

RABINDRANATH TAGORE UNIVERSITY

DEPARTMENT OF BOTANY

HOJAI-782435

UNDERGRADUATE (UG) PROGRAMME

SYLLABUS FOR I, II, III & IV SEMESTER

BOTANY

FRAMED ACCORDING TO THE NATIONAL EDUCATION POLICY, 2020

AUGUST 01, 2023

OUTCOMES OF B.Sc. BOTANY PROGRAMME AS PER NEP, 2020
Discipline Major/Core : BOTANY

By the end of the program the students will be able to deal with applications and sustainable utilization of natural resources for a harmonious global ecosystem. The programme learning outcomes have been formulated to ensure that students require strong basis in plant science and also developing a range of transferable skills and abilities that will equip them for a diverse range of professions and further studies.

- a) Gathering of knowledge on various life forms, life cycle and developmental process that exist among diversified plants.
- b) Understanding of mutual interactions among the various groups of plants and their role for the benefit of human being.
- c) Develop skill for the proper description by using botanical terminologies, identification, nomenclature and classification of life forms, particularly of plants and microorganisms.
- d) Understanding of major elements of variations that exist in the living world through comparative morpho-anatomical studies.
- e) Inculcate ability to explain biodiversity and evolution of life based on the empirical evidences in morphology, anatomy, embryology, physiology, biochemistry, life history cell biology and genetics.
- f) Development of skill for collection, preservation, analysis and recording of information after observation and critical analysis and to develop database up to molecular level.
- g) Awareness of the scientific and technological advancements, bioinformatics, biotechnology, biostatistics, GPS, GIS, mapping and global climate change for further learning and research in all branches of botany.
- h) Enable the graduates to prepare for national and international competitive examinations.
- i) Enable the graduates for practicing the best teaching pedagogy as botany teacher including the latest teaching digital modules.
- j) The graduate will be knowledgeable and competent enough to deliver appropriately the different aspects like ecology and environment, green technologies and organic agriculture etc.
- k) Graduate will be able to demonstrate proficiency in the hands-on experimental techniques for their area of specialization within biology during research and in professional career.
- l) Students will be capable of combining their understanding and skill with other disciplines and participating in multidisciplinary research and innovation.

FYUGP Structure as per NEP 2020 Credit Framework

FIRST YEAR

Year	Semester	Course	Title of the Course	Credit
First Year	1 st Semester	MAJOR-1.1	Cryptogams	4
		MINOR-1.1	Microbes & Thallophytes	4
		MD/GE- 1.1	Plant Science- 1	3
		SEC- 1.1	Biofertilizer	3
		AECC-1.1		2
		VAC-1.1		2
		VAC-1.2		2
			Total Credit	20
	2 nd Semester	MAJOR- 2.1	Morphology, Embryology and Anatomy of Angiosperm	4
		MINOR-2.1	Morphology and Reproduction of Seeded plant	4
		MD/GE-2.1	Plant Science- 2	3
		SEC-2.1	Nursery and Gardening	3
		AECC-2.1		2
		VAC-2.1		2
VAC-2.2			2	
		Total Credit	20	

SECOND YEAR

Year	Semester	Course	Title of the course	Credit
Second Year	3 rd semester	MAJOR-3.1	Cell Biology	4
		MAJOR-3.2	Microbiology and Phytopathology	4
		MINOR-3.1	Plant anatomy, Embryology and Cryptogams	4
		Md/GE-3.1	Plant pathology, Taxonomy and Cell Biology	3
		SEC-3.1	Ethnobotany	3
		AECC-3.1		2
			Total Credit	20
	4 th semester	MAJOR-4.1	Plant Biochemistry and Molecular Biology	4
		MAJOR-4.2	Morphology and Anatomy of Angiosperms	4
		MAJOR-4.3	Economic Botany	4
		MINOR-4.1	Plant Physiology and Metabolism	4
		AECC-4		2
		Summer Internship		2
		Total Credit	20	

Abbreviations Used: SEC = Skill Enhancement Course

GE /MDC= Generic Elective Course/Multi-disciplinary Cours

DETAILED SYLLABUS OF B. Sc. 1st SEMESTER

Title of the Course	: Cryptogams
Course Code	: MAJOR-BOT--1.1
Nature of the Course	: Major/ Core -1.1
Total Credits	:04
Distribution of Marks	: 100 : (Theory-60 +15) + 25 (Practical)

