Resolution No.: AC/II(21-22).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)

(Credit Based Semester and Grading System for the academic year 2021–2022)

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.

PROGRAM OUTCOMES

PO	PO Description **A student completing Bachelor's Degree in Science program will be able to:**
PO 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.
PO 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences
PO 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
PO 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
PO 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.
PO 6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
PO 7	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.
PO 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 SPECIFIC OUTCOMES

PSO	PSO Description A student completing Bachelor's Degree in Science program in the subject of Botany will be able to:
PSO 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
PSO 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.
PSO 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.
PSO 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.
PSO 5	Gain knowledge about laws of inheritance, various genetic interactions, chromosomal aberrations, multiple alleles and mutations.
PSO 6	Analyze morphological and anatomical plant structures in the context of metabolic /physiological functions of plants, including embryological and palynological aspects
PSO 7	Apply ethnobotanical aspects and medicinal, dietary and cosmetic uses of plants with special reference to phytochemistry and usage as mentioned in different Pharmacoepia
PSO 8	Acquire the skills in handling scientific instruments, planning and performing laboratory experiments and application of suitable statistical tools.
PSO 9	Understand the finer aspects of emerging areas such as Molecular biology and Bioinformatics.
PSO 10	Develop practical skills in laboratory techniques in various fields of botany along with collection and interpretation of biological materials
PSO 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.

PROGRAM OUTLINE

YEAR	SEM	COURSE CODE	COURSE TITLE	CREDITS
F Y	I	**RUSBOT 101**	**PLANT DIVERSITY- I**	
		I	Microbes and Algae	**02**
		II	Fungi	
		III	Bryophyta	
		RUSBOT 102	**FORM AND FUNCTION- I**	
		I	Cell biology	**02**
		II	Ecology	
		III	Genetics	
			Practicals	
		RUSBOTP 101,102	Plant Diversity -I, Form and Function- I (Practicals I and II)	**02**
	II	**RUSBOT 201**	**PLANT DIVERSITY- II**	
		I	Pteridophytes	**02**
		II	Gymnosperms	
		III	Angiosperms	
		RUSBOT 202	**FORM AND FUNCTION – II**	**02**
		I	Anatomy	
		II	Physiology	
		III	Horticulture and Medicinal Botany	
			Practicals	
		RUSBOTP 201,202	Plant Diversity - II, Form and Function- II (Practicals I and II)	**02**

	VI	II	Angiosperms II	
		III	Embryology	
		IV	Plant micro techniques	
		RUSBOT 603	**FORM AND FUNCTION VI**	
		I	Physiology II	**2.5**
		II	Genetics	
		III	Cosmetology	
		IV	Post-Harvest Technology	
		RUSBOT 604	**CURRENT TRENDS IN PLANT SCIENCES IV**	
		I	Economic Botany	**2.5**
		II	Plant Geography and Environmental Botany	
		III	Instrumentation	
		IV	Research methodology III	
		RUSBOTP 601, 602, 603,604	**Practical based on all the four courses in theory**	**06**

Resolution No.: AC/II(21-22).2.RUS4

S.P. Mandali's

RAMNARAIN RUIA AUTONOMOUS COLLEGE

Syllabus for: F. Y

Program: B. Sc.

Program Code: Botany (RUSBOT)

(Credit Based Semester and Grading System for the academic year 2021–2022)

SEMESTER-I

Course Code	UNIT	TOPICS	Credits
RUSBOT 101	**PLANT DIVERSITY I**		
	I	Microbes and Algae	**02**
	II	Fungi	
	III	Bryophyta	
RUSBOT 102	**FORM AND FUNCTION I**		
	I	Cell biology	**02**
	II	Ecology	
	III	Genetics	
RUSBOTP 101, 102, 303	**Practicals**	**Practical based on all the two courses in theory**	**02**
			06

SEMESTER- II

Course Code	UNIT	TOPICS	Credits
RUSBOT 201	**PLANT DIVERSITY II**		
	I	Pteridophytes	**02**
	II	Gymnosperms	
	III	Angiosperms	
RUSBOT 202	**FORM AND FUNCTION II**		
	I	Anatomy	**02**
	II	Physiology	
	III	Horticulture and Medicinal Botany	
RUSBOTP 201, 202	**Practicals**	**Practical based on all the two courses in theory**	**02**
			06

SEMESTER- I

Course Code: RUSBOT 101

Course Title: Plant Diversity- I

Academic year 2021 - 22

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

COURSE OUTCOME	CO DESCRIPTION
CO 1	Understand the fundamental concepts /diversity related to different Microorganisms
CO 2	Develop an understanding of fungi and appreciate their adaptive strategies
CO 3	Develop an understanding of fungi and appreciate their adaptive strategies
CO 4	Evaluate the significance of fungi and its different types
CO 5	Develop critical understanding about bryophytes and the life cycle of *Riccia*
CO 6	Analyze the anatomy and reproduction of *Riccia*

