifolia</i>
2	Sources of: Fibres & Paper; Spices & condiments
3	Identification of botanical sources used in aromatherapy and nutraceuticals (examples as per theory)
4	Extraction and evaluation of enzymes papain (fruit and leaf)/ bromelain (stem and fruit)
5	Identification of plants used in biofuels
6	Estimation of crude fibre in cereals & their products: (Assignment and projects)
7	Study of biodiversity (Visit to National Park/ Botanical Garden/ forests): Assignments/ projects

SEMESTER IV

Course Code: RUSBOT 401
Course Title: Plant Diversity IV
Academic year 2018-19

Learning Objective:

- The study of Ascomycete fungi with two life cycles.
- Study of Plant pathology, Lichens, Pteridophyta, Paleobotany and Gymnosperms.
- Classification of each of the above and knowledge about their economic importance.

Learning Outcomes –The students will learn to identify and study the life cycles of fungi, fungi causing plant diseases, lichens, Pteridophytes, Gymnosperms, and fossil members mentioned in the syllabus.

Detailed Syllabus

RUSBOT 401	Title: Plant Diversity IV	Credits – 2
UNIT I	Thallophyta: Fungi, Plant Pathology and Lichens	15 Lectures
	General characters of Ascomycetae	
	Structure, life cycle and systematic position of <i>Aspergillus</i> and <i>Xylaria</i>	
	Plant Pathology - symptoms, causative organism, disease cycle and control measures of Powdery mildew and Late blight of potato	
	Lichens- classification, structure, method of reproduction, economic importance and ecological significance of lichens.	
UNIT II	Pteridophyta and Paleobotany	15 Lectures
	Salient features and classification of Calamophyta and Pterophyta upto orders (G M Smith's system of classification)	
	Structure, life cycle and systematic position of <i>Equisetum</i> and <i>Lycopodium</i>	
	Paleobotany- Formation and types of fossils; Structure and systematic position of form genus <i>Rhynia</i>	

UNIT III	Gymnosperms	15 Lectures
	Salient features, classification up to orders (with examples of each) (Chamberlain's system of classification to be followed)	
	Structure life cycle and systematic position of <i>Pinus</i>	
	Structure and systematic position of the form genus <i>Cordaites</i>	
PRACTICALS		
RUSBOTP 401	Plant Diversity IV	Credits - 1
1	Study of stages in the life cycle of <i>Aspergillus</i> from fresh/ preserved material and permanent slides.	
2	Study of stages in the life cycle of <i>Xylaria</i> from fresh/ preserved material and permanent slides.	
3	Study of fungal diseases as prescribed for theory.	
4	Study of Lichens (crustose, foliose and fruticose).	
5	Study of stages in the life cycle of <i>Equisetum</i> and <i>Lycopodium</i> from fresh/ preserved material and permanent slides.	
6	Study of form genera <i>Rhynia</i> with the help of permanent slides/ photomicrographs	
7	Study of stages in the life cycle of <i>Pinus</i> from fresh/ preserved material and permanent slides.	
8	Study of the form genus <i>Cordaites</i> with the help of permanent slide/ photomicrographs.	

Course Code: RUSBOT 402
Course Title: Form and function IV
Academic year 2019 - 20

Learning Objectives-

- The study of fundamentals of Anatomy, Plant Physiology and Plant Biochemistry, Ecology and Environmental Botany in detail

Learning outcomes- The students will be able to relate structure with function by studying different anatomical details. They will be able to understand the basic concepts and applications of respiration, photorespiration, photoperiodism and vernalisation. They will be able to grasp the principles governing ecology and environmental biology with reference to biogeochemical cycles, ecological factors, and community ecology.

Detailed Syllabus

RUSBOT 402	Title: Form and function IV	Credits – 2
UNIT I	Anatomy	15 Lectures
	Normal secondary growth in dicotyledonous stem and root. Growth rings, periderm, lenticels, tyloses	
	Mechanical tissue system and <ul style="list-style-type: none"> • Tissues providing mechanical strength and support and their disposition • I-girders in aerial and underground organs Conducting tissue system	
	Study of ecological adaptations: Xerophytes and halophytes	
UNIT II	Plant Physiology and Plant Biochemistry	15 Lectures