Course objectives:-The objective of this course is to provide knowledge to the students on various forms of Algae, Fungi, Bryophyte and Pteridophyte – their characteristics, mode of reproduction and economic importance.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks: 18	<u>Algae: An Approach to Algae:-</u> Habitat and distribution, general characteristics, thallus structure, cell structure and components, Flagella, Mode of reproduction, pigments and, reserve foods, classification, economic importance of algae with special reference to industry and soil fertility. (i) Cyanophyceae -Structure and life history of Nostoc (ii) Chlorophyceae -Structure and life history of Volvox and Chara (iii) Bacillariophyceae (Diatoms) (iv) Pheophyceae -structure and life history of <i>Ectocarpus</i> (v) Rhodophyceae -Structure and life history <i>Batrachospermum</i> & <i>Polysiphonia</i>	13	2		15
Unit-II Marks: 16	<u>Fungi :-</u> General characteristics, classification, thallus organization, fungal tissue, nutrition, homothallism & heterothallism, Reproduction, different types of sporocarps: Ascocarp and Basidiocarp. (i) Phycomycetes - Study of life cycle of <i>Phytophthora</i> and <i>Mucor</i> (ii) Ascomycetes -Study of life cycle of <i>Saccharomyces</i> & <i>Penicillium</i> . (iii) Basidiomycetes - Study of life cycle of <i>Puccinia</i> and <i>A garicus</i> (iv) Deuteromycetes - Study of life cycle of <i>Alternaria</i>	13	2		15
Unit-III Marks:12	<u>Bryophytes:</u> General account, characteristics, classification and thallus structure. Morphology, anatomy and reproduction of <i>Riccia</i> , <i>Marchantia</i> , <i>Anthoceros</i> and <i>Polytrichum</i> . Their Comparative study and evolutionary trends in sporophytic generation.	7			7
Unit-IV Marks: 14	<u>Pteridophytes:-</u> Characteristics, classification. Chief characteristics of the main orders. Morphology, Anatomy and reproduction of <i>Rhynia</i> , <i>Psilotum</i> , <i>Selaginella</i> , <i>Lycopodium</i> , <i>Equisetum</i> and <i>Marselia</i> Heterospory and seed habit and Stelar structure	8			8
Practicals Marks: 25	1. Study of vegetative and reproductive structures of <i>Nostoc</i> , <i>Volvox</i> , <i>Chara</i> , <i>Ectocarpus</i> , <i>Batrachospermum</i> and <i>Diatom</i> through compound microscope & preparation of permanent slides. 2. Study of vegetative and reproductive structure through permanent slides of <i>Phytophthora</i> , <i>Mucor</i> , <i>Saccharomyces</i> , <i>Puccinia</i> and <i>Agaricus</i> .			15	15

	3. Study of thallus and reproductive structure of <i>Riccia</i> , <i>Marchantia</i> , <i>Polytrichum</i> and <i>Selaginella</i> , <i>Lycopodium</i> and <i>Marsilea</i> . 4. Collection & preparation report through Field study / Excursion				
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Total= 60

Mode of Assessment: a) One internal assessment/Sessional examination

(15 Marks)

DETAILED SYLLABUS OF B. Sc. 1st SEMESTER

Title of the Course : Microbes & Thallophytes
Course Code : MINOR-BOT-1.1
Nature of the Course : MINOR-1.1
Total Credits : 04
Distribution of Marks : 100:(60+15) + 25 (Practical)

Course Objectives: The objective of this course is to provide knowledge to the students on various forms of algae, fungi, and microbes – their characteristics, mode of reproduction and economic importance.

UNITS	CONTENTS		T	P	Total Hours
Unit-I Marks: 5	<u>Introduction to plants:</u> Plant Kingdom and its divisions, Role and importance of plants	3			3
Unit-II Marks: 18	<u>Microbes:-</u> <u>Bacteria:-</u> Discovery, General characteristics, Cell structure, Recombination (Conjugation, Transformation & Transduction). <u>Virus:</u> Characteristics, Structure and Replication of Virus-Lytic and Lysogenic cycles, DNA and RNA virus.	11	1		12
Unit-III Marks: 18	<u>Algae:-</u> Distribution and characteristics of Algae, Range of thallus structure, Classification, Morphology and life cycle of <i>Nostoc</i> , <i>Chlorella</i> , <i>Chara</i> , <i>Spirogyra</i> and <i>Batrachospermum</i> . Ecology and Economic importance of Algae.	13	2		15
Unit-IV Marks: 19	<u>Fungi:-</u> Ecology, distribution and general characteristics of fungi, thallus structure, nutrition and classification. Life cycle of <i>Mucor</i> (zygomycetes), <i>Yeast</i> (Ascomycetes), <i>Puccinia</i> (Basidiomycetes) <i>Fusarium</i> (Deuteromycetes); Economic Importance of Fungi	13	2		15
Practicals Marks: 25	1. Study of vegetative and reproductive structures of <i>Nostoc</i> , <i>Volvox</i> , <i>Chara</i> , <i>Chlorella</i> and <i>Batrachospermum</i> , through compound microscope & preparation of permanent slides. 2. Study of vegetative and reproductive structure through permanent slides of <i>Phytophthora</i> , <i>Mucor</i> and <i>Puccinia</i> . 3. Study of Bacterial cell types, Gram staining of <i>Lectobacillus</i> bacteria. 4. Study of Virus structure through photograph 5. Collection and field study report submission.			15	15

Total= 60

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF B. Sc. 1st SEMESTER

Title of the Course :Plant Science- 1
 Course Code :MD-BOT-1.1
 Nature of the Course :GE/ Multi-disciplinary-1.1
 Total Credits :03
 Distribution of Marks : 75: (60+15)

Course Objectives:-he objective of this course is to provide knowledge to the students on various forms of plants, their characteristics, habitat, economic importance and ecological role.