Detailed Syllabus

Course Code/Unit	Course/ Unit Title	Credits/Lectures
RUSBOT 101	**Plant Diversity I**	**Credits-2**
UNIT I	**Microbes and Algae**	**Lectures-15**
	Introduction to Microbiology: Microorganisms in the living World, Groups of Microorganisms- Viruses, Bacteria,Rickettsiae, Mycoplasma, algae, Archaebacterium, Actinomycetes, fungi, Protozoa. Distribution of Microorganisms in Nature	
	Major Characteristics of Bacteria, Microscopic examination of bacteria- Basic principles of staining	
	Outline of Classification according to G.M. Smith and general characters of Cyanophyta and Chlorophyta	
	Life cycle and systematic position of *Nostoc* and *Spirogyra*.	
	Economic importance of algae with reference to biofuels, food and agar.	
UNIT II	**Fungi**	**Lectures-15**
	Outline of Classification according to G. M. Smith	
	General characters of Phycomycetes.	
	Structure, lifecycle and systematic position of *Rhizopus* and *Albugo*	
	Modes of nutrition in Fungi (Saprophytism, predation and Parasitism).	
	Economic importance of Fungi.	

UNIT III	**Bryophyta**	**Lectures-15**
	Outline of classification according to G.M. Smith	
	General characters and range of thallus organization in Hepaticae	
	Structure, life cycle and systematic position of *Riccia*.	
	Economic importance of Bryophyta	

PRACTICALS

RUSBOTP 101	**Plant Diversity I**	**Credit – 1**
1	To study bacteria using Gram staining method	
2	Study of viruses	
3	Study of stages in the life cycle of *Nostoc* from fresh/ preserved material and permanent slides	
4	Study of stages in the life cycle of *Spirogyra* from fresh/ preserved material and permanent slides	
5	Economic importance of algae: *Ulva* (food), *Scenedesmus and Chlorella* (Biofuel), *Spirulina*(Neutraceutical), *Gelidium* (Agar)	
6	Study of stages in the life cycle of *Rhizopus* from fresh/ preserved material and permanent slides	
7	Study of stages in the life cycle of *Albugo* from material and permanent slides	
8	Economic importance of Fungi: Mushroom, Yeast, *Ganoderma*, *Penicillium*, *Aspergillus*, mycorrhiza- AM .	
9	Study of stages in the life cycle of *Riccia* from fresh/ preserved material.	

References:

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Course Code: RUSBOT 102

Course Title: Form and function – I

Academic year 2021 - 2022

COURSE OUTCOMES:

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

COURSE OUTCOME	CO DESCRIPTION
CO 1	Understand chemical composition and structure of cell wall and membrane
CO 2	Explain the ultra structure and functions of the cell organelles
CO 3	Understand the basic principles of plant ecology and examine the structure and functions of eco-system
CO 4	Critically analyze climate change, biodiversity and its conservation
CO 5	Gain conceptual understanding of Mendelian Genetics, genetic basis of loci and alleles and sex linked inheritance

Detailed Syllabus

Course Code/Unit	Course/ Unit Title	Credits/ Lectures
RUSBOT 102	**Title: Form and Function- I**	**Credits – 2**
UNIT I	**Cell Biology**	**Lectures-15**
	Prokaryotic and eukaryotic cell structure , General structure of plant cell: cell wall, Plasma membrane (bilayer lipid structure, fluid mosaic model) Mitosis	
	Ultra structure and functions of the following cell organelles: Endoplasmic reticulum and Chloroplast.	
UNIT II	**Environmental Biology**	**Lectures-15**
	Types of ecosystems: aquatic and terrestrial.	
	Effect of climate change on ecosystems, role of IPCCC,	
	Biodiversity: types of biodiversity, endemics and wides	
	Biodiversity Hotspots and PAN	
	Conservation Biology*: ex situ* and *in situ* methods, People's Biodiversity Register,	
	The Biological Diversity Act, 2002; Convention on Biological Diversity	
UNIT III	**Genetics**	**Lectures-15**
	Phenotype/Genotype, Mendelian Genetics- monohybrid, dihybrid ratios, test cross and back cross.	
	Epistatic and non epistatic interactions; multiple alleles.	
	Sex determination	

	Chromosomal Methods: heterogametic males and heterogametic females. Sex determination in monoecious and dioecious plants. Genic Balance Theory of sex determination in *Drosophila*, Lyon's Hypothesis of X chromosome inactivation. **Sex linked inheritance-** eye colour in *Drosophila*, Haemophilia, colour blindness **Sex influenced inheritance**- baldness in man	

