K. J. Somaiya College of Science and Commerce,

Vidyavihar, Mumbai 400077

Autonomous- Affiliated to University of Mumbai

Scheme of Course Structure (Faculty of Science) 2019-2020

Syllabus for S.Y.B.Sc.

Program: B.Sc.

Course : Botany

(Choice based Credit System)

With Effect From

The Academic Year 2019–2020

Preamble

The revised syllabus will be effective from the academic year 2019-20. Autonomy has given us the opportunity to frame the syllabus with a blend of Traditional and Modern Botany which will open the vistas in Higher Studies. Autonomy also helped to develop the Skill, Research and Consultancy. It has been prepared keeping in view the unique requirement of Botany students. Uniqueness of Botany is lies in the field of Taxonomy, Anatomy, Plant Diversity, Ethnobotany, Sustainable Agricultural Practices, Ecosystem Management, Industrial and Economic Botany. The content reflects the current changing needs of the students, specifically the subjects on statistics and computation skills. In the syllabus learner is introduced to Interdisciplinary approach of learning. The course contains new practical exercises so that the students get the hands on experiences on the latest techniques that are currently in use. Keeping the employment entrepreneurship in mind; applied courses has been introduced. These courses shall provide the botany students hands on experience and professional inputs. On whole the curriculum is a source of lot of information to develop scientific attitude to make students critical and curious also to enhance the environmental consciousness.

Programme Outcome

Knowledge and Understanding:

1. Role of plants in the functioning of ecosystem
2. To study phylogeny of plant diversity

Intellectual skills:

1. Write reports on an individual or team projects

Practical skills:

2. To carry out practical work in the field and in laboratory
3. To interpret plant morphology and anatomy.
4. Geo-tagging of plants
5. Chemical fingerprinting of plant material in plant physiology and biochemistry

Transferable skills:

1. Use of internet
2. Ability to use library resources

Scientific knowledge

1. Apply basic knowledge for fundamental processes

Problem analysis:

1 Identify taxonomic position of plants and also use principle of nomenclature and classification in Botany

Design:

1 Use of phyto-constituents to address diseases and symptoms

Plant pathology:

1 To identify symptoms, disease cycle and its impact on economy of nation and to provide solution to save the crops and thereby reduce the severity of infection and loss of yield.

Programme Specific Outcome

On completion of S.Y.B.Sc. Botany; Students will be able to,

- Analyze the morphological diversity and economic importance of plants of lower and higher groups.
- Develop the entrepreneurial skills through building the commercial aspect of botany.
- Critically analyze plant life at physical, chemical and biological level.
- Spread awareness about traditional medicinal practices through Ethnobotany.
- Practice the conservation strategies through sustainable agriculture.

Syllabus - S.Y.B.Sc. Botany

Semester III	Course Number	Course Title	Course code	Credits	Hours	Periods (50 min)	Unit/ Module	Lectures (50 MINUTES)	**Examination**		
									Internal Marks	External Marks	Total Marks
THEORY											
Core courses											
	I		19USBO301	2	30	36	1	12	40	60	100
							2	12			
							3	12			
	II		19USBO302	2	30	36					
	III		19UBO303	2	30	36					
Discipline Specific Electives											
DSE	I										
	II										
	III (OPTIONAL)										
Skill Enhancement Electives											
SEC **	I										
PRACTICALS											
CORE COURSES											
				1	4	2.4					50
				1	4	2.4					50
				1	4	2.4					50

Discipline Specific Electives											
DSE	1										
	2										
	3										
Skill Enhancement Electives											
SEC											
TOTAL				20							

** Skill enhancement courses may have theory or may have only practical component.

S.Y. B. Sc. (Botany) SEMESTER III
Course – I
COURSE TITLE : Plant diversity II
COURSE CODE: 19USBO301
[CREDITS - 02]

