Resolution No.: AC/II(23-24).2.RUS4

S.P. Mandali's

RAMNARAIN RUIA AUTONOMOUS COLLEGE

(Affiliated to University of Mumbai)

RUIA COLLEGE
Explore • Experience • Excel

Syllabus for: UG

Program: B. Sc.

Program Code: BOTANY(RUSBOT)

(Choice Based Credit System for the academic year 2024–2025)

S. P. Mandali's Ramnarain Ruia Autonomous College has adopted the Outcome Based Education model to make its science graduates globally competent and capable of advancing in their careers. The Bachelors Program in Science also encourages students to reflect on the broader purpose of their education.

GRADUATE ATTRIBUTES

GA	Description **A student completing Bachelor's Degree in Science program will be able to:**
GA 1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
GA 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences
GA 3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools
GA 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
GA 5	Take complex challenges, work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
GA 6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
GA7	Follow ethical practices at work place and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
GA 8	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner

PROGRAM OUTCOMES

PO	PO Description **A student completing Bachelor's Degree in Science program in the subject of Botany will be able to:**
PO 1	Understand the basic concepts of lower & higher plants their life cycle, economic and ecological importance, also evolution from algae to angiosperms and their industrial applications
PO 2	Develop an understanding of the principles underlying nomenclature and classification of Angiosperms, identify plants belonging to various families according to Bentham and Hooker's system.
PO 3	Elucidate ecological interconnectedness of life by energy and nutrient flow, relate the physical features of the environment to the structure of populations, communities, ecosystems, pollution, bioremediation, natural resources, sustainability and importance of conservation.
PO 4	Understand and relate priority areas such as genetics, cell and molecular biology, plant biotechnology and application of genetic engineering for the improvements of plants.
PO 5	Gain knowledge about laws of inheritance, various genetic interactions, chromosomal aberrations, multiple alleles and mutations.
PO 6	Analyze morphological and anatomical plant structures in the context of metabolic /physiological functions of plants, including embryological and palynological aspects
PO 7	Apply ethnobotanical aspects and medicinal, dietary and cosmetic uses of plants with special reference to phytochemistry and usage as mentioned in different Pharmacoepia
PO 8	Acquire the skills in handling scientific instruments, planning and performing laboratory experiments and application of suitable statistical tools.
PO 9	Understand the finer aspects of emerging areas such as Molecular biology and Bioinformatics.
PO 10	Develop practical skills in laboratory techniques in various fields of botany along with collection and interpretation of biological materials
PO 11	Apply research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

Credit Structure for SYBSc

Semester	Subject 1 (Major)		Subject 2 (Minor)	GE/ OE course	Vocational and Skill Enhancement Course (VSC) & SEC	Ability Enhancement Course/ VEC/IKS	OJT/FP/CEPCC, RP	Total Credits
	DSC	DSE						
3	Major 8		Minor 4	2	VSC-2-Major	AEC-2 MIL (Marathi/Hindi)	FP -2, CC-2	22
4	Major 8		Minor 4	2	SEC-2	AEC-2 MIL (Marathi/ Hindi)	CEP-2, CC-2	22
Total	16		8	4	4	4	8	44
Exit option: award of UG Diploma in Major with 88 credits and an additional 4 credit Core NSQF course/ Internship or Continue with Major and Minor								

SEMESTER III

Course Code	UNIT	TOPICS	Credits
RUSMJBOTO201	PLANT SCIENCE III (MAJOR)		
	I	Soil microbial interactions	03
	II	Cryptogamic Botany: Algae, Fungi and Bryophyta	
	III	Cytogenetics II	
RUSMJBOTO202	PLANT SCIENCE - IV (MAJOR + MINOR)		
	I	Anatomy II	03
	II	Developmental Botany I	
	III	Physiology I	
RUSMJBOTPO201	Practicals	Practical based on RUSMJBOTO201	01
RUSMJBOTPO202	Practicals	Practical based on RUSMJBOTO202	01
			08

SEMESTER IV

Course Code	UNIT	TOPICS	Credits
RUSMJBOTE211	INDIAN MEDICINAL SYSTEMS (MAJOR)		
	I	Indian System of medicine -I	03
	II	Indian system of medicine -II	
	III	Functional foods	
RUSMJBOTE212	PLANT SCIENCE V (MAJOR+MINOR)		
	I	Plant systematics II	03
	II	Environmental Botany- II	
	III	Pharmacognosy I	
RUSMJBOTPE211	Practicals	Practical based on RUSMJBOTE211	01
RUSMJBOTPE212	Practicals	Practical based on RUSMJBOTE212	01
			08

