Resolution No.: AC/I(21-22).2(II).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 2022–2023)

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	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.
GA 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.
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.

S.P. Mandali's

RAMNARAIN RUIA AUTONOMOUS COLLEGE

Syllabus for: F. Y

Program: B. Sc.

Program Code: Botany (RUSBOT)

(Choice Based Credit System for the Academic year 2022–2023)

SEMESTER-I

Course Code (Core Course)	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	**Practicals**	**Practical based on RUSBOT101& 102**	**02**
			06

SEMESTER- II

Course Code (Core Course)	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	**Practicals**	**Practical based on RUSBOT 201 & 202**	**02**
			06

SEMESTER- I

Course Code: RUSBOT 101
Course Title: Plant Diversity- I
(Core Course)

Academic year 2022 - 23

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

COURSE OUTCOME	CO DESCRIPTION
CO 1	Describe the fundamental concepts /diversity related to different Microorganisms
CO 2	Outline the classification of Algae and interpret their Industrial applications
CO 3	Classify fungi and appreciate their adaptive strategies
CO 4	Outline the classification of Bryophytes and explain the life cycle of *Riccia* and its economic importance
CO 5	Illustrate the significance of fungi and its different types
CO6	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*.	
	Industrial applications of algae with reference to nutraceutical, pharmaceutical, biofuels, food , biofertilizers , 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).	

	Industrial applications of Fungi in the field of • Medicine, Agriculture , brewing & baking, Food(edible and poisonous mushrooms), Colorant, human and plant pathogens • Association of fungi with Algae, roots of higher plants, leaf cutter ants, termites, bioluminescent fungi • Spoilage of food and essential commodities, diseases	

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*.	
	• Role of bryophytes in: Plant succession and Pollution Monitoring • Economic importance of bryophytes with special reference to Sphagnum	
PRACTICAS		
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 andChlorella* (Biofuel), *Spirulina*(Nutraceutical), *Gelidium* (Agar), Extraction of nutraceutical from *Spirulina*	
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.	
10	Preparation of Jelly/ Pudding / Custard using Agar- Agar. Herbarium preparation of algae	
11	Conservation/ Culturing of at least one species of alga and bryophyte in the botanical garden	

References:

- Pelczar M. J, Chan E.C., Krieg, N. R.1993. Microbiology by Pelczar Chan and Krieg 5th ed.
- Brodie J. and Lewis J.2007. Unravelling the algae: the past, present and future of algal systematics. CRC press, New York, pp. 335.
- Bellinger E.G. and Sigee D.C. 2010. Freshwater algae: Identification and use as bioindicators, Willey-Blackwell, UK, pp. 271.
- Desikachary T.V. 1959. Cyanophyta. ICAR, New Delhi.
- Gangulee, Das and Dutta. 2006.College Botany Volume I and II. Central Education enterprises
- Graham L.E. and Wilcox L.W. 2000. Algae. Penticce-Hall,Inc, pp. 64
- Krishnamurthy V. 2000. Algae of India and neighboring countries Indian Chlorophycota, Oxford & IBH, New Delhi.
- Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
- Lee R.E. 2008. Phycology. Cambridge University Press, pp.547.
- Prescott G.W.1969. The algae.
- Smith G.M.1950. The fresh water algae of the United States, Mc-Graw Hill NewYork.
- Srinivasan K.S. 1969. Phycologia India. Vol. I & II, BSI, Calcutta.
- Vashista B.R, Sinha A.K and Singh V.P. 2005. Botany for degree students –Algae, S. Chand's Publication.
- Ainsworth, Sussman and Sparrow. 1973. The fungi. Vol IV A & IV B. AcademicPress.

Fungi:

- Alexopolous C.J., Mims C.W. and Blackwell M.1999.4th Edition. IntroductoryMycology. Willey, New York, Alford R.A.

- Deacon J.W.2006. Fungal Biology. 4th Edition. Blackwell Publishing, ISBN.1405130660.
- Mehrotra R.S. and Aneja K.R. 1990. An introduction to mycology. New AgePublishers, ISBN 8122400892.
- Webster J. and Roland W. 2007. Introduction to fungi (3rd Edition) CambridgeUniversity Press, 978-0-521-80739-5.
- Dube H.C. 2004. An Introduction to fungi. Vikas Publishers.
- Sharma O.P. 2010. A text book of fungi. S.Chand's Publication.
- Vashista B.R and Sinha A.K. 2008. Botany for degree students – Fungi. S.Chand's Publication.

Bryophytes:

- Cavers F.1976. The interrelationships of the Bryophytes. S.R. Technic, AshokRajpath, Patna.
- Chopra R.N. and Kumar P.K.1988. Biology of Bryophytes. John Wiley & Sons,New York, NY.
- Parihar N.S.1980. Bryophytes: An Introduction to Embryophyta. Vol I. CentralBook Depot, Allahabad.
- Watson E.V. 1971. Structure and Life of Bryophytes.3rd Edition. HutchinsonUniversity Library, London.

