VIDYASAGAR UNIVERSITY

Midnapore, West Bengal

PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF

BACHELOR OF SCIENCE (HONOURS)

MAJOR IN BOTANY

4-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2023-2024)

Based on

Curriculum & Credit Framework for Undergraduate Programmes

(CCFUP), 2023 & NEP, 2020

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VIDYASAGAR UNIVERSITY
BACHELOR OF SCIENCE (HONOURS) MAJOR IN BOTANY
(under CCFUP, 2023)

Level	YR.	SEM	Course Type	Course Code	Course Title	Credit	L-T-P	Marks		
								CA	ESE	TOTAL
B.Sc. (Hons.)	1st	I	**SEMESTER-I**							
			Major-1	BOTHMJ101	**T: Plants and Microbial Diversity and its Evolution** **P: Practical**	4	3-0-1	15	60	75
			SEC	BOTSEC01	**P: Biofertilizers**	3	0-0-3	10	40	50
			AEC	AEC01	Communicative English -1 (***common for all programmes***)	2	2-0-0	10	40	50
			MDC	MDC01	Multidisciplinary Course -1 (***to be chosen from the list***)	3	3-0-0	10	40	50
			VAC	VAC01	ENVS (***common for all programmes***)	4	2-0-2	50	50	100
			Minor (Disc.-I)	BOTMI01	**T: Plant Science-I *(To be taken by students of other Disciplines)*** **P: Practical**	4	3-0-1	15	60	75
			Semester-I Total			20				400
		II	**SEMESTER-II**							
			Major-2	BOTHMJ102	**T: Morphology, Anatomy and Plant Taxonomy** **P: Practical**	4	3-0-1	15	60	75
			SEC	BOTSEC02	**P: Floriculture**	3	0-0-3	10	40	50
			AEC	AEC02	MIL-1 (***common for all programmes***)	2	2-0-0	10	40	50
			MDC	MDC02	Multi Disciplinary Course-02 (***to be chosen from the list***)	3	3-0-0	10	40	50
			VAC	VAC02	Value Added Course-02 (***to be chosen from the list***)	4	4-0-0	10	40	50
			Minor (Disc.-II)	BOTMI02	**T: Plant Science-II *(To be taken by students of other Disciplines)*** **P: Practical**	4	3-0-1	15	60	75
			Summer Intern.	CS	Community Service	4	0-0-4	-	-	50
			Semester-II Total			24				400
			TOTAL of YEAR-1			44				800

MJ = Major, MI = Minor Course, SEC = Skill Enhancement Course, AEC = Ability Enhancement Course, MDC = Multidisciplinary Course, VAC = Value Added Course; CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical, MIL = Modern Indian Language, ENVS = Environmental Studies

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MAJOR (MJ)

MJ-1: Plants and Microbial Diversity and its Evolution **Credits 04 (Full Marks: 75)**

MJ-1T: Plants and Microbial Diversity and its Evolution **Credits 03**

Course contents:

UNIT	Topic	No. of Lectures
1	Introduction to microbial diversity; Whittaker's five-kingdom system and Carl Richard Woese's three-domain system.	**3**
2	Virus: General characteristics; classification (Baltimore), idea aboutviroids and prions; detailed structure T4-phage and SARS-COV2, lytic and lysogenic cycle; Economic importance of viruses.	**7**
3	Bacteria: General characteristics; Types-archaebacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Bergey's classification, Cell structure; Nutritional types; vegetative and Reproductive structure - asexual and recombination (conjugation, transformation and transduction).Economic importance of bacteria.	**8**
4	Algae: General characteristics; Ecology and distribution; range of thallus organization; Classification (Van Den Hoek, 1995), reproduction and life cycles of *Nostoc*, *Oedogonium, Chara*, and *Polysiphonia*.	**8**
5	Fungi: General characteristics; Affinities with plants and animals; Thallus organization; Heterothallism and parasexuality. Classification Ainsworth (up to Order). Life cycles of *Synchitrium, Saccharomyces*, *Ascobolus*, *Agaricus*. Symbiotic associations: Lichen and Mycorrhiza. Economic importance.	**8**
6	Archegoniate: Unifying features of archegoniates, Bryophytes: General characteristics; Adaptations to land habit; Range of thallus organization. Idea about different orders. Outline classification (Mishler), Morphology, anatomy and reproduction of *Marchantia, Porella, Anthoceros*, *Notothylas and Funaria*; Economic importance with special reference to *Sphagnum.*	**7**
7	Pteridophytes: General characteristics; Idea about different orders. Classification (Sporne, 1975), Early land plants (*Rhynia* and *Asteroxylon*)Morphology, anatomy and reproduction of *Lycopodium, Selaginella, Equisetum* and *Pteris. E*conomic importance.	**7**
8	Gymnosperms: General characteristics, idea about different orders, Classification (Sporne, 1965), morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum*; Economic importance.	**7**
9	Palaeobotany: Geological time scale and important events, Types of plant fossils - impressions, compressions, petrifaction. Stromatolites, Factors for fossilization.	**5**

