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.)	2nd	III	SEMESTER-III							
			Major-3	BOTHMJ03	T: Cell Biology; P: Practical	4	3-0-1	15	60	75
			Major-4	BOTHMJ04	T: Economic Botany and Pharmacognosy; P: Practical	4	3-0-1	15	60	75
			SEC	BOTSEC03	P: Mushroom Cultivation Technology	3	0-0-3	10	40	50
			AEC	AEC03	Communicative English -2 (***common for all programmes***)	2	2-0-0	10	40	50
			MDC	MDC03	Multidisciplinary Course -3 (***to be chosen from the list***)	3	3-0-0	10	40	50
			Minor-3 (Disc.-I)	BOTMIN03	T: Plant Science-III; P: Practical	4	3-0-1	15	60	75
					Semester-III Total	20				375
		IV	SEMESTER-IV							
			Major-5	BOTHMJ05	T: Biochemistry and Metabolism; P: Practical	4	3-0-1	15	60	75
			Major-6	BOTHMJ06	T: Plant Pathology and Plant Health Science; P: Practical	4	3-0-1	15	60	75
			Major-7	BOTHMJ07	T: Ecology, Phytogeography and Evolution; P: Practical	4	3-0-1	15	60	75
			AEC	AEC04	MIL-2 (***common for all programmes***)	2	2-0-0	10	40	50
			Minor-4 (Disc.-II)	BOTMIN04	T: Plant Science-IV; P: Practical	4	3-0-1	15	60	75
			Summer Intern.	INT	Internship/ Apprenticeship - activities to be decided by the Colleges following the guidelines.	4	0-0-4	-	-	50
					Semester-IV Total	22				400
					TOTAL of YEAR-2	42				775

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

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MAJOR (MJ)

MJ-3: Cell Biology **Credits 04 (Full Marks: 75)**

MJ-3T: Cell Biology (Theory) **Credits 03**

Course contents:

Unit	Topic
Unit- 1	**Cell:** Cell as a unit of structure and function; Origin of Eukaryotic cell (Endosymbiotic theory).Chemistry, structure and function of Plant cell wall. Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.
Unit-2	**Organelles:** Structural organization and function of membrane; fluid mosaic model; intracellular organelles (nucleus, mitochondria, GERL system, Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility).
Unit-3	**Cell division and cell cycle:** Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases.
Unit-4	**Chromosome:** General features, chromatin, nucleosome structure,higher order structure of chromatin, euchromatin and heterochromatin; Structure and significance of polytene and lampbrush chromosomes; brief knowledge of chromosome banding (only definitions of C-, G-and Q-bands) and its applications.
Unit-5	**Cellular communication:** General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation. Cell signaling Hormones and their receptors, cell surface receptor, second messengers.

MJ-3P: Cell Biology (Practical) **Credits 01**

Course contents:

1. Study of plant cell structure with the help of epidermal peel mount of *Onion/Rhoeo.*
2. Study the phenomenon of plasmolysis and deplasmolysis.
3. Study of cell and its organelles with the help of electron micrographs.
4. Study different stages of mitosis (onion root tip) and meiosis .
5. Preparation of normal, molar solutions and percent solutions (using NaCl and Sucrose).
6. Measurement of cell size by the technique of micrometry.
7. Study the effect of organic solvent and temperature on membrane permeability.