Course Code: RUSBOT 102
Course Title: Form and function – I
(Core Course)
Academic year 2022 - 2023

COURSE OUTCOMES:

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

COURSE OUTCOME	CO DESCRIPTION
CO 1	Outline the chemical composition , structure and functions of the cell organelles
CO 2	Interpret the structure and functions of eco-systems studied
CO 3	Apply the principles of microscopy and operate it
CO 4	Analyze climate change, biodiversity and its conservation
CO 5	Evaluate 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.	
	Techniques in Biology : Principles of microscopy- Light Microscopy, Phase contrast microscopy	
UNIT II	**Environmental Biology**	**Lectures-15**
	Types of ecosystems: aquatic ,terrestrial and Mangrove ecosystem	
	Effect of climate change on ecosystems, role of IPCC,	
	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	
	Environmental heritage : Types of heritage, Sustainable heritage management	
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.	Introduction on handling, use and maintenance of microscopes and other laboratory equipments	
2.	Common stains, mountants (Water, Glycerine, DPX, Lactophenol) and temporary slide Preparation	
3.	Examining various stages of mitosis in root tip cells (*Allium*)	
4.	Cell inclusions**:** Starch grains (Potato and Rice); Aleurone layer, Maize	
5.	Cystolith (*Ficus*); Raphides (*Pistia*); Sphaeraphides (*Opuntia*).	
6.	Identification of cell organelles with the help of photomicrograph Plastids: Chloroplast, Amyloplast, Endoplasmic reticulum and Nucleus.	
7.	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,*), Epiphytes (Orchid aerial root), Halophytes(Avicennia, Salvadora)	
8.	Calculation of mean, median and mode, Calculation of Standard deviation	
9.	Frequency distribution, graphical representation of data- frequency polygon, histogram, pie chart.	
10.	Study of Karyotype – Human and *Allium cepa*	
11.	Preparing Biodiversity register for F North Ward	

References

- Griffith Freeman and Company. 2000. An introduction to Genetic analysis.
- Brown TA. 2006. Gene Cloning and DNA Analysis. 5th Edition.
- Reece RJ, Wiley. 2004. Analysis of Genes and Genomes.
- Gupta, P.K. 1999. A Text Book of Cell and Molecular Biology. Rastogi Publication, Meerut. India.
- Verma, P. S., V. K. Agrawal. 2008. Cell Biology, Genetics, Molecular biology, Evolution and Ecology.3rd edition S. Chand & co. New Delhi, India.
- De Robertis and De Robertis. 8th Edition. 2017. Cell and Molecular Biology.
- Harvey et al. New York: W. H. Freeman. 2000. Molecular Cell Biology, 4th edition. ISBN-10: 0-7167-3136-3
- Watson, J. D. 2004. Molecular Biology of Gene. 5th Edition. Pearson Benjamin Cummings.
- Kothari, A. 1997. Understanding Biodiversity: Life Sustainability and Equity Orient Longman.
- Mukherjee B. Environmental Biology, Tata McGraw Hill Publishing Co. Ltd. New Delhi, India.
- Odum E. P 1983. Basic Ecology, Saunders, Philadelphia.

- Sharma, P.D. Ecology and Environment, Rastogi publication, Meerut, India.
- Purohit, S.S. and R. Ranjan. Ecology and Environmental Pollution, Agro-Bios Publishers, Jodhpur, India.

- Agrawal, K.C. 1996. Environmental Biology. Agro-Botanical Publisher, Bikaner India
- Heywood, V.H. and Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press, Cambridge.
- Hill, M. K. 1997. Understanding Environmental Pollution, Cambridge University Press.

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 toanswerquestions)/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**

x 0 x

Semester-II
Course Code: RUSBOT 201
Course Title: Plant Diversity- II
(Core Course)

Academic year 2022 - 23

COURSE OUTCOMES:

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

COURSE OUTCOME	CO DESCRIPTION
CO 1	Outline the classification and salient features of Pteridophytes, Gymnosperms and Angiosperms
CO 2	Associate the principles underlying Bentham & Hooker's system of classification
CO 3	Identify plants from prescribed families
CO 4	Apply the ecological and economic importance of Pteridophytes, Gymnosperms and Angiosperms in economic development
CO 5	Differentiate the anatomy and reproduction of Pteridophytes and Gymnosperms.
CO 6	Evaluate the secret life of novel groups of plants(Insectivorous and parasitic 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	Ecological and Economic importance of Pteridophytes(food, medicine, in Agriculture) , Scope of ferns in horticulture and economic development	
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 with reference to Wood, Resins, Essential oils, and Drugs.	
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 above said 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	Ornamental pteridophytes and Gymnosperms, Propagation of ferns	
	Field visit	