	Respiration: Aerobic: Glycolysis, TCA Cycle, ETS and Energetics of respiration; anaerobic respiration.	
	Photorespiration: Mechanism of photorespiration, Energetics and significance of photorespiration	
	Photoperiodism: Phytochrome Response and vernalization with reference to flowering in higher plants, Physico-chemical properties of phytochrome, Pr-Pfr interconversion, role of phytochrome in flowering of SDPs and LDPs;	
	Vernalization mechanisms and applications.	
UNIT III	Ecology and Environmental Botany	15 Lectures
	Ecological factors: Concept of environmental factors. Soil as an edaphic factor, Soil composition, types of soil, soil formation, soil profile.	
	Community ecology - Characters of community - Quantitative characters and Qualitative characters	
	Environmental Impact Assessment (EIA)	
PRACTICALS		
RUSBOTP 402	Form and function IV	Credits - 1
1	Study of normal secondary growth in the stem and root of a Dicotyledonous plant (Sunflower, stem and root)	
2	Study of mechanical tissues in <i>Typha</i> ,	
3	Study of ecological adaptations: Xerophytes and halophytes	
4	Study of conducting tissues, Growth rings, periderm, lenticels, tyloses.	
5	Q ₁₀ – germinating seeds using phenol red indicator.	
6	Study of the working of the following Ecological Instruments- Soil thermometer, Soil testing kit, Soil pH, Wind anemometer.	
7	Mechanical analysis of soil by the sieve method and pH of soil.	
8	Quantitative estimation of organic matter of the soil by Walkley and Blacks Rapid titration method.	
	Projects:	
1	Estimation of proteins by Lowry's method (Prepare standard graph).	
2	Study of vegetation by the list quadrat method.	

Course Code: RUSBOT 403

Course Title: Current Trends in Plant Sciences II
Academic year 2019 - 20

Learning Objectives –

- The study the basic principles and wider aspects of Horticulture, Biotechnology and Bioinformatics.
- Exposure to the field of research and methodology

Learning outcomes - The students will be able to identify horticulture garden plants and garden locations, work with various tissue culture techniques. They will be able to apply the tools of Biostatistics and Bioinformatics for analysis problem solving in Botany. Basic concepts of research and GLP shall be learnt by the students

Detailed Syllabus

RUSBOT 403	Title: Current Trends in Plant Sciences II	Credits – 2
UNIT I	Biotechnology	15 Lectures
	Introduction to plant tissue culture <ul style="list-style-type: none"> • A historic perspective • Laboratory organization and techniques in plant tissue culture • Totipotency • Morphogenesis(Organogenesis - Rhizogenesis, Caulogenesis) • Organ culture – root cultures, meristem cultures, embryo culture • Problems in plant tissue culture: contamination, phenolics and recalcitrance. • Factors responsible for <i>in vitro</i> and <i>ex vitro</i> hardening 	
	R-DNA technology- <ul style="list-style-type: none"> • Gene cloning • Enzymes involved in Gene cloning • Vectors used for Gene cloning. 	
UNIT II	Biostatistics and Bioinformatics	15 Lectures
	Biostatistics: <ul style="list-style-type: none"> • The chi square test. • Correlation – Calculation of coefficient of correlation. 	
	Bioinformatics <ul style="list-style-type: none"> • Introduction and Bioinformatics resources: Knowledge of various databases and bioinformatics tools available at these resources, data retrieval tools- Entrez • Organization of biological data, databases-the major content of the databases, literature databases, databases of bioinformatics: Primary, secondary and tertiary 	
	Sequence-based Database Searches; BLAST and FASTA, various versions of basic BLAST and FASTA.	
UNIT III	Research Methodology I	15 lectures
	Basic concepts of research: <ul style="list-style-type: none"> • Review of literature and bibliography • Identification and understanding a research problem. 	
	Good laboratory practices <ul style="list-style-type: none"> • Molarity and normality • Preparation of solutions • Dilutions • Knowledge of common toxic chemical and safety measures in their handling 	
PRACTICALS		
RUSBOTP 403	Current Trends in Plant Sciences II	Credits - 1
1	Various sterilization techniques	
2	Preparation of Stock solutions	

3	Preparation of MS medium.
4	Seed sterilization and inoculation
5	Callus induction
6	Identification of the cloning vectors – pBR322, pUC 18, Ti plasmid.
7	Chi square test
8	Calculation of coefficient of correlation
9	Sequence search in NCBI BLAST
10	Review of literature, its consolidation and bibliography
11	Preparation of molar and normal solutions
12	Preparation of Serial dilutions