Unit	Content	L	T	P	Total hours
Unit-I Marks: 10	Introduction: Plants, different types, Classification, Cryptogams. Phanerogams. Microbes: Structure, types and general characteristics of Bacteria and Vrus. Different branches of Botany.	6	1		7
Unit-II Marks: 20	Algae: Ecology and distribution, Habit, Habitat, Classification, Morphology and Reproduction of <i>Spirogyra</i> , <i>Chara</i> , <i>Diatom</i> . Economic importance of algae. Fungi: Habitat, habit, Classification, Nutrition, Ecological role of fungi. Morphology & reproduction of Yeast, <i>Penicillium</i> & <i>Puccinia</i> . Importance of fungi in food and soil fertility. Lichen: General characteristics, Habitat, Types, Economic importance. Mycorrhiza: Occurence, Components, Role and function of Mycorrhiza.	15	1		16
Unit-III Marks: 17	Bryophytes: General characteristics, Occurence Thallus structure, General account on <i>Riccia</i> and <i>Marchantia</i> . Pteridophytes: General characteristics, General account of <i>Rhynia</i> , <i>Selaginella</i> and <i>Pteris</i> , Heterospory. Economic importance of <i>Pteridophytes</i> . Gymnosperms: General characteristics, General account on <i>Cycas</i> and <i>Pinus</i> , Economic importance of Gymnosperms.	11	1		12
Unit-IV Marks:13	Microbes:- Bacteria:- Discovery, General characteristics, Cell structure, Recombination (Conjugation, Transformation& Transduction). Virus:- Characteristics, Structure and Replication of Virus- Lytic and Lysogenic cycles, DNA and RNA virus.	9	1		10

Total= 45

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF B. Sc. 1st SEMESTER

Title of the Course : BIOFERTILIZER
Course Code : SEC-BOT-1.1
Nature of the Course : Skill Enhancement Course -1.1
Total Credits : 03
Distribution of Marks : 75: (60+15)

Course Objectives: The objective of this course is to provide knowledge to the students on various forms of lower groups of plants and their role and to develop skill for production of biofertilizers.

Unit	Content	L	T	P	Total hours
Unit-I Marks: 10	General account about the microbes used as biofertilizer – <i>Rhizobium</i> – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis	5			5
Unit-II Marks: 15	<i>Azospirillum</i> : isolation and mass multiplication – carried based inoculant, associative effect of different microorganisms. <i>Azotobacter</i> : Characteristics classification, crop response to <i>Azotobacter inoculum</i> , maintenance and mass multiplication	10	2		12
Unit-III Marks: 10	<i>Cyanobacteria</i> :- (blue green algae), <i>Azolla</i> and <i>Anabaena azollae</i> association, nitrogen fixation, factors affecting growth, blue green algae and <i>Azolla</i> in rice cultivation.	9	1		10
Unit-IV Marks: 25	<i>Mycorrhiza</i> :-Mycorrhiza association, types of mycorrhiza association, taxonomy, occurrence and distribution, nutrition, growth and yield- colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants. Organic farming :- Green manuring and Organic fertilizers, Recycling of bio-degradable municipal, agricultural and industrial wastes- bio compost making methods, types and method of vermicompost- field Application.	17	1		18

Total= 45

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF B. Sc. 2nd SEMESTER

Title of the Course : Morphology, Embryology and Anatomy of Angiosperm.

Course Code : MAJOR-BOT-2.1

Nature of the Course : Major/ Core -2.1

Total Credits : 04

Distribution of Marks : 100:(60+15) + 25 (Practical)

Course Objectives:-The objective of this course is to provide knowledge to the students on Angiosperm with their morphology, reproduction and anatomical structure.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks: 10	Morphology of Root, Stem and Leaves with their types and modification, Phyllotaxy, Venation, Morphology of inflorescence, flower, stamen and carpel.	8			8
Unit-II Marks: 10	Structural development of anther and anther wall. Microsporogenesis and Microgametogenesis. Pollen characteristics, structure of pollen wall, NPC system.	9	1		10
Unit-III Marks: 20	Structure and types of ovule, megasporogenesis and megagametogenesis, embryosac and its types. Pollination, Fertilization, double fertilization, development of monocot and dicot embryo, structure and function of endosperm, polyembryony, apomixis, parthenogenesis.	12	2		14
Unit-IV Marks: 20	Anatomy:- organisation of plant body; cell, cell inclusions, tissue system, meristem, Histogen Theory and Tunica Corpus theory, vascular bundle, cambium, anatomy of monocot and dicot stem, anomalous secondary growth, periderm, heart wood and soft wood.	12	1		13
Practicals Marks:25	<ol style="list-style-type: none"> 1. Study of special types of inflorescence – Cyathium, Hypanthodium, Verticillaster. 2. Apical meristem of root and shoot. 3. Epidermal system: cell types, stomata types. 4. Stem: monocot, dicot - primary and secondary growth. 5. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy). 6. Adaptive Anatomy: xerophytes, hydrophytes. 7. Collection of different types of modified plant organs. 8. Field study/visit to any aquatic or deserticimportant places around. 			15	15

Total= 60

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF B. Sc. 2nd SEMESTER

Title of the Course :Morphology and Reproduction of Seed plant.

Course Code : MINOR-BOT-2.1

Nature of the Course : Minor-2.1

Total Credits : 04

Distribution of Marks : 100:(60+15) + 25 (Practical)