References:

- Sporne K.R.1986. The morphology of Pteridophytes. Hutchinson UniversityLibrary, London.
- Stewart W.N. and Rothwell G.W. 2005. Paleobotany and the Evolution of Plants.2nd Edition. Cambridge University Press.
- Arnold A.C. 2005. An Introduction to Paleobotany Agrobios, Jodhpur, India.
- Chamberlain C.J. 1998. Gymnosperms: Structure and evolution. CBS Publishers, New Delhi.
- Pant D.D. 2003. Cycas and allied Cycadophytes, BSIP, Publications.
- Sharma O.P. 2002. Gymnosperms, PragatiPrakashan, Meerut.
- Siddiqui, K.A. 2002. Elements of Palaeobotany, KitabMahal, Allahabad.
- Bhatnagar, S.P. and Moitra A. 1996. Gymnosperms, New Age International Pvt. Ltd., New Delhi
- Naik V. N.1994. Taxonomy of Angiosperms Tata McGraw Hill PublishingCompany.New Delhi.

- Dutta. S. C. 1988. Systematic Botany. Wiley Eastern Ltd. New Delhi.
- Gangulee, Das and Datta. 2002.College Botany, Vol. I., New Central Book Agency, Kolkata
- Singh V. and Jain D. K. 2010. Taxonomy of Angiosperms. Rastogy Publications Meerut.

Course Code: RUSBOT 202
Course Title: Form and function - II
(Core Course)
Academic year 2022 – 23

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

COURSE OUTCOME	CO DESCRIPTION
CO 1	Outline the concepts and fundamentals of plant anatomy
CO 2	Interpret the adaptive and protective systems of plants.
CO 3	Apply the significance of photosynthesis and nutritional requirements of plants
CO 4	Implement various cultivation practices for plant propagation
CO 5	Compare the active constituents in medicinal plants
CO 6	Formulate home remedies for various ailments using grandmas pouch

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	
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 & functional foods	
10	Seed germination and calculate the percentage germination	
11	Method of growing microgreens.	
12	Plant propagation by stem cutting (hard wood), leaf cutting.	
13	Preparation of 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:

- Pandey. B. P. 2007. Plant Anatomy. S. Chand and Comp. Ltd. New Delhi.
- Esau K. 1993. Plant Anatomy. Wiley Eastern Ltd. New Delhi.
- Eames A.J. 1961 Morphology of the angiosperms. Mc. Graw Hill, New York.
- Wallis. T.E. 2014. Text books of pharmacognosy. CBS publishers and distributor New Delhi.
- Pathak, Khatri, Pathak. 2003. Fundamentals of plant pathology. Agrobios Ltd.
- Mehrotra, R.S. 1991. Plant Pathology. Tata McGraw Hill Company, Delhi.

- PandeyB.P.2009. Plant Pathology, S.Chand Co.
- Noggle and Fritz. 2002. Introduction to Plant Physiology. Prentice Hall Publisher.
- Verma, V. 2007. Text Book Of Plant Physiology. Ane Books India, New Delhi.
- Nobel, P.S. 2009. Physicochemical and Environmental Plant Physiology.4th edition. Academic Press, UK
- Taiz, L. and Zeiger, E. 2006. Plant Physiology.4th Edition. Sinnauers Associates. Saunders land, Massachusetts, USA.
- Salisbury F.B. and Ross C.B. 2005. Plant Physiology.5th Edition. WadsworthPublishing Co. Belmont CA.
- HelgiOPik, Stephen A. Rolfe, Arthur J. Willis. 2005. The Physiology of FloweringPlants, Cambridge University Press, UK.
- Kirkham, M.B. 2004. Principles of Soil and Plant Water Relations. Elsevier, Amsterdam, Netherlands.
- Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. 1997. Plant Metabolism. 2nd Edition. Longman Group, U.K.
- Fitter, A. and Hay, R.K.M. 2001. Environmental Physiology of Plants. Academic Press, UK.
- Press, M.C., Barker, M.G., and Scholes, J.D. 2000. Physiological Plant Ecology, British Ecological Society Symposium, Volume 39, Blackwell Science, UK.
- Crusess, W. B.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition,Pub: Agrobios India
- Manay, S. and Shadaksharaswami, M.2004. Foods: Facts and Principles, New Age Publishers
- Acquaah G. (2002). Horticulture: Principles and Practices. Blackwell Publ.
- Peter K. V. (2009). Basics of Horticulture. New India Publ. Agency.
- Gopalaswamiengar K. S.(1935) Complete gardening in India
- Sadhu M.K. (1994) Plant Propagation, John Wiley & Sons; First edition.

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**

x 0 x