Reference Books

1. Noggle and Fritz (2002) Introduction to Plant Physiology by, Prentice Hall Publisher
2. An introduction to Genetic analysis Griffith Freeman and Company (2000)
3. Fundamentals of Biostatistics by Rastogi, Ane Books Pvt. Ltd. (2009).
4. Instant Notes on Bioinformatics by Westhead (2002), Taylor Francis Publications.
5. Davis P.H and V.H Heywood (1963). Principles of Angiosperm Taxonomy. Oliver and Boyd London.
6. Gurucharan Singh (2005)- Systematics theory and practice (Oxford IBH)
7. Heywood V.H (1967) Plant Taxonomy, London.
8. Lawrence, G.H.M 1951. Taxonomy of Vascular Plants. N.Y.
9. Stewart W.N. and Rathwell G.W. 1993. Paleobotany and the Evolution of plants. Cambridge University Press.
10. Swingle D.B. 1946. A Text book of Systematic Botany. McGraw Hill Book Co. New York.
11. Takhtajan A. 1969. Flowering Plants; Origin and Disposal.
12. Theodore Cooke (1903)- The flora of The Presidency of Bombay Vol. I, II, III
13. Verma, V. (2007): Text Book Of Plant Physiology, Ane Books India, New Delhi.
14. Nobel, P.S. 2009. Physicochemical and Environmental Plant Physiology. 4th edition Academic Press, UK
15. Taiz, L. and Zeiger, E. 2006. Plant Physiology. 4th Edition. Sinauer Associates, Sunderland, Massachusetts, USA
16. Salisbury F.B. and Ross C.B. 2005. Plant Physiology. 5th Edition. Wadsworth Publishing Co. Belmont CA.
17. Helgi Olafsson, Stephen A. Rolfe, Arthur J. Willis. 2005. The Physiology of Flowering Plants, Cambridge University Press, UK
18. Kirkham, M.B. 2004. Principles of Soil and Plant Water Relations. Elsevier, Amsterdam, Netherlands.
19. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. 1997. Plant Metabolism. 2nd Edition. Longman Group, U.K.
20. Fitter, A. and Hay, R.K.M. 2001. Environmental Physiology of Plants. Academic Press, UK.
21. Press, M.C., Barker, M.G., and Scholes, J.D. 2000. Physiological Plant Ecology, British Ecological Society Symposium, Volume 39, Blackwell Science, UK.
22. Fundamental Molecular Biology ; Allison LA; 2007
23. Techniques for Molecular Biology ; Tagu D & Moussard C; INRA; 2006
24. Gene Cloning and DNA Analysis ; 5th Ed ; Brown TA ; 2006
25. Analysis of Genes and Genomes ; Reece RJ ; Wiley; 2004
26. Recombinant DNA and Biotechnology ; 2nd Ed ; Kreuzer H and Massey A ; ASM; 2006
27. Text book of biotechnology, R.C. Dubey, 2009, S.Chand, Delhi

28. Nanobiotechnology, Concepts, Applications and perspectives, C.M. Niemeyer and C.A. Mirkin ; 2004; WILEY-VCH,.

Ramnarain Ruia Autonomous College

MODALITY OF ASSESSMENT

Theory Examination Pattern:

A) Internal Assessment - 40%: 40 marks.

Sr No	Evaluation type	Marks
1	Assignment / Field Visit/ Submission/ On-line test /Active Participation (attentiveness/ability to answer questions)/Participation in academic or Co-curricular activities	20
2	One class Test (multiple choice questions / objective)	20

B) External examination - 60 %

Semester End Theory Assessment - 60 marks

- i. Duration - These examinations shall be of **2 hours** duration.
- ii. Paper Pattern:
 1. There shall be **03** questions each of **16** marks and **01** question of **12** marks. On each unit there will be one question & last question will be based on all the **03** units.
 2. All questions shall be compulsory with internal choice within the questions.

Questions	Options	Marks	Questions on
Q.1) A, B, C	Any 2 out of 3	16	Unit I
Q.2) A, B, C	Any 2 out of 3	16	Unit II
Q.3) A, B, C	Any 2 out of 3	16	Unit III
Q.4) a, b, c, d , e.	Any 3 out of 5	12	All units

Practical Examination Pattern:

(A) Internal Examination:

Heading	Practical I
Journal	05
Practical/ Field Report/ Presentation	15
Total	20

(B) External (Semester end practical examination):

Particulars	Practical
Laboratory work and/or <i>Viva voce</i>	30
Total	30

PRACTICAL BOOK/JOURNAL

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / Incharge of the department; failing which the student will not be allowed to appear for the practical examination.

Overall Examination and Marks Distribution Pattern

Semester- III and IV

Course	301/401		302/402		303/403		Total per Course	Grand Total
	Internal	External	Internal	External	Internal	External		
Theory	40	60	40	60	40	60	100	300
Practicals	20	30	20	30	20	30	50	150

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