Course Objectives:-The objective of this course is to provide knowledge to the students on gymnosperm and angiosperm with their morphology, reproduction and ecological importance.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks: 20	Gymnosperm:- General characteristics, classification. External and internal morphology and reproduction of <i>Cycas</i> , <i>Pinus</i> , <i>Gingko</i> and <i>Gnetum</i> . Economic importance. Fossils:- Geological times scale, process of fossilization and types. General account of <i>Rhynia</i> , <i>Sphenophyllum</i> and <i>Pteridosperms</i> . Importance of fossil study.	11	2		13
Unit-II Marks: 10	Morphology of Angiosperm:- Morphology and types of root, stem and leaves. Venation and phyllotaxy. Flower, Types of Inflorescence – modified types.	8			8
Unit-III Marks: 15	Anther and Ovule:- Anther wall and function, microsporogenesis and microgametogenesis, pollen wall, NPC system, melissopalynology. Structure and types of ovule, Megasporogenesis and megagametogenesis, embryosac and types.	11	1		12
Unit-IV Marks: 15	Pollination and fertilization:- Types of pollination, significance and adaptation of pollination, double fertilization, development of monocot and dicot embryo, endosperm and its function, polyembryony.	11	1		12
Practicals Marks:25	1. Study of morphology and reproductive parts of <i>Cycas</i> , <i>Pinus</i> and <i>Gnetum</i> . 2. Study of fossil plants through photograph/specimens. 3. Study of different types of leaves, venation, phyllotaxy 4. Study of different types of inflorescence. 5. Anatomical study of monocot and dicot stem. 6. Study of secondary growth in stem. 7. Study of pollen morphology. 8. Visit to any hilly forest area.			15	15

Total= 60

Mode of Assessment: a) One internal assessment/Sessional examination-(15Marks)

DETAILED SYLLABUS OF B. Sc. 2nd SEMESTER

Title of the Course :Plant Science-2
 Course Code : MD-BOT-2.1
 Nature of the Course : GE/ Multi-disciplinary-2.1
 Total Credits : 03
 Distribution of Marks : 75: (Theory-60+15)

Course Objectives:- The objective of this course is to provide knowledge to the students on Morphology, Anatomy, Ecology, Cell biology, Genetics, Physiology.

Unit	Content	L	T	P	Total hours
Unit-I Marks: 10	<u>Morphology and Anatomy:-</u> Life forms, types of leaf, stem and root, flower and their modification, cell, tissue and its type and function. Anatomy of root, stem and leaf.	7	1		8
Unit-II Marks: 25	<u>Ecology:-</u> Definition, abiotic and biotic factors, ecosystem, food chain, food web, Ecological pyramids, population and community. Biodiversity and conservation, Types of forest, ecological adaptation. Soil, water and air pollution. Greenhouse effect, global warming and climate change. <u>Organic cultivation:-</u> Bio-fertilizer –definition and its types, advantage over chemical fertilizer, benefits of use of organic fertilizer and organic food items with special reference to health and resource generation.	15	1		16
Unit-III Marks: 15	<u>Cell biology, Genetics and Plant Breeding:-</u> <u>Plant cell:-</u> Ultra structure of cell and functions of cell organelles <u>Chromosome:-</u> physical and chemical nature. DNA- its physical and chemical nature. Various forms of DNA. Different types of RNA.	11	1		12
Unit-IV Marks:10	<u>Plant Physiology:-</u> Transpiration, photosynthesis and respiration	8	1		9

Total= 45

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF B. Sc. 2nd SEMESTER

Title of the Course : Nursery and Gardening
Course Code : SEC-BOT-2.1
Nature of the Course : Skill Enhancement Course -2.1
Total Credits : 03
Distribution of Marks : 75:(60+15)

Course Objectives:-The objective of this course is to provide knowledge to the students on various aspects of nursery and gardening.

Unit	Content	L	T	P	Total hours
Unit-I Marks: 18	<p>Nursery: definition, objectives and scope and building up of infrastructure for nursery, Planning and seasonal activities – Planting - direct seeding and transplants.</p> <p>Seed:- Structure and types – Seed dormancy; causes and methods of breaking dormancy – seed storage: Seed banks, factors affecting seed viability, genetic erosion – Seed production technology – Seed testing and certification.</p>	13	1		14
Unit-II Marks: 12	<p>Vegetative propagation: Definition and types of air- layering, cutting and grafting, selection of cutting, collecting season, treatment of cutting, rooting medium, planting- hardening of plants.</p> <p>Geenhouse: – mist chamber, shed roof, shade house and glass house.</p>	9	1		10
Unit-III Marks: 18	<p>Gardening:- definition, objectives and scope- different types of gardening – landscape and home gardening – parks and its components – plant materials and design – computer application in landscaping - Gardening operations: soil laying , manuring, watering, management of pests and diseases and harvesting. Green belt, Green Building</p>	11	1		12
Unit-IV Marks: 12	<p>Sowing/raising of seeds and seedlings:- Transplanting of seedlings, Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomato, and carrot- storage and marketing procedures.</p>	8	1		9

Total= 45

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF B. Sc. 3RD SEMESTER

Title of the course : CELL BIOLOGY

Course Code : MAJOR-BOT-3.1

Nature of the Course : Major/Core-3.1

Total Credits : 04

Distribution of Marks : 100 (Theory-60+15) + 25 (Practical)

Course Objectives: The objective of this course is to provide knowledge to the students on various aspects of cell biology