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Suggested Readings:

1. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
2. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
3. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

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MJ-4: Economic Botany and Pharmacognosy **Credits 04 (Full Marks: 75)**

MJ-4T: Economic Botany and Pharmacognosy (Theory) **Credits 03**

Course contents:

Unit	Topic
Unit- 1	Origin of Cultivated Plants; Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity.
Unit-2	Study of the following economically important plants (Scientific names, families, parts used and importance; Spices-Ginger, cumin, Beverages- Tea, coffee, Medicinal plants-, neem, Vasaka, Vegetables- Potato, raddish, bottle, Fibre yielding plants- jute, Timber yielding plants- Sal, Lac Culture, Fruits- Mango, Sugar yielding plant- Sugarcane. Medicinal Plants : Serpentine root (Rauvolfia), Creat (Andrographis), Ipecac, Aljun, Yew (Taxus), Red periwinkle (Catharanthus), Margosa.
Unit-3	Medicinal botany: History, scope and importance of medicinal plant, a brief idea about indigenous medicinal sciences- ayurveda, siddha and unani. Polyherbal formulations.
Unit-4	Methods of cultivation : Rice, Tea, Cashew nut.; cultivation of Lemon grass and oil extraction method.
Unit-5	Pharmacognosy- General account: Pharmacognosy and its importance in modern medicine, Crude drugs, Classification of drugs- chemical and pharmacological, Drug; evaluation– organoleptic, microscopic, chemical, physical and biological. Major pharmacological groups of plant drugs and their uses.
Unit-6	Secondary metabolites: Definition of secondary metabolites and difference with primary metabolites , Major types–terpenoids, phenolics, flavonoids, alkaloids and their protective action against pathogenic microbes and herbivores.
Unit-7	Pharmacologically active constituents: Source plants (one example) parts used and uses of: Steroids (Solasodin, Diosgenin, Digitoxin), Tannin (Catechin), Resins (Gingerol, Curcuminoids), Alkaloids (Quinine, Atropine. Pilocarpine, Strychnine, Reserpine, Vinblastine), .Phenols (Sennocide and Capsaicin).

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MJ-4P: Economic Botany and Pharmacognosy (Practical) Credits 01

1. Study of local economically important plants and submission of report with photographs
2. Study of cultivation practices in the field and submission of report.
3. Chemical tests for (a) Tannin (*Camellia sinensis / Terminalia chebula*), (b) Alkaloid (*Catharanthus roseus*).
4. Powder microscopy – Zingiber and Holarrhena.
5. Histochemical tests of (a) Curcumin (*Curcuma longa*), (b) Starch in non-lignified vessels (Zingiber), (c) Alkaloid (stem of *Catharanthus* and bark of *Holarrhena*).

Suggested Readings:

1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
3. Chrispeels, M.J. and Sadava, D.E. 1994 Plants, Genes and Agriculture. Jones & Bartlett_Publishers.

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MJ-5: Biochemistry and Metabolism **Credits 04 (Full Marks: 75)**

MJ-5T: Biochemistry and Metabolism (Theory) **Credits 03**

Course contents:

Unit	Topic
Unit- 1	Bioenergetics: Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as an energy currency molecule.
Unit-2	Forces stabilizing atomic and molecular interactions: Formation, properties and biological significance of Van der Waals force, hydrogen bond, ionic bond, covalent bond and hydrophobic interaction, free radicals. **pH and buffer:** biological significance of pH, Characteristics of buffer.
Unit-3	Carbohydrate chemistry: Classification and properties of carbohydrates with emphasis on glycosidic bond, stereoisomerism, optical isomerism, epimerization, mutarotation and reducing action of sugars.
Unit-4	Protein chemistry: Classification of proteins, primary, secondary, tertiary and quaternary structure of proteins; Properties of proteins with emphasis on isoelectric pH, biuret test and heat coagulation.
Unit-5	Lipid Chemistry: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacylglycerols structure, functions and properties; Phosphoglycerides.
Unit-6	Nucleic acid chemistry: Elementary concept of nucleoside, nucleotide, polynucleotide, elementary concept of RNA, chemical properties of DNA and comparison of A, B, Z.
Unit-7	Enzymes: Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; isoenzymes; Features of active site, substrate specificity, mechanism of action (activation energy), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity. enzyme inhibition.
Unit-8	**Metabolism:** Synthesis and catabolism of sucrose and starch. β-oxidation of fat, Synthesis and breakdown of triglycerides,

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MJ-5P: Biochemistry and Metabolism (Practical) **Credits 01**

1. Qualitative tests for carbohydrates - reducing and non-reducing sugars, glucose, fructose, sucrose, starch and lipids.
2. Qualitative tests for detection of proteins, amino acids and organic acids (citric, tartaric, oxalic and malic acids).
3. Estimation of glucose by Benedict's quantitative reagent.
4. Qualitative tests for carbohydrate, protein, lipid, alkaloids, tannins, phenols, and flavonoids using polar and nonpolar solvents of plant samples.