PRACTICALS		
RUSBOTP 102	**Form and Function- I**	**Credit – 1**
1	Examining various stages of mitosis in root tip cells (*Allium*)	
2	Cell inclusions**:** Starch grains (Potato and Rice); Aleurone layer, Maize	
3	Cystolith (*Ficus*); Raphides (*Pistia*); Sphaeraphides (*Opuntia*).	
4	Identification of cell organelles with the help of photomicrograph Plastids: Chloroplast, Amyloplast, Endoplasmic reticulum and Nucleus.	
5	Identification of plants adapted to different environmental conditions and internal structure adaptations: Hydrophytes free floating (*Pistia /Eichhornia*), Rooted floating (*Nymphaea*), submerged (*Hydrilla),* Mesophytes (any common plant), Hygrophytes (*Typha, Cyperus*), Epiphytes (Orchid aerial root)	
6	Calculation of mean, median and mode.	
7	Calculation of Standard deviation.	
8	Frequency distribution, graphical representation of data- frequency polygon, histogram, pie chart.	
9	Study of Karyotype – Human and *Allium cepa*	

References

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MODALITY OF ASSESSMENT

Theory Examination Pattern:

Internal Assessment - 40% :40 marks.

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

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:

Internal Examination:

Heading	Practical
Journal	05
Practical participation	05
Practical/ Field Report/ Presentation	10
Total	20

External (Semester end practical examination):

Particulars	Practical
Laboratory work and/or *Viva voce*	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- I

Course	101			102			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Practicals	20	30	50	20	30	50	100

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Semester-II
Course Code: RUSBOT 201

Course Title: Plant Diversity- II

Academic year 2021 - 22

COURSE OUTCOMES:

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

COURSE OUTCOME	CO DESCRIPTION
CO 1	Understand the basic principles of classification and salient features of Pteridophytes, Gymnosperms, Angiosperms and their economic importance.
CO 2	Analyze the anatomy and reproduction of Pteridophytes and Gymnosperms.
CO 3	Understand the principles underlying Bentham & Hooker's system of classification and identify plants from prescribed families.
CO 4	Gain knowledge about novel groups of plants

Detailed Syllabus

Course Code/Unit	Course/ Unit Title	Credits/ Lectures
RUSBOT 201	**Title: Plant Diversity – II**	**Credits – 2**
UNIT I	**Pteridophytes**	**Lectures-15**
1	Salient features and classification of Psilophyta and Lepidophyta upto orders according to G. M. Smith's classification.	
2	Structure life cycle, systematic position and alternation of generations in *Selaginella.*	
3	Stelar evolution.	
4	Economic importance and propagation of ferns.	
UNIT II	**Gymnosperms**	**Lectures-15**
1	General characters, Outline of classification according to C.J. Chamberlin	
2	Structure life cycle systematic position and alternation of generations in *Cycas.*	
3	Economic importance of Gymnosperms.	
4	Geological time scale.	
UNIT III	**Angiosperms**	**Lectures-15**
1	Definition of taxonomy, systematic botany, concepts of taxonomy, aims of taxonomy.	

2	Study of following families: Malvaceae, Leguminosae: Caesalpinaceae, Papilionaceae, Mimosae, Solanaceae, Convolvulaceae, Amaryllidaceae.	
3	Secret life of plants: Insectivorous and parasitic plants	
PRACTICALS		
RUSBOTP 201	**Plant Diversity – II**	**Credits – 1**
1	Study of stages in the life cycle of *Selaginella*, T.S. of rachis.	
2	T.S. of *Selaginella* stem	
3	Stelar evolution with the help of permanent slides, Protostele, haplostele , actinostele, plectostele, mixed protostele, siphonostele, ectophloic, amphiphloic, dictyostele, eustele and atactostele.	
4	*Cycas*: T.S of leaflet (*Cycas* pinna) microsporophyll, megasporophyll, coralloid root, microspore, L.S. of ovule of *Cycas*– all specimens to be shown.	
5	Economic importance of Gymnosperms: *Pinus* (turpentine, wood, seeds)	
6	Leaf: simple leaf, types of compound leaves, Incisions of leaf, leaf base, apex, margins and leaf shapes. Modifications of leaf: spine, tendril, hooks, phyllode, pitcher, *Drosera* or insectivorous plants.	
7	Inflorescence: Racemose: simple raceme, spike, catkin, corymb, umbel, spadix, capitulum. Cymose, monochasial, dichasial, polychasial. Compound: Panicle, cyathium, verticellaster, hypanthodium.	
8	Study of following families: Malvaceae, Leguminosae: Caesalpinaceae and Papilionaceae, Mimosae, Solanaceae, Convolvulaceae, Amaryllidaceae. Pollen morphology of the abovesaid families. Morphological peculiarities, palynological studies and economic importance of the members of these families.	
9	Identification and study of insectivorous and parasitic plants: *Drosera, Nepenthes, Utricularia,* Venus fly trap*, Cuscuta, Loranthus, Viscum, Orobanche*	
10	Propagation of ferns	