UNIT	CONTENTS	L	T	P	Total hours
Unit-I Marks:10	<u>The cell:-</u> Cell as a unit of structure and function; characteristics of prokaryotic and eukaryotic cells; origin of eukaryotic cell (Endosymbiotic theory)	6	1		7
Unit-II Marks: 25	<u>Cell wall and plasma membrane:-</u> Chemistry, structure and function of the plant cell wall. Overview of Fluid Mosaic Model; Chemical composition of membranes; membrane function. <u>Cell organelles:-</u> Nucleus:- structure- nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus, . Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filaments. Chloroplast, Mitochondria and Peroxisomes:- Structural organization; Function; semiautonomous nature of mitochondria and chloroplast. Ribosomes- types, components and function, Lysosome, Endoplasmic reticulum- structure, targeting and insertion of proteins in ER and Golgi apparatus	15	2		17
Unit-III Marks:-15	<u>Membrane transport and protein sorting:-</u> Membrane transport- Passive, Active and Facilitated transport, membrane channels, gates and pores, endocytosis and exocytosis, protein glycosylation, protein sorting and export from Golgi Apparatus; protein folding and processing, Smooth endoplasmic reticulum and lipid synthesis, export of proteins and lipids.	10	3		13
Unit-IV Marks: 10	<u>Cell Division:-</u> Phases of eukaryotic cell cycle, mitotic and meiotic cell division; Regulation of cell cycle checkpoints, role of protein kinases, significance	7	1		8

Practicals Marks: 25	<ol style="list-style-type: none"> 1. Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo/Crinum. 2. Demonstration of the phenomenon of protoplasmic streaming in Hydrilla and Vallisnaria leaf. 3. Measurement of cell size by micrometric method 4. Counting the cells per unit volume with the help of haemocytometer. (Yeast/pollen grains). 5. Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique. 6. Study of cell and its organelles with the help of electron micrograph (Demonstration) 7. Study the phenomenon of plasmolysis and deplasmolysis. 8. Study different stages of mitosis and meiosis 	15			15
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Total=60

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF B.Sc. 3RD SEMESTER

Title of the course : Microbiology and Phytopathology

Course Code : MAJOR-BOT-3.2

Nature of the Course : Major/Core-3.2

Total Credits : 04

Distribution of Marks : 100 (Theory-60+15) + 25 (Practical)

Course Objectives: The objective of this course is to provide knowledge to the students on various aspect of Microbiology and Phytopathology

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks: 18	<p><u>Introduction to Microbial World:-</u> Introduction and scope of microbiology Microorganism and diversity of life: brief account on-<i>Archaeobacteria, Eubacteria, Rickttisia, Chlamydiae, Actinomycetes, Mycoplasma and Speharoplasts.</i> Nutritional requirement and growth of microorganism: Nutrients, Factors affecting and influencing microbial growth, Culture media, Types of culture media. Microbial metabolism: Metabolism [Only an overview of microbial metabolism- the concept of anabolism (Biosynthesis) and catabolism (ATP- generating Pathways- Respiration and Fermentation- Glycolysis, Krebs cycle and Electron transport chain)]. Some products of microbial origin</p>	13	2		15
Unit-II Marks:12	<p><u>Viruses:-</u> Discovery, general characteristics; classification (Baltimore), general structure, replication (lytic and lysogenic cycle), Structure of viroids, prions, DNA virus(T-phage), RNA virus(TMV). Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organism of plant diseases. Dissemination of plant virus.</p>	7	1		8
Unit-III Marks:12	<p><u>Bacteria:-</u> Discovery, General Characteristics; various forms of virus, Cell structure; Nutrition; Reproduction- Vegetative, asexual and recombination (Conjugation, transformation and transduction). Economic importance of bacteria withreference to their role in agriculture and industry (Alcohol and Antibiotic production).</p>	7	0		7
Unit-IV Marks:18	<p><u>Phytopathology:-</u> Terms and concepts; Genera symptoms of plant diseases; principles of prevention and control of plant diseases, role of quarantine. classification of diseases; Host-Pathogen relationships; Koch's postulates, aflatoxin and phytoalexin Some typical plant diseases with host plant, causal organism, symptoms, etiology, disease cycle and their control measures:- <u>Bacterial diseases-</u> Citrus canker and angular leaf spot of cotton. <u>Viral diseases-</u> Tobacco Mosaic Viruses (TMV), vein clearing disease.</p>	13	2		15

	Fungal diseases- Late blight of potato, Black stem rust of wheat, White rust of crucifers.			
Practical Marks: 25	<ol style="list-style-type: none"> 1. Electron micrographs/ Models of viruses- T-Phage and TMV/ Line drawings/ Photographs of Lytic and Lysogenic Cycle, 2. Types of bacteria to be observed from temporary/ permanent slides/ Photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root nodule. 3. Gram staining 4. Isolation of soil microflora 5. Phytopathology: Bottle specimens, Herbarium specimens should be made of bacterial diseases, Viral diseases, Fungal diseases (Locally available). 6. Preparation of local diseases album 	15		15

Total=60

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF B.Sc. 3RD SEMESTER

Title of the course : PLANT ANATOMY, EMBRYOLOGY AND CRYPTOGAMS

Course Code : MINOR-BOT-3.1

Nature of the Course : MINOR-3.1

Total Credits : 04

Distribution of Marks : 100 (Theory-60+15) + 25 (Practical)

Course Objectives: The objective of this course is to provide knowledge to the students on various aspects plant anatomy and embryology