SEMESTER - III
Course Code: RUSMJBOTO201
(Core Course)
Course Title: Plant Diversity III
Academic year 2024 – 2025

COURSE OUTCOMES:

Upon successful completion of this course, learners will be able to;

COURSE OUTCOME	CO DESCRIPTION
CO 1	Describe the characteristics of bacteria, their growth and reproduction
CO 2	Demonstrate various bacterial culture techniques
CO 3	Explore Plant- Microbe interactions and sea weeds in the field of Agriculture.
CO 4	Outline the classification and life cycles of algae, fungi and bryophytes
CO 5	Evaluate the Cytological and Genetic effects of Deletions, Duplications, Inversions and Translocations and extra nuclear genetics
CO6	Apply the variations in chromosome number in crop improvement and evolution of aneuploids and euploids.
CO7	Perform experiments to analyze some parameters, record observations and derive inference of the topics mentioned above.

Detailed Syllabus

Course Code/Unit	Course/ Unit Title	Credits
RUSMJBOTO201	**Title: Plant Diversity III**	**Credits – 3**
UNIT I	**Soil microbial interactions**	
	Reproduction and Growth in Bacteria Nutritional types, Physical conditions for growth	
	Cultivation of Bacteria- Bacteriological Media, Sterilization Pure culture techniques, Cultural Characteristics of bacteria.	
	Plant- Microbe interactions- Rhizosphere and Phyllosphere microorganisms Plant growth promoting bacteria (PGPB) Root nodule associated bacteria- *Rhizobium*- infection process and the mutualist association, Actinorhizae Mycorrhiza	
UNIT II	**Cryptogamic Botany: Algae, Fungi and Bryophyta**	
	Structure, life cycle and systematic position of *Vaucheria* and *Sargassum*	
	Structure, life cycle and systematic position of *Aspergillus*	
	Plant Pathology - symptoms, causative organism, disease cycle and control measures of Powdery mildew and Late blight of Potato	
	Structure, life cycle and systematic position of *Anthoceros*	
UNIT III	**Cytogenetics II**	
	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- Chloroplast determines heredity - Plastid transmission in plants, Streptomycin resistance in *Chlamydomonas*. Male sterility in maize	

PRACTICALS		
RUSMJBOTPO201	**Plant Diversity III**	**Credit – 1**
1	Sterilization of glassware, preparation of media, slants and plates.	
2	Serial dilution of soil sample and plating.	
3	Slide burial technique for rhizoplane fungi.	
4	Cultivation and staining of *Rhizobium*	
5	Study of stages in the life cycle of *Vaucheria* and *Sargassum* from fresh/ preserved material and permanent slides	
6	Study of stages in the life cycle of *Aspergillus* and *Xylaria* from fresh/ preserved material and permanent slides.	
7	Study of stages in the life cycle of and *Anthoceros* from fresh/ preserved material and permanent slides.	
8	Study of chromosomal aberrations in tobacco water/ plant extract pretreated onion root tips.	
Assignments	Culturing of microalgae Extraction of phytochemicals from Seaweeds	

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SEMESTER – III

Course Code: RUSMJBOTO202
(Core Course)
Course Title: PLANT SCIENCE - IV
Academic year 2024 – 2025

COURSE OUTCOMES:

Upon successful completion of this course, learners will be able to;

COURSE OUTCOME	CO DESCRIPTION Students will be able to -
CO 1	Integrate the concepts of plant anatomy with respect to secondary growth, mechanical and conducting tissue systems and their role in adaptations.
CO 2	Apply the fundamentals of palynology in various areas of science.
CO 3	Express fundamental concepts of plant embryology
CO 4	Comprehend the photosynthetic process, the conversion of radiant energy and the diverse carbon fixation pathways.
CO 5	Explain the role of nutrients and nutritional deficiencies in plants.
CO 6	Perform experiments to analyze some parameters, record observations and derive inference of the topics mentioned above.

Detailed Syllabus

Course Code/Unit	Course/ Unit Title	Credits
RUSMJBOTO202	**PLANT SCIENCE IV**	**Credits – 3**
UNIT I	**ANATOMY II**	
	Normal secondary growth in dicotyledonous stem and root.	
	Growth rings, periderm, lenticels, tyloses	
	Mechanical tissue system and • Tissues providing mechanical strength and support and theirdisposition • I-girders in aerial and underground organs conducting tissue system	
	Study of ecological adaptations: Xerophytes and halophytes	
UNIT II	**DEVELOPMENTAL BOTANY I**	
	Palynology I: • Pollen morphology	
	Plant Embryology I: • Microsporogenesis– Structure of microsporangium, microsporogenesis and development of male gametophyte. • Megasporogenesis– Structure of megasporangium, megasporogenesis and development of female gametophyte	
UNIT III	**PHYSIOLOGY I**	

	Structures of carbohydrates: monosaccharides, oligosaccharides and polysaccharides.	
	Photosynthesis: Plant pigments and their interaction with light, Light reactions, photolysis of water, cyclic and non-cyclic photophosphorylation, carbon fixation phase (C_3, C_4 and CAM pathways), Photorespiration	
	Role of macronutrients and micronutrients in plants.	