References:

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Course Code: RUSBOT 202
Course Title: Form and function - II
Academic year 2021 – 22

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

COURSE OUTCOME	CO DESCRIPTION
CO 1	Develop an understanding of concepts and fundamentals of plant anatomy.
CO 2	Evaluate the adaptive and protective systems of plants.
CO 3	Explain the significance of photosynthesis and nutritional requirements of plants.
CO 4	Gain knowledge about various branches of horticulture.
CO 5	Critically evaluate different cultivation practices.
CO 6	Recognize basic medicinal plants/ functional foods and know their applications.
CO 7	Understand the basic concept of primary and secondary metabolites.

Detailed Syllabus

Course Code/Unit	Course/ Unit Title	Credits/Lectures
RUSBOT 202	**Title: Form and function – II**	**Credits – 2**
UNIT I	**Anatomy**	**Lectures-15**
	Simple tissues, complex tissues, meristematic tissues, permanent tissues, wall ingrowths and transfer cells, adcrustation and incrustation, ergastic substances.	
	Primary structure of dicot and monocot root, stem and leaf (Kranz anatomy).	
	Epidermal tissue system: types of hair, monocot and dicot stomata.	
UNIT II	**Physiology**	**Lectures-15**
	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).	
	Role of macronutrients and micronutrients in plants.	
	Structures of amino acids.	
UNIT III	**Horticulture and Medicinal Botany**	**Lectures-15**
	Introduction to horticulture: Definition, importance and objectives of Horticulture, branches of Horticulture, Pomology, Olericulture, Landscape Gardening, Nurseries and development	
	Propagation practices: By Seeds: Advantages and disadvantages, method of seed propagation**,** Seed treatment to control diseases, Concept of microgreens, Health Benefits	

	Artificial methods of plant propagation Cutting– Stem cutting and leaf cuttings.	
	Medicinal botany: Concept of primary and secondary metabolites, difference between primary and secondary metabolites.	
	Grandma's pouch: Following plants have to be respect to botanical source, part of the plant used, active constituents present and medicinal uses: *Ocimum sanctum, Justicia adhatoda, Zingiber officinale, Curcuma longa, Santalum album, Aloe vera*.	
	Functional Foods : Garlic, Carrot, Citrus, Jackfruit, Drumstick and Dill	
PRACTICALS		
RUSBOTP 202	**Form and function – II**	**Credit – 1**
1	Primary structure of dicot and monocot root.	
2	Primary structure of dicot and monocot stem.	
3	Study of dicot and monocot stomata.	
4	Epidermal outgrowths: with the help of mountings: Unicellular: *Gossypium*/Radish Multicellular: *Lantana*/Sunflower Glandular: *Drosera* and Stinging: *Urtica* – only identification with permanent slides. Peltate: *Thespesia* Stellate: *Erythrina*/ *Sida acuta*/ *Solanum*/ *Helecteris* T-shaped: *Avicennia*	
5	Separation of chlorophyll pigments by strip paper chromatography.	
6	Separation of amino acids using strip paper chromatography.	
7	Extraction of anthocyanin pigments and their use as a pH indicator.	
8	Tests for alkaloids and tannins, chromatographic separation of alkaloids.	
9	Identification of plants/plant parts found in Grandma's Pouch.	
10	Identification of functional foods.	
11	Seed germination and calculate the percentage germination	
12	Method of growing microgreens.	
13	Plant propagation by stem cutting (hard wood), leaf cutting.	
14	Terrarium/Bottle garden/ Dish garden	

Note: One field excursions for habitat studies are compulsory.
Field work of not less than eight hours duration is equivalent to one period per week for a batch of 15 students.

References:

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MODALITY OF ASSESSMENT

Theory Examination Pattern:

Internal Assessment - 40% :40 marks.

Sr No	Evaluation type	Marks
1	Assignment / Field Visit/ Submission/Case study/ Survey report/ 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)	20

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:

Internal Examination:

Heading	Practical
Journal	05
Practical participation	05
Practical/ Field Report/ Presentation	10
Total	20

External (Semester end practical examination):

Particulars	Practical
Laboratory work and/or *Viva voce*	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- II

Course	201			202			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	**40**	**60**	**100**	**40**	**60**	**100**	**200**
Practicals	**20**	**30**	**50**	**20**	**30**	**50**	**100**

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