MJ-1P: Plants and Microbial Diversity and its Evolution (Practical) **Credits 01**

Course contents:

1. Electron micrographs/Models of viruses – T-Phage and Sars-CoV2,
2. Sketches of Lytic and Lysogenic Cycle.
3. Study ofcurd organisms curd through Gram staining.

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4. Endospore staining.
5. Study of vegetative and reproductive structures of *Nostoc*, *Oedogonium* and *Polysiphonia*.
6. Study of reproductive structures of *Ascobolus*, and *Agaricus.*
7. Study of reproductive structure of *Saccharomyces* and *Penicillium*.
8. Lichens: Photomicrographs of different types of Lichens.
9. *Marchantia*- Morphology of thallus, whole mount of rhizoids & Scales, vertical section of thallus through Gemma cup, whole mount of Gemmae (all temporary slides), vertical section of antheridiophore, archegoniophore, longitudinal section of sporophyte (all permanent slides).
10. *Anthocero*s- Morphology of thallus, dissection of sporophyte (to show spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide).
11. *Pogonetum*- Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); Permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema.
12. *Selaginella*- Morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobilus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide).
13. *Equisetum*- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores, transverse section of rhizome (all permanent slide).
14. *Pteris*- Morphology, transverse section of rachis, vertical section of sporophyll, wholemount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide).
15. *Cycas*- Morphology (leaf),vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide).
16. *Pinus*- Morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle (temporary slide), transverse section of stem, longitudinal section of / transverse section of male cone, whole mount of microsporophyll, whole mount of Microspores (temporary slides), longitudinal section of female cone, tangential longitudinal section &radial longitudinal sections stem (permanent slide).
17. *Gnetum*- Morphology (stem, male & female cones), transverse section of stem, vertical section of ovule (all permanent slide)
18. Study of fossil genera - *Rhynia, Cooksonia, LepidodendronandLepidocarpon* through photographs.

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MJ-2: Morphology, Anatomy and Plant Taxonomy **Credits 04 (Full Marks: 75)**

MJ-2T: Morphology, Anatomy and Plant Taxonomy **Credits 03**

Course contents:

UNIT	Topic	No. of Lectures
1	**Vegetative morphology**- A general account of root, stem & leaves with different types of modifications; Different types of stipules and modifications along with phyllotaxy and diversity of leaves.	**5**
2	**Flower**- different types of inflorescences**;** Floral morphology, aestivation with special reference to adhesion and cohesion of the floral parts, Placentaion - types; Floral formula, Floral diagram.	**5**
3	Fruits & seeds-types and dispersal mechanisms	**3**
4	**Structure and Development of Plant Body**: internal organization of plant body: The three tissue systems, types of cells and tissues. Root stem transition. Apical meristems, types of stomata, Types of vascular bundles; Stele and its evolution.	**5**
5	Vascular Cambium and Wood Structure, function and seasonal activity of cambium; Secondary growth in root and stem, Types of Anomalous secondary growth with special emphasis on *Boerhavia and Dracaena*. Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Annual ring; composition of periderm, rhytidome and lenticels.	**5**
6	**Significance of Plant systematics**; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys:Single access and Multi-access.	**5**
7	**Taxonomic hierarchy**, Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary). Botanical nomenclature, Principles and rules (ICN); Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.	**7**
8	**Systems of classification**, Overview of artificial, natural and phylogenetic classification; Classification system of Bentham and Hooker (up to series). Brief reference of Angiosperm Phylogeny Group (APG IV) classification.	**6**
9	**Taximatrics**: numerical taxonomy and cladistics Characters; OTUs, Cluster analysis; Phenograms, cladograms (definitions and differences).	**4**
10	**Phylogeny of Angiosperms**: Terms and concepts (homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms. Concept of Basal Angiosperms and Eudicots.	**7**
11	**General descriptions of the given families**: Magnoliaceae, Malvaceae, Acanthaceae, Verbenaceae, Scrophulariaceae, Fabaceae, Caesalpinioideae, Asteraceae, Euphorbiaceae, Lamiaceae, Poaceae, Orchidaceae.	**8**

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MJ-2P: Morphology, Anatomy and Plant Taxonomy (Practical) Credits 01

1. Study of phyllotaxy and stipules.
2. Study of Inflorescence types- Racemose, Cymose, Special types (Capitulum, Verticellaster, and Hypanthodium)
3. Study of floral morphology with special reference to adhesion and cohesion of the floral parts, placentation types.
4. Study of different fruit types.
5. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):
   Malvaceae – *Sida*sp. / *Abutilon* sp.
   Acanthaceae – *Ruellia* sp./*Barleria* sp.
   Fabaceae – *Tephrosia*sp./*Crotalaria* sp.
   Verbenaceae – *Lantana* sp./*Duranta*sp.
   Asteraceae - *Vernonia*sp./*Ageratum* sp., *Ecliptas*p./*Tridax*sp.
   Lamiaceae –*Leucas*sp./*Ocimum* sp.
   Euphorbiaceae – *Euphorbia* sp. / *Jatropha* sp.
   Poaceae –*Triticum*sp./*Chrysopogon*sp. or any local common grass
   Orchidaceae- *Vanda* sp.
6. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book – At least 25 nos.).
7. Root: monocot, dicot, secondary growth.
8. Stem: monocot, dicot - primary and secondary growth
9. Anatomy of Leaf: isobilateral, dorsiventral
10. Anomalous secondary growth (Through permanent slides).
11. Study of Stomata and its types
12. Field visit (two) at least one to study the local flora

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MINOR (MI)

MI – 1: Plant Science-I **Credits 04 (Full Marks: 75)**

MI – 1T: Plant Science-I **Credits 03** **[45L]**

Course contents:

UNIT	Topic	No. of Lectures
1	**Introduction to microbial world-** Whittaker's five-kingdom system **Virus:** General characteristics, classification (Baltimore), Economic importance. **Bacteria:** General characteristics, Bergey's Classification, Economic importance. **Algae:** General characteristics; habitat, classification (Van Den Hoek, 1995), lifecycle patterns of *Volvox* and *Batrachospermum*, Economic importance. **Fungi:** General characteristics,Classification (Ainsworth, up to Order), life cycle patterns of *Rhizopus* and *Agaricus*, economic importance. Brief account of lichen and mycorrhiza.	15
2	**Bryophytes:** General characteristics, classification (Proskauer, 1957), morphology, anatomy and reproduction of *Riccia*, *Anthoceros* and *Funaria*, economic importance of bryophytes. **Pteridophytes:** General characteristics, Classification (Sporne, 1975), morphology, anatomy and reproduction of *Lycopodium*, *Adiantum* and *Marsilea*. Economic importance	15
3	**Gymnosperms:** General characteristics, Classification (Sporne, 1965), morphology, anatomy and reproduction of *Cycas* and *Pinus.* Economic importance. **Paleobotany:** Geological time scale and important events, Types of plant fossils.	15