Sem III Paper I Unit I	**Microbiology**	Lectures 12
	Learning Objectives: • To enumerate general characters of viruses • To show the methods of microbiology	
	Learning Outcome: The student will be able to; • Differentiate between viruses • Prepare culture media	
1	**Viruses -** General characters, size and shape, ultrastructure, classification (Plant, Animal and Bacterial viruses), Multiplication of bacteriophage T_4, significance of viruses (Positive and Negative aspect).	
2	Methods of Microbiology – Culture media preparation, pure culture methods.	
3	Basic principles of staining	
4	Microbiology of water.	
Sem III Paper I Unit II	**Algae**	Lectures 12
	Learning Objectives: • To elucidate range of thallus in algae • To view origin and evolution of sex in algae • To describe life cycle of Diatoms • To enumerate applications of algae	
	Outcomes: The student will be able to; • Identify type of thallus in algae • Correlate evolution of sex in algae • Explore life cycle of Diatoms • Use algae in various application	
1	Range of thallus in algae.	
2	Origin and evolution of sex in algae.	
3	Structure, life cycle and systematic position of ***Diatoms***.	
4	Applications- Role of Algae (Agriculture and biofuel)	
Sem III Paper I Unit III	**Fungi and Plant Pathology**	Lectures 12
	Learning Objectives: • To demonstrate general characters of Ascomycetes • To depict life cycle of *Aspergillus* • To illustrate characteristics of fungal diseases, powdery mildew and ergot	
	Outcomes: The student will be able to;	

	• Distinguish between genera of Ascomycetes • Identify stages in lifecycle of *Aspergillus* • Recognize fungal diseases; powdery mildew and ergot
1	General characters of Ascomycetes with respect to vegetative structure and reproduction.
2	Structure, life cycle and systematic position of ***Aspergillus.***
3	Diseases-Symptoms, causal organism, disease cycle and control measures of Powdery mildew and Ergot.

References:

1. Kale V.V., Bhusari K.P., (2015) Applied Microbiology, Mumbai, Himalaya Publication House.
2. Pelczar M.J., Chan E.C.S., Kriwg Noel R., (2004) Microbiology, New Delhi, Tata McGraw Hill
3. Powar, C.B., Daginawala, H.F., (1989) General Microbiology, Mumbai, Himalaya Publication
4. Gangulee, H.C., Kar, A.K., (1994) College Botany Volume II, Calcutta, New Agency Ltd. Sharma, O.P., (2011) Algae, Mumbai, Tata McGraw Hill
5. Smith, G.M., (1972) Cryptogamic Botany Volume I, Mumbai, Tata McGraw Hill Vashishtha, B.R., Sinha, A.K., Singh, V.P., (2008) Botany for Degree Students, New Delhi, S. Chand and Company LTD.
6. Dube, H.C. (1996), An Introduction to Fungi, New Delhi, Vikas Publishing House Pvt. Ltd. Gangulee, H.C., Kar, A.K., (1994) College Botany Volume II, Calcutta, New Agency Ltd. Sharma, O.P., (1989), Textbook of Fungi, Mumbai, Tata McGraw Hill
7. Vashishtha, B.R. (1999) Botany for Degree Students, New Delhi, S. Chand and Company LTD.

S.Y. B. Sc. (Botany) SEMESTER III
Course – II
COURSE TITLE : Forms and Function
COURSE CODE: 19USBO302
[CREDITS - 02]

Sem III Paper II Unit I	**Anatomy**	Lectures 12
	Learning Objectives: • To show normal secondary growth in dicot stem and root • To show construction of mechanical tissue in different stress • To show defense mechanism in plants • To demonstrate stellar evolution in plants	
	Outcomes: The students will be able to ; • To locate normal secondary growth in dicot stem and root • To identify mechanical tissue in different stress • To identify defense mechanism in plants • To compare stellar evolution in plants	
1 2 3 4	Normal secondary growth in dicot stem and root. Construction and distribution of mechanical tissue in different stress-inextensibility, inflexibility, incompressibility and shearing stress. Defense mechanism in plants. Stellar Evolution in plants.	
Sem III Paper II Unit II	**Economic Botany**	Lectures 12
	Learning Objectives: • To describe different fibers • To discuss cultivation and therapeutic uses of medicinal plants • To identify plant based products; tannins and dyes • To recognize starch yielding plants	
	Outcomes: The student will be able to; • Identify different fibers • Correlate cultivation and therapeutic uses of medicinal plants • Use plant based products; tannins and dyes • Explore starch yielding plants	
1 2 3 4	Study of Fibres – Cotton, Jute, Coir. Cultivation and therapeutic uses of medicinal plants –Ashwagandha, Adulsa. Plant based products: Tannins and Dyes. Starch yielding plants – Ginger, Elephant foot yam	
Sem III Paper II Unit III	**Plant Physiology**	Lectures 12
	Learning Objectives: • To comprehend the basic concept of photo-physiology and photo-respiration.	