UNITS	CONTENT	L	T	P	TOTAL HOURS
Unit-I Marks:20	<p><u>Plant Anatomy:-</u> Meristematic tissue:- Definition, types of meristematic tissues and permanent tissues, root and shoot apical meristems; simple and complex tissues Organs:- Structure of dicot and monocot root, stem and leaf Secondary Growth:- Vascular Cambium- Structure and function, seasonal activity, secondary growth in root and stem, Wood(heartwood and sapwood). Adaptive and Protective systems:- Epidermis,Cutical, Stomata; General account of adaptations in Xerophytes and hydrophytes</p>	15	2		17
Unit-II Marks:15	<p><u>Embryology:-</u> Structural organization of flower:- Structure of anther and pollen; structure and types of ovules; types of embryo sacs. Organization and ultra structure of mature embryo sac. Pollination and fertilization:- Pollination mechanisms and adaptations; Double fertilization;</p>	7	1		8
Unit-III Marks:10	<p><u>Embryo and Endosperm:-</u> Endosperm types,structure and function; Dicot and monocot embryo; Embryo-endosperm relationship Apomixis and Polyembryony:-Definition, types and practical applications</p>	6	1		7
Unit-IV Marks:15	<p><u>Cryptogams:-</u> Bryophytes:-General Characteristics, Classification, photosynthetic tissue, life cycle, amphibians of the plant world, economic importance of bryophytes, life history of <i>Marchantia sp</i>, <i>Anthoceros sp</i>. <i>Polytrichum sp</i>. Pteridophytes:- General characteristics, life cycle, classification, apospory, apogamy, and parthenogenesis,life history of <i>Lycopodium sp</i>. <i>Equisetum sp</i>. <i>Marsilia sp</i>.</p>	11	2		13

Practicals Marks:25	1. Study of meristem through permanent slides and photographs. 2. Tissues (Parenchyma, collenchyma and sclerenchyma), Phloem(permanent slides, photographs). 3. Stem: Monocot: Canna ; Dicot: tinospora; Secondary growth: Amaranthus 4. Root: Monocot: Canna ; Dicot: tinospora; Secondary: Amaranthus. 5. Leaf: Monocot & Dicot leaf 6. Study of embryological slides (permanent). 7. Study of morphology, anatomy and reproductive structure of Marchantia sp. Polytrichum sp. Lycopodium sp. Marsilea sp.	15			15
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Total=60

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF B. Sc. 3RD SEMESTER

Title of the course : PLANT PATHOLOGY, TAXONOMY AND CELL BIOLOGY

Course Code : MD-BOT-3.1

Nature of the Course : Generic elective Course/ Multi-disciplinary-3.1

Total Credits : 03

Distribution of Marks : 75:(Theory-60+15)

Course Objectives: The objective of this course is to provide knowledge to the students on various aspects of plant physiology, taxonomy and cell biology

UNIT	CONTENTS	L	T	P	Total hours
Unit-I Marks:20	<p><u>Phytopathology:-</u> Terms and concepts; Genera symptoms of plant diseases; principles of prevention and control of plant diseases, role of quarantine. classification of diseases; Host-Pathogen relationships; Koch's postulates, aflatoxin and phytoalexin Some typical plant diseases with host plant, causal organism, symptoms, etiology, disease cycle and their control measures:-- <u>Bacterial diseases:-</u> Citrus canker and angular leaf spot of cotton. <u>Viral diseases:-</u> Tobacco Mosaic Viruses (TMV), vein clearing disease. <u>Fungal diseases:-</u> Late blight of potato, Black stem rust of wheat, White rust of crucifers.</p>	14	1		15
Unit-II Marks:20	<p><u>Identification and Nomenclature:-</u> Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, keys: Single-access and multi-access. E-flora, Virtual herbarium. Principles and rules (ICN): Ranks and names; binomial system, typification , author citation, valid publication, rejection of names, principles of priority and its limitation.</p>	13	2		15
Unit-III Marks:10	<p><u>Classification of plants:-</u> Salient features of classification- artificial system, natural system and phylogenetic system of classification.</p>	6	1		7

Unit-IV Marks:10	Cell biology:- The cell:- Cell as a unit of structure and function; characteristics of prokaryotic and eukaryotic cells; origin of eukaryotic cell (Endosymbiotic theory) Cell organelles:- Structure and function: Nucleus, Chloroplast, Mitochondria, Golgi Apparatus, Lysosomes, ER Cell division:- Cell cycle, meiosis and mitosis, cell cycle checkpoints.	7	1		8
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Total=45

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF B. Sc. 3RD SEMESTER

Title of the course : ETHNOBOTANY

Course Code : SEC-BOT-3.1

Nature of the Course : Skill Enhancement Course (SEC)-3.1

Total Credits : 03

Distribution of Marks : 75:(Theory-60+15)

Course Objectives: The objective of this course is to provide knowledge to the students on various aspects of ethnobotany

UNITS	CONTENT	L	T	P	TOTAL HOURS
Unit-I Marks:15	ETHNOBOTANY:- Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India and their life styles. Plants used by the tribals: (a) Food plants (b) intoxicants and beverages (c) resins and oils and miscellaneous uses	8	2		10
Unit-II Marks:10	Methodology of Ethnobotanical studies (a)Field work (b) Herbarium (c) Ancient Literature (d) Archaeological Findings (e) Temples and sacred places	6	1		7
Unit-III Marks:25	Role of ethnobotany in modern medicineMedico-ethnobotanical sources in India; Significance of the following plants in ethnobotanical practices (along with their habitat and morphology) (a) <i>Azadirachtaindica</i> (b) <i>Ocimum sanctum</i> (c) <i>Vitexnegundo</i> (d) <i>Gloriosasuperba</i> (e) <i>Tribulusterrestris</i> (f) <i>Pongamiapinnata</i> (g) <i>Cassia auriculata</i> (h) <i>Indigoferatinctoria</i> . Role of ethnobotany in modern medicine with special example (a) <i>Ravolfiaserpentina</i> ,(b) <i>Trichopuszeylanicus</i> ,(c) <i>Artemisiaannua</i> (d) <i>withania somnifera</i> . Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management).	15	1		16
Unit-IV Marks:10	Ethnobotany and legal aspects Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and traditional knowledge.	10	2		12

Total=45

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF B.Sc. 4th SEMESTER

Title of the course : PLANT BIOCHEMISTRY AND MOLECULAR BIOLOGY

Course Code : MAJOR-BOT-4.1

Nature of the Course : Major/Core-4.1

Total Credits : 04

Distribution of Marks : 100 (Theory-60+15) + 25 (Practical)

Course Objectives: The objective of this course is to provide knowledge to the students on various aspects of plant biochemistry and molecular biology.