Suggested Readings:

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.

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MJ-6: Plant Pathology and Plant Health Science **Credits 04 (Full Marks: 75)**

MJ-6T: Plant Pathology and Plant Health Science (Theory) **Credits 03**

Course contents:

Unit	Topic
Unit- 1	Definitions - disease, pathogen, inoculum, infection, resistance, incubation period, Disease cycle, Koch's postulates. Symptoms- necrotic, hypoplastic and hyperplastic.
Unit-2	Plant Pathogens and Diseases - Types of plant pathogens (viruses, bacteria, fungi,nematodes);Life cycle of pathogens; Mode of transmission; Plant-pathogen interactions- pathogenicity factors;Phytoalexins in defense mechanism; Systemic and Local acquired resistance.
Unit-3	Common plant diseases and their symptoms- Late blight of potato, Black stem rust of wheat, Stem rot of jute, Brown spot of rice; Epidemiology of plant diseases; Disease development and progression; Symptomology; Symptoms variability;
Unit-4	Plant Disease and Health Management - Principles of integrated pest management; Cultural practices of disease prevention, biological and chemical control methods
Unit-5	Plant Health in Agriculture:–Disease management in the agricultural system; Role of plant health in sustainable agriculture; Food safety and plant health.
Unit-6	Plant Health and the Environment–Impacts of plant health in ecosystems; Plant health and climate change; Bio-security and plant health; Plant quarantine; Plant Variety Protection (PVP) rights, Plant Breeder's rights.

MJ-6P: Plant Pathology and Plant Health Science (Practical) **Credits 01**

1. Visual diagnosis of common diseased plant symptoms and signs–Fungal leaf spots, Bacterial leaf spots, Vein banding, Mosaic and ring spot, Leaf distortion, Powdery mildew, Leaf tip death, Cankers, Fruit discoloration, Wilts, Blights, Damping off.
2. Laboratory testing of plant pathogens by microscopy and pathogen-selective media plates.
3. A field visit and assessment of plant disease incidence and severity.

Suggested Readings:

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1. Agrios, G. N. 1997. Introductory Plant Pathology. 4th ed. Academic Press, New York, NY.
2. Hansen, M. A. and R. L. Wick. 1993. Plant disease diagnosis: present and future prospects. Advances in Plant Pathology 10:65-126.
3. Hansen, M. A. and R. L. Wick. 1993. Plant disease diagnosis: present and future prospects. Advances in Plant Pathology 10:65-126.

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MJ-7: Ecology, Phytogeography and Evolution **Credits 04 (Full Marks: 75)**

MJ-7T: Ecology, Phytogeography and Evolution (Theory) **Credits 03**

Course contents:

Unit	Topic
Unit- 1	Introduction: Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, Carrying capacity, homeostasis.
Unit-2	Edaphic factors : Soil Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development; Water ; States of water in the environment
Unit-3	Plant communities: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement. Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts.
Unit-4	Population Ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection).
Unit-5	Biotic interactions: Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism;
Unit-6	Phytogeography : Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local Vegetation.
Unit-7	The evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale; Origins of unicellular and multicellular organisms; Major groups of plants.