	• To identify the structure of plant pigments and their corresponding interaction with light. • To recognize different pathways of photosynthesis • To describe structure, synthesis, biodegradation of starch and cellulose
	Outcomes: The students will be able to ; • Compare concepts of photo-physiology and photo-respiration • Discriminate the structure of plant pigments and their corresponding interaction with light. • Correlate different pathways of photosynthesis • Compare structure, synthesis, biodegradation of starch and cellulose
1	Photophysiology and Photorespiration – Plant pigments and their interaction with light, light reaction and dark reaction of photosynthesis.
2	C_3, C_4 and CAM pathways, Photorespiration.
3	Carbohydrate metabolism: Structure, synthesis and degradation of starch and cellulose.

References:

1. Esau, K., (1953) London, John Wiley and Sons Inc.
2. Pandey, B.P., (1978) Plant anatomy, S. Chand and Company Pvt. Ltd.
3. Roy, Piyush, (2010), Plant Anatomy, London, New Central Agency (p) Ltd.
4. Sunderraj, D.D., Thulasidas G., Botany of Field Crops, India, Macmillan India Ltd.
5. Kochhar, P.L., (1976) Plant Physiology, Delhi, Atma Ram and Sons
6. Satyanarayan, U., Chakrapani, U., (2016), Biochemistry, New Delhi and Kolkata, Elsevier and Books and Allied Pvt. Ltd.
7. Sinha, R.K., (2015), Modern Plant Physiology, New Delhi, Narosa Publishing House
8. Verma, S.K. and Verma, M., (2005), Textbook of Plant Physiology, Biochemistry and Biotechnology, Delhi, S. Chand and Company Ltd.
9. Verma, V., (1978), A Textbook of Plant Physiology, Delhi, M.K. Publications

S.Y. B. Sc. (Botany) SEMESTER III
Course – III
COURSE TITLE : Applied Botany
COURSE CODE: 19USBO303
[CREDITS - 02]

Sem III Paper III Unit I	**Instrumentation and Techniques**	Lectures 12
	Learning Objectives: • To show principle, working and application of pH meter • To depict different methods to chromatography techniques	
	Outcomes: The student will be able to; • Measure pH of a solution, to prepare buffers, • Use TLC for separation of biomolecules	
1	Basic principles, working and applications of pH meter and Colorimeter.	
2	Study of Separation Technique (i) Chromatography- Principle, types of chromatography, adsorption and partition chromatography, paper, column and thin layer chromatography.	
Sem III Paper III Unit II	**Pharmacognosy and Medicinal Botany**	Lectures 12
	Learning Objectives: • To overview the chemical constituents from plants	
	Learning Outcomes: The student will be able to; • Identify analyze primary and secondary metabolites from plants • Identify herbal drugs and recognize their therapeutic uses.	
	PHARMACOGNOSY	
1	Pharmacognosy- Definition and scope.	
2	Pharmacopoeia- Introduction.	
3	Elementary knowledge of primary and secondary metabolites.	
4	Primary analysis of crude drug obtained from leaves and bark.	
	MEDICINAL BOTANY Monographs of drugs with respect to biological sources, geographical distribution, macroscopic and microscopic characters, chemical constituents, therapeutic uses and adulterants of the following plants/Drugs.	
1	*Syzigium aromaticum* (Clove bud)	
2	*Strychnos nuxvomica* (Seed)	
3	*Aloe vera* (Leaf)	
Sem III Paper III Unit III	**Industrial Botany**	Lectures 12
	Learning Objectives: • To describe sources and uses of enzymes • To depict processing, storage and preservation of beverages • To show single cell protein production • To show mushroom cultivation	

	Outcomes: The student will be able to; • Use enzymes for different experimental purposes • Compare different manufacturing aspects of beverages • Explore different available sources of single cell protein • Cultivate mushroom on small scale
1	Study of enzymes:- Cellulases, peroxidases with reference to their plant sources and their use in industry
2	Beverages-Alcoholic and non-alcoholic, source, processing, storage and preservation of coffee and wine
3	Single Cell Protein from Algae and Fungi.
4	Mushroom industry – Cultivation and its commercial significance
Sem III Paper III Unit IV	**Bio-Fertilizer** Lectures 12
	Learning Objectives: • To introduce basic concept of bio-fertilizers • To demonstrate various aspects of applications of biofertilizers
	Outcomes: The student will be able to; • Develop bio-fertilizer facility
1	Introduction, Types, Components.
2	Nitrogen fixing microorganisms- symbiotic and free living bacteria, phosphate solubilising bacteria. Coralloid roots, Mycorrhizal fungi and VAM.
3	Mass production-Culture methods.
4	Carrier based inoculants.
5	Methods of application.
6	Quality control in production and maintenance
7	Importance of biofertilizers and Economics of its industry.