UNIT	CONTENTS	L	T	P	Total hours
Unit-I Marks: 25	<p>Biomolecules:- Types of chemical bonds and its significance, structure and properties of water; P^H and buffers.</p> <p>Carbohydrates:- Nomenclature and classification; brief account and types of Monosaccharides; Oligosaccharides and Polysaccharides.</p> <p>Lipids:- Definition and importance, biological roles of lipids, saturated and unsaturated fatty acids, major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacylglycerols structure, functions and properties.</p> <p>Proteins:- Structure of amino acids; levels of protein structure – primary, secondary, tertiary and quaternary; Protein denaturation and roles of protein.</p> <p>Nucleic acids:- Physical and chemical Structure of nucleic acids Types of nucleic acids- linear and circular; various forms of DNA Viz. A, B, C, D, Z forms); different types of RNA.</p>	15	2		17
Unit-II Marks:10	<p>Bioenergetics Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, couples reactions, redox potential. ATP: structure, its role as an energy currency molecule.</p>	5	1		6
Unit-III Marks:10	<p>Enzymes Structure of enzyme: holoenzyme, Apoenzyme , Cofactors, Coenzymes and prosthetic group; Classification of enzymes; features of active site; substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced – fit theory) Michaelis - Menten equation, enzyme inhibition and factors affecting enzyme activity.</p>	9	1		10
Unit-IV Marks 15	<p><u>Genetic materials and its organization:-</u> Carriers of genetic information Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment.</p> <p><u>The replication of DNA :-</u> Chemistry of DNA synthesis (Kornberg's discovery); General principles – bidirectional, semiconservative and semi discontinuous replication, RNA priming; Various models of DNA</p>	11	1		12

	replication , including rolling circle, θ (theta) mode of replication, replication of linear ds-DNA; Enzymes involved in DNA replication				
Practicals Marks:25	<ol style="list-style-type: none"> 1. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins. 2. Estimation of plant proteins by Biruret /Lowry method. 3. Estimation of reducing and non-reducing sugars in plant samples. 4. DNA estimation by diphenylamine reagent/UV spectrophotometry. 5. Study of DNA replication mechanism through Photographs (Rolling circle, theta replication and semi-discontinuous replication) 6. Photograph establishing nucleic acids as genetic materials(Messelson and Stahl's, Avery et al, Griffith's, Hershey and Chase's and Fraenkel & Conrat;s experiment) 7. Effect of temperature and P^H on enzyme activity. 	15			15

Total=60

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF 4TH SEMESTER

Title of the course : MORPHOLOGY AND ANATOMY OF ANGIOSPERMS

Course Code : MAJOR-BOT- 4.1

Nature of the Course : MAJOR/CORE-4.2

Total Credits : 04

Distribution of Marks : 100 (Theory-60+15) + 25 (Practical)

Course Objectives: The objective of this course is to provide knowledge to the students on various aspects of morphology and anatomy of angiosperms.

UNITS	CONTENT	L	T	P	TOTAL HOURS
Unit-I Marks:7	<u>MORPHOLOGY:-</u> Morphology of inflorescence, stamens and carpel, fruit; Telome theory, Phyllode theory; Role of morphology in plant classification	4	1		5
Unit-II Marks:15	<u>INTRODUCTION AND SCOPE OF PLANT ANATOMY:-</u> Applications in systematics, forensics, and pharmacognosy <u>STRUCTURE AND DEVELOPMENT OF PLANT BODY:-</u> Internal organization of plant body: the three tissue systems, types of cells and tissues. <u>Development of plant body:</u> Cytodifferentiation and organogenesis during embryogenic development.	10	1		11
Unit-III Marks:20	<u>TISSUES:-</u> Classification of tissues; simple and complex tissues(no phylogeny); Cytodifferentiation of tracheary elements and sieve elements; Pits and plasmodesmata; Wall ingrowths and transfer cells, adcrustation and incrustation, Ergastic substances. Hydathodes, cavities, lithocysts and laticifers. <u>APICAL MERISTEMS:-</u> Evolution of concept of organization of shoot apex (Apical cell theory, Histogen theory, tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structure of dicot and monocot stem; Origin, development, arrangement and diversity in size and shape of leaves; Structure of dicot and monocot leaf, Kranz anatomy, organization root apex(Apical cell theory, Histogen theory, Korper - Kappe theory); Quiscent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root.	15	2		17