MJ-7P: Ecology, Phytogeography and Evolution (Practical) **Credits 01**

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH of various soil and water samples (pH meter, universal indicator/Lovibond comparator and pH paper)
3. Study of morphological adaptations of hydrophytes and xerophytes. Comparative study of ecologically significant anatomy in plants: Aquatic (*Eichhornia crassipes* root, *Ipomoea carnea* stem); Xerophytic (*Peperomia pellucida* leaf, *Bambusa* sp. leaf).

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4. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).
5. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
6. Determination of organic carbon content of soil sample.
7. Field visit to familiarise students with ecology & Sustainability of different sites.

Suggested Readings:

1. Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
2. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
4. Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
5. Kormondy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.

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MINOR (MI)

MI – 3: Plant Science-III **Credits 04 (Full Marks: 75)**

MI – 3T: Plant Science-III **Credits 03** **[45L]**

Cell Biology

Course contents:

UNIT	Topic	No. of Lectures
1	**Cell as a unit of Life-** The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components.	15
2	**Cell Organelles-** Structure and function of cell organelles: Chloroplast, Mitochondria, Ribosomes, Endoplasmic reticulum. **Cell Membrane and Cell Wall-** The functions of membranes; Models of membrane structure; The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of the membranes; Selective permeability of the membranes; Cell wall.	15
3	**Cell Cycle-** Overview of Cell cycle, Mitosis and Meiosis. Fundamental differences between mitosis and meiosis. Synaptonemal complex, mitotic spindle, significance of meiosis.	15

MI – 3P: Plant Science-III (Practical) **Credits 01**

Course Outline

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.
2. Study of the photomicrographs of cell organelles.
3. To study the structure of plant cell through temporary mounts.
4. Study of mitosis and meiosis (temporary mounts and permanent slides).
5. Study the effect of temperature, organic solvent on semi permeable membrane.
6. Demonstration of dialysis of starch and simple sugar.
7. Study of plasmolysis and deplasmolysis on *Rhoeo* leaf.
8. Measure the cell size (either length or breadth/diameter) by micrometry.

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MI-4: Plant Science IV **Credits 04 (Full Marks: 75)**

MI-4T: Plant Science IV **Credits 03** **[45L]**

Economic Botany and Pharmacognosy

Course contents:

UNIT	Topic	No. of Lectures
1	**Origin of Cultivated Plants-** Concept of centres of origin, their importance with reference to Vavilov's work.	15
2	**Cereals-**Wheat -Origin, morphology, uses. **Legumes-** General account with special reference to Gram and soybean. **Spices-** General account with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses). **Beverages-**Tea (morphology, processing, uses). **Oils and Fats-** General description with special reference to groundnut. **Fibre Yielding Plants-** General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)	15
3	**Pharmacognosy:** Definition, Importance, Classification of drug - Chemical and Phannacological, Drug evaluation. Organoleptic and microscopic studies with reference to nature of active principles and common adulterants of *Alstonia* (bark), *Adhatoda*(leaf), *Strychnos*(seed), *Rauvolfia* (root), and *Zinziber* (rhizome). Secondary Metabolites: Definition of primary and secondary metabolites and their differences, major types - terpenes, phenolics and alkaloids. A brief idea about extraction of alkaloids.	15

MI-4P: Plant Science IV (Practical) **Credits 01**

Course Outline:

1. Study of economically important plant: Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and microchemical tests.
2. Organoleptic and powder microscopy of *Alstonia*bark, *Adhatoda* leaf, *Strychnos* seed and *Zinziber* rhizome.
3. Chemical tests for Tannin (*Terminalia chebula*) and Alkaloid (*Catharanthus roseus*).

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SKILL ENHANCEMENT COURSE (SEC)

SEC 3: Mushroom Cultivation Technology **Credits 03**

SEC3P: Mushroom Cultivation Technology **Full Marks: 50**

Course Outline:

Unit 1: Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus*.

Unit 2: Cultivation Technology: Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production.

Unit 3: Storage and nutrition: Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in saltsolutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.

Unit 4: Food Preparation: Types of foods prepared from mushroom.Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested Readings:

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

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