Reference:

1. Ali, M. Textbook of Pharmacognosy
2. Gokhale, S.B., Kokate, C.K., Purohit, A.P., (2009) A Textbook of Pharmacognosy, Pune, Nirali Publication
3. Jain, S.K.,(1955), Manual of Ethnobotany, Jodhpur, Scientific Publishers.
4. Kochhar, S.L. (2012) Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
5. Sen S (1992). Economic Botany, New Central Book Agency, Kolkata.
6. Wilson, K., Walker, J., (2009) Principles and Techniques of Biochemistry and Molecular Biology, 6th Ed, Delhi, Cambridge University Press

Syllabus - S. Y.B.Sc. Semester IV Botany

Semester V	Course Number	Course Title	Course code	Credits	Hours	Periods (50 min)	Unit/ Module	Lectures (50 MINUTES)	Examination		
									Internal Marks	External Marks	Total Marks
THEORY											
Core courses											
	I	Plant Diversity II	**19USBOP401**	2	30	36	1	12	40	60	100
							2	12			
							3	12			
	II	Functional Botany	**19USBOP402**	2	30	36	1	12	40	60	100
							2	12			
							3	12			
	III	Applied Botany	**19USBOP403**	2	30	36	1	12	40	60	100
							2 /3/4	12			
							2/3/4	12			
Discipline Specific Electives											
DSE											
Skill Enhancement Electives											
SEC **											
PRACTICALS											
CORE COURSES											
		Plant Diversity II		1	4						50
		Functio		1	4						50

		nal Botany									
		Applied Botany		1	4						50

Discipline Specific Electives											
DSE											
Skill Enhancement Electives											
SEC											
TOTAL											

** Skill enhancement courses may have theory or may have only practical component.

S.Y. B. Sc. (Botany) SEMESTER IV
Course – I
COURSE TITLE : Plant Diversity II
COURSE CODE: -----**19USBOP401**
[CREDITS - 02]

Sem IV Paper I Unit I	**Bryophyta and Pteridophyta**	Lectures 12
	Learning Objectives: • To study the life cycle and compare the evolutionary trend.	
	Learning Outcome: The student will be able to; • Identify , classify and compare the characters of Bryophyta and Pteridophyta.	
	BRYOPHYTA	
1	General characteristics of Class: Anthocerotae.	
2	Structure, life cycle and systematic position of ***Anthoceros.***	
3	Ecological and Economic importance of Bryophytes.	
	PTERIDOPHYTA	
4	General characteristics of Division: Lycopsida.	
5	Structure, life cycle and systematic position of ***Selaginella.***	
	Ornamental ferns- types and uses	
Sem IV Paper I Unit II	**Gymnosperms and Paleobotany**	Lectures 12
	Learning Objectives: The student will be able to; • To study the plants that existed as fossils in the past. • To describe the life cycle	
	Learning Outcome: Students will be able to; • Identify, classify Gymnosperms and compare it with the fossil plants. • Interpret the evolutionary pattern.	
	GYMNOSPERMS	
1	Classification of Gymnosperms up to the order according to the system proposed by D. D. Pant.	
2	Structure, life cycle and systematic position of ***Pinus.***	
	PALEOBOTANY	
3	Geological time scale, Introduction to Paleobotany.	
4	Types of fossils-compression, cast, petrifaction, Impression and compaction.	
5	Study of ***Rhynia.***	
Sem IV Paper I Unit III	**Taxonomy and Ethnobotany**	Lectures 12
	Learning Objectives: • To describe plants based on morphological characters • To study the plants used by tribes.	

	Learning Outcomes: The student will be able to; • Identify plants based on key characteristics of the families. • Apply the knowledge of traditional medicine and concept of digital herbaria.
	TAXONOMY
1	Bentham and Hooker's system of classification for flowering plants up to family with respect to the following prescribed families and economic and medicinal importance for members of these families. Brassicaceae, Combretaceae, Rubiaceae, Euphorbiaceae, Liliaceae
	ETHNOBOTANY
2	Role of Ethnobotany in Modern medicine.
3	Sacred grooves and their role in conservation.
4	Concept of e-herbaria.