PRACTICALS		
RUSMJBOTPO202		**Credit – 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 *Typha leaf, Salvia stem and Cyperus leaf.*	
3	Study of conducting tissues, Growth rings, periderm, lenticels, tyloses.	
4	Study of pollen morphology (NPC Analysis) of the following by Chitley's Method • *Hibiscus* • *Datura* • *Ocimum* • *Pancratium*	
5	Study of various stages of microsporogenesis, megasporogenesis with the help of permanent slides / photomicrographs	
6	Estimation of carbohydrates	
7	Study of Hill's reaction	
8	Separation of photosynthetic pigments using TLC.	
Assignments	Pollen study of different flowers other than mentioned above.	
	Study of ecological adaptations: Xerophytes and halophytes	
	Plant nutrient deficiency symptoms in crop plants.	

References:

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MODALITY OF ASSESSMENT

Discipline Specific Core Course (3 credits)

A) Internal Assessment(Theory)- 40%- 30 Marks

Sr No	Evaluation type	Marks
1	**Class Test**	**20**
2	**Project / Assignment / Presentation/ Case study**	**10**
	TOTAL	**30**

B) External Examination (Semester End)- 60%- 45 Marks

Semester End Theory Examination:

1. Duration – The duration for these examinations shall be of **1 hr 30min**
2. Theory question paper pattern:

Paper Pattern:

Question	Options	Marks	Questions Based on
Q.1	**Attempt ANY 3 out of 4**	**15**	**Unit I**
Q.2	**Attempt ANY 3 out of 4**	**15**	**Unit II**
Q.3	**Attempt ANY 3 out of 4**	**15**	**Unit III**
	TOTAL	**45**	

Practical Examination Pattern: Total Marks -25

SEMESTER END EXAMINATION	
Laboratory work	15
Field study	5
Journal	2
Practical participation	3
Total marks	**25**

PRACTICAL JOURNAL

The students are required to present **a duly certified journal** and a field notebook (applicable to the semester) 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.

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SEMESTER IV

Course Code: RUSMJBOTE211
(Core Course)
Course Title:INDIAN MEDICINAL SYSTEMS
Academic year 2024 - 2025

COURSE OUTCOMES :

Upon successful completion of this course, learners will be able to;

COURSE OUTCOME	CO DESCRIPTION Students will be able to -
CO 1	Explore the Pharmacoepias in relation to Ayush and the Philosophy of Ayurvedic principles - an ancient Indian Science.
CO 2	Comprehend the importance of various alternative systems of medicine and their significance in the current scenario.
CO 3	Evaluate the role and functional food in prevention and cure of human diseases.
CO4	Perform experiments to realise the nutritional properties of functional foods.

Detailed syllabus

Course Code/Unit	Course/ Unit Title	Credits -3
RUSMJBOTE211	**Title: INDIAN MEDICINAL SYSTEMS**	
UNIT I	**INDIAN SYSTEM OF MEDICINE – I**	
	AYUSH, Pharmacopeia, Principles of Ayurveda - Historical background: Ayurveda -a way of life	
	Philosophical background of Ayurveda Three Doshas, Dhatu, Agni, Rasa, Ahar, Ama, Prakruti and its types	
	Methods of drug preparation.	
UNIT II	**INDIAN SYSTEM OF MEDICINE – II**	
	Alternative systems of medicine: Principles and methods of drug preparation in Siddha Unani Homeopathy Aromatherapy Naturopathy Yoga	
UNIT III	**FUNCTIONAL FOOD**	
	Definition according to FDA, concept, categories and scientific basis of	

	functional food.	
	Role of functional food in health and disease.	
	Garlic, Carrot, Citrus, Jackfruit, *Moringa* (Drumstick), Turmeric, Dill, Cucurbits as functional food.	