Unit-IV Marks: 18	VASCULAR CAMBIUM AND WOOD :- Structure, function and seasonal activity of cambium; Secondary growth in root and stem. Axially and radially oriented elements; Types of rays and axial parenchyma; Cyclic aspects and reaction wood; Sapwood and Heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology, Development and composition of periderm, rhytidome and lenticels, stele. ADAPTIVE AND PROTECTIVE SYSTEM:- Epidermal tissue system, cuticle, epicuticular waxes, Trichomes (uni- and multicellular, glandular and non-glandular, two examples of each), stomata (classification); Adcrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes.	11	1		12
Practicals Marks:25	<ol style="list-style-type: none"> 1. Study of special types of inflorescence – Cyathium, Hypanthodium, Verticillaster, Hypanthium. 2. . Study of special types of fruits- Superior fruits (Dillenia); Aggregate fruits (Custard apple, Michelia, Periwinkles, Polyalthia); Multiple fruits (Pine apple, Jack fruits). 3. Study of anatomical details through permanent slides/temporary stain mounts / macerations / museum specimens with the help of suitable examples. 4. Apical meristem of root, shoot and vascular cambium. 5. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular. 6. Root: monocot, dicot, secondary growth. 7. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels. 8. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy). 9. Adaptive Anatomy: xerophytes, hydrophytes. 10. Secretory tissues: cavities, lithocysts and laticifers. 	15			15

Total=60

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF 4TH SEMESTER

Title of the course : ECONOMIC BOTANY

Course Code : MAJOR-BOT- 4.3

Nature of the Course : MAJOR/CORE-4.3

Total Credits : 04

Distribution of Marks : 100 (Theory-60+15) + 25 (Practical)

Course Objectives: The objective of this course is to provide knowledge to the students on various aspects of economic botany

UNITS	CONTENT	L	T	P	TOTAL HOURS
Unit-I Marks:12	<p><u>ORIGIN OF CULTIVATED PLANTS:-</u> Centre of origin, their importance with reference to Vavilov's work. Introductions, domestication and loss of crop genetic diversity; evolution of new crops/ varieties, importance of germplasm diversity</p> <p><u>CEREALS:-</u> Wheat and Rice (origin, morphology, processing & uses); Brief account of millets.</p>	7	1		8
Unit-II Marks:12	<p><u>LEGUMES:-</u>Origin, morphology and uses of chick pea, Pigeon pea and fodder legume. Importance to man and Ecosystem</p> <p><u>SOURCES OF SUGARS AND STARCHES:-</u> Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation and uses</p>	6	1		7
Unit-III Marks:18	<p><u>SPICES:-</u> Listing of important spices, their family and parts used. Economic importance with special reference to fennel, saffron, clove and black pepper</p> <p><u>BEVERAGES:-</u> Tea, Coffee (morphology, processing and uses)</p> <p><u>SOURCES OF OILS AND FATS:-</u> General description, classification, extraction, their use and health implications groundnut, coconut, linseed, soybean, mustard and coconut(Botanical name, family and uses)</p> <p><u>NATURAL RUBBER:-</u> Para- rubber: tapping, processing and use</p>	15	2		17

Unit-IV Marks:18	DRUG- YIELDING PANTS:- Therapeutic and habit forming drugs with special reference to Cinchona, Digitalis, Papaver and Cannabis; Tobacco (Morphology, processing, uses and health hazards). TIMBER PLANTS:- General account with special reference to teak and pine FIBERS:- Classification based on the origin of fibers; Cotton, Coir and Jute (morphology, extraction and uses).	11	2		13
Practicals Marks:25	<ol style="list-style-type: none"> 1. Cereals: Study of useful parts: Rice/Bean (habit sketch, study of paddy and grain, starch grain, micro-chemical test). 2. Legumes: Bean, Groundnut, (habit, fruit, seed structure, micro-chemical tests). 3. Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans). 4. Sources of oils and fats: Coconut and Mustard. 5. Rubber: Specimen, photograph/model of tapping, samples of rubber products. 6. Test for alkaloids: Neem, Vinca rosea. 7. Fiber-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), Jute (specimen, transverse section of stem, test for lignin). 8. Local field tour in an area having availability of economic plants. 	15			15

Total=60

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)

DETAILED SYLLABUS OF 4TH SEMESTER

Title of the Course: Plant Physiology & Metabolism

Course code: MINOR-BOT-4.1

Nature of the Course: Minor-4.1

Total Credits: 04

Distribution of Marks:

Course objectives: The objective of this course is to provide knowledge to the students on the various aspects of plant physiology and metabolism

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:15	<p><u>Plant-water relations</u> :- Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation</p> <p><u>Mineral nutrition</u> :- Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps</p>	10	2		12
Unit-II Marks:15	<p><u>Translocation in phloem</u> :- Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading.</p> <p><u>Photosynthesis</u> :- Photosynthetic Pigments (Chl-a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C₃, C₄ and CAM pathways of carbon fixation; Photorespiration</p>	10	2		12
Unit-III Marks:15	<p><u>Respiration</u>:- Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.</p> <p><u>Enzymes</u> :- Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.</p> <p><u>Nitrogen metabolism</u> :- Biological nitrogen fixation; Nitrate and ammonia assimilation.</p>	10	2		12

Unit-IV Marks:15	Plant growth regulators :- Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene. Plant response to light and temperature :- Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization	8	1		9
Practicals Marks:25	1. Determination of osmotic potential of plant cell sap by plasmolytic method. 2. To study the effect of light on transpiration by excised twig. 3. Calculation of stomatal index and stomatal frequency. 4. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration. 5. To study the effect of bicarbonate concentration on O ₂ evolution in photosynthesis. Demonstration experiments :- 1. Bolting. 2. Effect of auxins on rooting. 3. Suction due to transpiration. 4. R.Q. 5. Respiration in roots.	15			15

Total=60

Mode of Assessment: a) One internal assessment/Sessional examination-(15 Marks)