Reference:

1. Gangulee, H.C., and Kar, A. K., (1994) College Botany Vol.II. New Central Book Agency Ltd. Calcutta.
2. Hutchinson J (1959), Families of flowering plants, Cambridge University Press
3. Lawrence GHM (1955), An Introduction to plant Taxonomy, Central Book Depot
4. Lawrence GHM (1964), Taxonomy of Vascular Plants, Mac Millon Co., New York
5. Rashid,A. 1999. Pteridophyta. Vikas Publishing House, New Delhi
6. Sambamurthy AVSS, A Textbook of Bryophyta, Pteridophyta, Gymnosperms and Paleobotany
7. Sharma OP (1990) Plant Taxonomy, Oxford Publishers, New Delhi
8. Sharma,O.P 2006.Text book of Pteridophyta. . Macmillan India Ltd.,New Delhi.
9. Singh G (1999), Plant systematics: Theory and Practice, Oxford IBH.
10. Smith,G.M. 1976. Cryptogamic Botany Vol.II. Tata McGraw Hill, Publishing Co. Ltd. New Delhi.
11. Vashishta, B.R., (1999) Botany for Degree Students. S. Chand and Company Ltd, New Delhi.

S.Y. B. Sc. (Botany)SEMESTER IV

Course – II

COURSE TITLE :Functional Botany

COURSE CODE: -----**19USBOP402**

[CREDITS - 02]

Sem IV Paper II Unit I	**Ecosystem Management**	Lectures 12
	Learning Objectives: • To know the ecosystems and strategies for its management	
	Learning Outcomes: The student will be able to; • Design strategies for restoration of ecosystem. • To apply and achieve sustainable development goals.	
1	Terrestrial Ecosystem Management-Restoration Ecology, Invasive Species Management	
2	Aquatic Ecosystem Management- Wetland Conservation, Environmental Flows	
3	Agro-ecosystem Management- Crop Management, Pastureland Management, Plantation Management	
4	Urban Ecology- Urban Greening, Living Shorelines	
Sem IV Paper II Unit II	**Bioinformatics and Biostatistics**	Lectures 12
	Learning Objective: • To evaluate the data using biostatistics and bioinformatics tools.	
	Learning Outcomes: The student will be able to; • Validate and document scientific data • Analyze the data scientifically • Apply bioinformatics tools for predicting the functioning of DNA and proteins	
	BIOINFORMATICS	
1	Internet and its uses, tools used in bioinformatics, services offered by NCBI,	
2	Structure of protein an overview.	
	BIOSTATISTICS	
1	Common terms used in statistics – Population, Sample, Data- Qualitative	
2	and Quantitative data, Observation, Parameter, Characteristic; attributes and variables	
3	Representation of data-Tabular and Graphical.	
4	Normal distribution; Concept, Normal distribution curve, Properties of normal distribution, Relationship between normal curve area and standard deviation, Region of acceptance and rejection in brief.	

5	Chi square test and Coefficient of Correlation.
Sem IV Paper II Unit III	**Cytogenetics and Molecular Biology** Lectures 12
	Learning Objectives: • To know the structure of DNA. • To understand the significance of DNA in heredity . • To study the role of multiple genes and multiple alleles in determination of traits.
	Learning Outcomes: The student will be able to; • Comprehend the structure and role of DNA • Describe and Compare between replication in prokaryotic and eukaryotic cell. • Evaluate the impact of variation in chromosome no . on organisms.
1	Structure of DNA; Watson and Crick Model, Packaging of DNA into chromosomes.
2	Comparative account of DNA Replication in Prokaryotes and Eukaryotes
3	Multiple genes and multiple alleles.
4	Variation in chromosome number – Origin and production, Euploids, aneuploidy, syndromes- Down's, Klinefelter's, Turner's

Reference:

1. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. _II Edition. Benjamin Cummings.
2. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi
3. Fulekar M.H. (2014) Environmental Biotechnology. Science Publisher, USA.
4. Gupta P.K (1995) Genetics and Cytogenetics. Rastogi Publications, Meerut .
5. Kar D.K. and Halder S. (2006) Plant Breeding and Biometry. New Central Book Agency (P) Ltd., Kolkata.
6. Lewin B. 2000. Genes VII. Oxford University Press, New York.
7. Mahajan B. K. (1991) Methods of Biostatistics. Jaypee brothers, New Delhi.
8. Odum E.P. (1978) Ecology. Oxford and IBS Publishing Co., New Delhi.
9. Pawar C.B 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.
10. Prasad S. (2006) Elements of Biostatistics. Jogi Publications, Meerut.
11. Purohit S.G., Ranade V.D., Dusane A.V. (2002) Introduction to Biometry Narendra Prakashan Pune.
12. Rastogi V. B. (2017) Fundamentals of Biostatistics. Medtech, New Delhi.
13. Sharma P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut.
14. Strickberger 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
15. Verma P.S. and Agarwal V.K. (1991), Genetics. S Chand Comp. Ltd. Ramnagar,

New Delhi.

S.Y. B. Sc. (Botany) SEMESTER IV
Course – III
COURSE TITLE : Applied Botany
COURSE CODE: -----**19USBOP403**
[CREDITS - 02]

Sem IV Paper III Unit I	**Forestry** Lectures 12
	Learning Objectives: • To acquaint students with types of forestry. • To recognize its utility
	Outcomes: The student will be able to; • Comment on importance of forestry • Participate towards Forest Regeneration
1	Types of Forest in India
2	Methods of Regeneration of Forest -Principle and Practices of Silviculture. Social forestry.
3	Agroforestry- Aims, Objective and Need
Sem IV Paper III Unit II	**Sustainable Agriculture Practices** Lectures 12
	Learning Objective: The student will be able to; • To study concept of sustainable management for various environmental issues.
	Learning Outcome: Students will be able to • Effectively practice the knowledge gained for sustainability of agri crops. • apply and implement conservation strategies for sustainability management.
1.	Introduction to sustainable agricultural practices: Concept, Principle, Components- Soil, Water, Sustainable pest management.
2.	Soil conditioning- Biochemistry of composting and characterization of biocompost- particle size, C : N ratio, temperature, pH and aeration.
3.	Agricultural water management- Irrigation and drainage management, water
4.	recycle practices- Rain water and grey water. Effective irrigation technology for reducing water loss.
Sem IV Paper III Unit III	**Horticulture** Lectures 12
	Learning Objectives: • To study the basic and advance techniques in horticulture.
	Outcomes: The student will be able to; • Design Garden layouts. • Develop entrepreneurial skills
1	Potting and Re-potting.

2	Garden design and types of garden.
3	Green house technology – scope and objectives of floriculture.
4	Floral decoration, dry flower and florist shop management.
5	Space garden.
Sem IV	**Nursery Development** Lectures 12
Paper III Unit IV	**Learning Objectives:** • To gain knowledge about establishment of a nursery • To acquaint the techniques of plant propagation.
	Learning Outcomes: The student will be able to; • Comprehend and apply the propagation techniques. • Develop entrepreneurial skills.
1	Introduction, Importance of Nursery development.
2	Components of nursery, Classification, factors affecting the establishment of a nursery.
3	Preparation of nursery beds.
4	Parts of nursery. Pots and Field nursery.
5	Propagating methods- Seed, Vegetative and Micropropagation.
6	Management, Marketing and Economics of nursery practices

Reference:

1. Krishnan, P.R., Kalia, R. K., Tewari, J.C., Roy, M.M., (2014) Plant Nursery Management: Principles and Practices, Jodhpur, Central Arid Zone Research Institute
2. Kumar, V., Tiwari, A. (2018) Practical Manual of Nursery Management, New Delhi, Agro-Biovet Press
3. Negi S.S. (2008) Handbook of Forestry.
4. Pretty, J., 363 (2008) 447-465 Agricultural Sustainability: Concepts, Principles and Evidence, Essex, UK
5. Sagwal S. S. (2016) Introductory Forestry. Kalyani Publisher, New Delhi
6. Thorat, S., Inamdar, V., Bhor, P., Nandre, D., Rajput, H., Ambad, S., Hendre, P., ( ), Resource Book on Horticulture Nursery Management, NAIP-ICAR, Nashik, The Registrar, Yashwantrao Chavan Maharashtra Open University, Nashik
7. Tripathi, P.C., Sakthivel, T., Hazarika, S., Reddy, T.M., (2010), Compendium of Training Programme on Nursery Management of Horticultural Crops, Karnataka, Indian Institute of Horticultural Research