MI – 1P: Plant Science-I (Practical) **Credits 01**

Course Outline

1. Electron micrographs/Models of viruses – T-Phage and Sars-CoV2.
2. Study of Curd organisms through Gram staining.
3. Study of vegetative and reproductive structure of *Volvox*, and *Batrachospermum.*
4. Study of morphology and reproductive structure of *Rhizopus* and *Agaricus.*
5. Study of morphology of thallus and reproductive structure of *Riccia*, *Anthoceros* and *Funaria.*
6. Study of morphology vegetative and reproductive structure of *Lycopodium*, *Adiantum* and *Marsilea.*
7. Study of morphology and vegetative structure of *Cycas* and *Pinus.*
8. Study of fossil types (impressions, compressions, petrifaction).

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MI-2: Plant Science II **Credits 04 (Full Marks: 75)**

MI-2T: Plant Science II **Credits 03** **[45L]**

Course contents:

UNIT	Topic	No. of Lectures
1	**Plant morphology**- A general account of root, stem & leaves of monocot and dicot; phyllotaxy.	3
2	**Flower**- different types of inflorescences, Aestivation, Placentation - types; Floral formula, Floral diagram.	4
3	Fruits and Seeds-types	2
4	**Structure and Development of Plant Body**: The three tissue systems, primary structure of root, stem, and leaf; types of stomata, Types of vascular bundles; Secondary growth in root and stem, Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood; Annual ring; peridermand lenticels.	5
5	**Significance of Plant systematics**; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Brief concept about Flora, Monographs; Keys:Single access and Multi-access.	4
6	**Taxonomic hierarchy**, Concept of taxa (family, genus, species); Species concept (taxonomic, biological, evolutionary). Botanical nomenclature, Principles and rules (ICN); author citation, valid publication.	4
7	**Systems of classification**, Overview of artificial, natural and phylogenetic classification; Classification system of Bentham and Hooker (up to series). Brief account of Angiosperm Phylogeny Group classification. Concept of primitive and Advance angiosperms (basal angiosperm and eudicots).	4
8	**General descriptions of the given families**: Malvaceae, Papilionaceae, Acanthaceae, Verbenaceae, Asteraceae, Poaceae.	4

MI-2P: Plant Science II (Practical) **Credits 01**

Course Outline:

1. Study of leaf types (Simple and Compounds).
2. Study of inflorescence types(recemose and cymose)
3. Study of floral diversity with special reference to adhesion and cohesion.
4. Study of fruit types:
   Berry: *Cucumis sativus*, *Capsicum annuum*, *Solanum melongena*
   Drupe: *Mangifera indica*, *Borasus flaballifer*
   Hesperidium: *Citrus*
   Nut: *Arachis hypogea*
5. Study of vegetative and floral characters of the following families
   Malvaceae – *Sida* sp. / *Abutilon* sp.
   Acanthaceae – *Ruellia* sp./*Barleria* sp.
   Papilionaceae – *Tephrosia* sp./*Crotalaria* sp.
   Verbenaceae – *Lantana* sp./*Duranta* sp.

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SKILL ENHANCEMENT COURSE (SEC)

SEC 1: Biofertilizers **Credits 03**

SEC1P: Biofertilizers **Full Marks: 50**

Course Outline:

Unit- 1: General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.

Unit- 2: *Azospirillum:* isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication.

Unit- 3: Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

Unit- 4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

Unit-5: Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

Suggested Readings:

1. Dubey, R.C., 2005 A Text book of Biotechnology, S. Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New _Delhi.
6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic _Farming Akta Prakashan, Nadiad

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SEC 2: Floriculture **Credits 03**

SEC 2P: Floriculture **Full Marks: 50**

Course Outline:

UNIT-1: Introduction: History of gardening; Importance and scope of floriculture and landscape gardening.

UNIT-2: Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

UNIT-3: Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai.

UNIT-4: Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India.

UNIT-5: Landscaping Places of Public Importance: Landscaping highways and Educational institutions.

UNIT-6: Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Lilium, Orchids).

UNIT-7: Diseases and Pests of Ornamental Plants.

Suggested Readings:

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

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