PRACTICALS		
RUSMJBOTPE211		**Credit – 1**
1	Powder analysis of amla, harda and beheda with reference to Indian Pharmacopeia	
2	Identification of Prakruti	
3	Study of functional food - Garlic, Carrot, Citrus (lemon/orange), Jackfruit, Drumstick, Turmeric, Dill, Cucurbits (cucumber, ash gourd).	
4	Estimation of Vitamin C from lemon.	
5	Chromatographic separation of carotenoids from carrot.	
6	Estimation of Fibre and Calcium content of *Moringa* leaf/ fruit powder	
7	Coefficient of correlation	
8	Visit to Ayurvedic College / Yoga Institute / Spirulina Farm	
Assignments	Estimation of Vitamin C from functional food other than mentioned above.	
	Chromatographic separation of carotenoids other than mentioned above.	
	Fibre and Calcium content of functional food other than mentioned above	

References:

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SEMESTER - IV
Course Code: RUSMJBOTE212
(Core Course)
Course Title: PLANT SCIENCE - V
Academic year 2024 – 2025

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Apply the principles underlying Bentham and Hooker's classification and identify plants from the prescribed families.
CO 2	Associate the principles governing ecology and environmental biology with respect to biogeochemical cycles, edaphic factors, and community ecology.
CO 3	Explain the fundamental concepts of phytochemistry in relation to secondary metabolites.
CO 4	Identify adulterants in crude drugs.
CO 5	Identify plants from prescribed families, conduct experiments in ecological studies and isolate few secondary metabolites.

Upon successful completion of this course, learners will be able to;

Course Code/Unit	Course/ Unit Title	Credits -3
RUSMJBOTE212	**Title: PLANT SCIENCE V**	
UNIT I	**PLANT SYSTEMATICS - II**	
	Systematics: Categories and taxonomic hierarchy; Plant Nomenclature, John Hutchinsons system of classification	
	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: • Brassicaceae • Capparidaceae • Myrtaceae • Combretaceae • Solanaceae • Convolvulaceae • Euphorbiaceae • Palmae	
UNIT II	**ENVIRONMENTAL BOTANY – II**	
	Edaphic 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 and Social Impact Assessment (ESIA)	

UNIT III	PHARMACOGNOSY – I	
	Concept of primary and secondary metabolites	
	Study of secondary metabolites: Sources, properties, extraction, active constituents and therapeutic uses of alkaloids, glycosides, phenolic compounds (tannins, flavonoids), saponins and terpenoids (volatile oils).	
	Classification of crude drugs, drug adulteration.	

PRACTICALS		
RUSMJBOTPE212		**Credit – 1**
1	Study of one plant from each family prescribed for theory: • Brassicaceae • Capparidaceae • Myrtaceae • Combretaceae • Solanaceae • Convolvulaceae • Euphorbiaceae • Palmae	
2	Study of the working of the following Ecological Instruments- Soil thermometer, Wind anemometer.	
3	Mechanical analysis of soil by the sieve method and pH of soil.	
4	Quantitative estimation of organic matter of the soil by soil testing kit.	
5	Study of vegetation by the list quadrat method.-on field – Assignment	
6	Tests for secondary metabolites: • Tests for alkaloids from *Strychnos* (seeds) / *Holarhhoena* (bark) • Tests for glycosides from *Glycyrhhiza* rhizome/*Aloe* leaf • Tests for tannins from *Terminalia arjuna bark* / *Acacia catechu.* • Tests for flavonoids from *Momordica charantia/ Clitorea flowers* • Tests for saponins from *Sapindus laurifolius/ Trigonella foenum- graecum*	
7	Study of Stomatal index (use of micrometer for measurement of size of stoma)	
8	Study of vein islet number	
9	Study of drug adulterants in black pepper seeds, cinnamon bark, turmeric powder, chilli powder)	
Assignments	Preparation of herbarium and wet preservation technique.	
	Quadrat/ Transect study.	
	Tests for secondary metabolites / adulterants from plants other than mentioned above.	

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MODALITY OF ASSESSMENT

Discipline Specific Core Course (3 credits)

C) Internal Assessment(Theory)- 40%- 30 Marks

Sr No	Evaluation type	Marks
1	**Class Test**	**20**
2	**Project / Assignment / Presentation/ Case study**	**10**
	TOTAL	**30**

D) External Examination (Semester End)- 60%- 45 Marks

Semester End Theory Examination:

3. Duration – The duration for these examinations shall be of **1 hr 30min**
4. Theory question paper pattern:

Paper Pattern:

Question	Options	Marks	Questions Based on
Q.1	**Attempt ANY 3 out of 4**	**15**	**Unit I**
Q.2	**Attempt ANY 3 out of 4**	**15**	**Unit II**
Q.3	**Attempt ANY 3 out of 4**	**15**	**Unit III**
	TOTAL	**45**	

Practical Examination Pattern: Total Marks -25

SEMESTER END EXAMINATION	
Laboratory work	15
Field study	5
Journal	2
Practical participation	3
Total marks	**25**

PRACTICAL JOURNAL

The students are required to present **duly certified journal** and a field notebook (applicable to the semester) 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.

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