Evaluation Pattern: Theory

For each course I, II and III

External Evaluation – Semester End Examination (60 M) - Duration: 2 hours

Paper Pattern –

Question No	Module	Marks with Option	Marks without Option
1.	I	12	8
2.	II	12	8
3.	III	12	8

Internal Evaluation - (40 M)

(Give different ways of **Internal Evaluation** finalised for each module)

Semester III		
Course I	**Plant Diversity III**	
Module **I**	Microbiology	Test, Assignment
Module **II**	Algae	Test, Assignment
Module **III**	Fungi and Plant Pathology	Test, Assignment
Course II	**Forms and Function**	
Module **I**	Anatomy	Test, Assignment
Module **II**	Economic Botany	Test, Assignment
Module **III**	Plant Pathology	Test, Assignment
Course III	**Applied Botany**	
Module **I**	Instrumentation and Techniques	Test, Assignment, Research article
Module **II**	Pharmacognosy and Medicinal Botany	Test, Assignment, Project
Module **III**	Industrial Botany	Test, Assignment
Module **IV**	Bio-fertilizer	Test, Assignment, Project
Semester IV		
Course I	**Plant Diversity IV**	
Module **I**	Bryophyta and Pteridophyta	Test, Assignment
Module **II**	Gymnosperms and Paleobotany	Test, Assignment
Module **III**	Taxonomy and Ethnobotany	Test, Assignment, Project
Course II	**Functional Botany**	

Module **I**	Ecosystem Management	Test, Assignment, Research article
Module **II**	Bioinformatics and Biostatistics	Test, Assignment, Problems
Module **III**	Cytogenetics and Molecular Biology	Test, Assignment
Course III	**Applied Botany**	
Module **I**	Forestry	Test, Assignment
Module **II**	Sustainable Agriculture Practices	Test, Assignment
Module **III**	Horticulture	Test, Assignment, Project
Module **IV**	Nursery Development	Test, Assignment, Project

S. Y. B. Sc. (Botany)
SEMESTER III - Practicals
Course-I
COURSE CODE: 19USBOP301

	Experiments	Number of Credits	Number of hours
		1	
1	Study of ultrastructure of plant and animal viruses / Bacteriophage with the help of photomicrographs.		
2	Preparation of culture media and preparation of slants and plates.		
3	Study of streak plate technique for isolation of bacteria.		
4	Effects of plant extract (turmeric and garlic) on microbial growth by the pour plate technique.		
5	Determine the potability of water samples collected from different localities using MPN Technique.		
6	Range of thallus in algae – Unicellular– Motile – *Chlamydomonas.* Non-motile –*Cosmarium.* Multicellular – colonial – *Volvox.* Non-flagellate –*Scenedesmus.* Filamentous- *Oedogonium* Branched filamentous- *Cladophora* Siphonaceous- *Vaucheria* Parenchymatous- *Chara*		
7	Study of stages in the life cycle of *Oscillatoria*, *Diatoms* and *Sargassum* from fresh/preserved material and permanent slides.		
8	Study of application of algae in agriculture and biofuels with the help of specimen/ photomicrograph. Projects can be given on biofuels		
9	Study of stages in the life cycle of *Aspergillus* and *Agaricus* from fresh/preserved material and permanent slides.		
10	Study of fungal diseases- Powdery mildew and Ergot.		

S. Y. B. Sc. (Botany)
SEMESTER III - Practicals
Course-II
COURSE CODE: 19USBOP302

	Experiments	Number of Credits	Number of hours
		1	
1	Study of normal secondary growth in dicot stem and root.		
2	Study of mechanical tissue system in root, stem and leaf.		
3	Study of defence mechanism in plants.		
4	Study of types of stele with the help of permanent slides.		
5	Identification of plants as a source of fibres- cotton, jute, coir.		
6	Study of medicinal plants with respect to cultivation and uses of Ashwagandha and Adulsa.		
7	Identification of plant based products – Tannins- Arjuna bark, Catechu Dyes- Heena, Beet root, Pomogranate rind, Indigofera, *Bixa*.		
8	Identification of plants as a source of starch– Elephant foot yam, Potato, Rice.		
9	Extraction and isolation of starch from Ginger (Demonstration).		
10	Study of absorption spectra pattern of chlorophyll.		
11	Quantitative estimation of photosynthetic pigments.		
12	Study of Hill's reaction (Demo).		
13	Estimation of reducing sugar by DNSA Method.		

S. Y. B. Sc. (Botany)
SEMESTER III - Practicals
Course-III
COURSE CODE: 19USBOP303

	Experiments	Number of Credits	Number of hours
		1	
1	Demonstration of working of pH meter and colorimeter.		
2	Separation of amino acids by circular paper chromatography.		
3	Demonstration of Column chromatography for separation of photosynthetic pigments.		
4	Separation of carotenoids by thin layer chromatography.		
5	Tests for alkaloids, glycosides and tannins.		
6	Study of the following medicinal plants, plant parts with respect to their morphological, anatomical and biochemical characters for authentication of the drug source. i. *Syzigium aromaticum* (Clove flower bud) ii. *Strychnos nuxvomica* (seed) iii. *Aloe vera* (leaf)		
7	Colorimetric estimation of cellulases by DNSA method.		
8	Quantitative estimation of peroxidase from potato tuber /germinating moong seeds.		
9	Production of single cell protein from algae /fungi (Demonstration)		
10	Demonstration of mushroom cultivation, nutritive value – protein and Vit. B.		
11	Identification of edible and poisonous mushrooms from photomicrographs (Demonstration).		
12	Study of Biofertilizers using permanent slides/ specimen.		
13	Isolation and identification of symbiotic nitrogen fixers using CRYEMA agar.		
14	Isolation and identification of phosphate solubilising bacteria on suitable agar medium.		

S. Y. B. Sc. (Botany)
SEMESTER IV - Practical
Course-I
COURSE CODE: 19USBOP401

	Experiments	Number of Credits 01	Number of hours
1	Study of stages in the life cycle of ***Anthoceros*** *and* ***Funaria*** from fresh/preserved material and permanent slides.		
2	Economic and ecological significance of bryophyte with the help of photomicrograph.		
3	Study of stages in the life cycle of ***Selaginella*** and ***Equisetum*** from fresh/preserved material and permanent slides.		
4	Ornamental ferns, Types and Uses.		
5	Study of stages in the life cycle of ***Pinus*** from fresh / preserved material and permanent slides.		
6	Study of different types of fossils.		
7	Study of ***Rhynia*** with the help of permanent slide.		
8	Bentham and Hooker's system of classification for flowering plants up to family with respect to the following prescribed families and economic and medicinal importance for members of these families. Brassicaceae, Combretaceae, Rutaceae, Rubiaceae, Verbinceae, Euphorbiaceae and Liliaceae.		
9	Ethno botany – Demonstration of digital herbarium.		
10	Identification of Sacred grooves.		
11	Plants used in modern medicine.		

S. Y. B. Sc. (Botany)
SEMESTER IV - Practical
Course-II
COURSE CODE: 19USBOP402

	Experiments	Number of Credits 01	Number of hours
1	Study of ecological instruments- Soil thermometer, hygrometer, wind anemometer, rain gauze, lux meter.		
2	Study of Plant population using List and Chart Quadrat		
3	Set-up of green wall (Demonstration)		
4	Establishing the green roof (Demo)		
5	Demonstration of NCBI and EBI databases, retrieval of data.		
6	Problems based on Chi square test- 10		
7	Problems based on Coefficient of correlation- 10		
8	Identification of different structures of proteins.(primary, secondary, tertiary and quaternary)		
9	Study of karyotype Normal Male and Female, Down's, Klinefelter and Turner syndrome.		
10	Mitosis and Meiosis		
11	Extraction of DNA from suitable plant material		

S. Y. B. Sc. (Botany)
SEMESTER IV - Practical
Course-III
COURSE CODE: 19USBOP403

	Experiments	Number of Credits 01	Number of hours
1	Study of Biodiversity composition of different types of forests in India.		
2	Geo-tagging of some plants of SVV campus.		
3	Identify the type of forest based on list of dominant flora.		
4	Study of site for plantation- edaphic factors, climatic conditions.		
5	Study of different parameters of compost- Acidity and Organic carbon.		
6	Estimation of available nutrients like P and Ca by suitable chemical method.		
7	Study of soil microflora to comment on type of possible plantation.		
8	Study of soil macro and micronutrients.		
9	Potting and Repotting		
10	Plants suitable for various garden locations.		
11	Study of green house plants- *Carnation*, *Anthurium* and *Gerbera*		
12	Garden Design-Formal and Informal		
13	Western style of flower arrangement (Demonstration).		

Evaluation Pattern

External evaluation: 50 Marks practical examination at the end of each semester per course.

==========