WEST BENGAL STATE UNIVERSITY

DRAFT SYLLABI STRUCTURE IN BOTANY OF THE 4-YEAR UNDERGRADUATE PROGRAMME (HONOURS) / (HONOURS WITH RESEARCH) UNDER NEP BASED CREDIT SYSTEM

(w. e. f. 01.08.2023)

SEMESTER I **T+P** **50+50** **Exam-50**	**Major (DSC) DS-1**
DS1 (5) **DS-1T (3), Microbiology 25 and Phycology 25**	**THEORY: 50 marks (45 lectures)** **Microbiology - 25 Marks** (23 lectures) **Unit 1:** Introduction to the microbial world. Binomial nomenclature, difference between Prokaryotic and Eukaryotic microorganisms, development of microbiology as a discipline, spontaneous generation vs biogenesis, contribution of Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming. Primary concept of microorganism – 3 domain concept. **Unit 2:** Viruses Physiochemical and biological characteristics; general structure with special reference to subviral particles (Satellite virus, Viroids and Prions); groups of virus, DNA virus (T-phage, λ phage), lytic and lysogenic cycle, RNA virus (TMV) – physico-chemical characteristics and its mode of multiplication. **Unit 3:** Bacteria General characteristics, Microbial nutrition and types. Types - archaebacteria, eubacteria, and mycoplasma; cell structure;

	Reproduction- asexual and recombination (conjugation, transformation and transduction). **Unit 4:** Applied Microbiology Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine). **Phycology - 25 Marks** (22 lectures) **Unit 5:** General characteristics; ecology and distribution-brief introduction; range of thallus organization; cell structure and components; cell wall, pigment system, reserve food (only groups represented in the syllabus), flagella and flagellar roots; methods of reproduction; classification; criteria, evolution of sex in algae; SET (serial endo symbiotic) theory; classification of Lee 2015 (only up to groups); significant contributions of important phycologists (F.E. Fritsch, G.M. Smith, M.O.P. Iyengar). **Unit 6:** Cyanophyta and Xanthophyta Ecology and occurrence; range of thallus organization; cell structure; reproduction, morphology and life-cycle of *Nostoc* and *Vaucheria*. **Unit 7**: Chlorophyta and Charophyta General characteristics; occurrence; range of thallus organization; cell structure; reproduction. Morphology and life-cycles of *Volvox*, *Oedogonium*, *Chara*. Evolutionary significance of Prochloron. **Unit 8:** Phaeophyta and Rhodophyta Characteristics; occurrence; range of thallus organization; cell structure; reproduction. Morphology and life-cycles of *Ectocarpus*, *Fucus* and *Polysiphonia*. **Unit 9:** Applied Phycology Role of algae in the environment, agriculture, biotechnology and industry, bioremediation.

DS-1P (2), Microbiology 10+15 and Phycology 10+15	**Practical 50 marks** **Microbiology - 25** **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.** Demonstration of the preparation of media, sterilization and sub culturing. **4.** Gram staining of bacteria from curd sample/culture; Endospore staining with malachite green using the (endospores taken from soil bacteria). **Phycology - 25** **5.** Study of vegetative and reproductive structures of *Nostoc*, *Volvox*, *Oedogonium*, *Chara*, *Vaucheria*, *Ectocarpus*, *Fucus* and *Polysiphonia*, through temporary preparations and permanent slides. Prochloron through electron micrographs. **6.** Illustration through drawing prism with magnification of vegetative and reproductive structure of *Oedogonium, Chara, Vaucheria*. **Suggested Readings** **Microbiology** 1. Atlas, R.M……. Principles of Microbiology [McGraw Hill] 2. Willey, M.J., Sherwood, L.M. &Woolverton, C. J. Prescot, Harley and Klein's……Microbiology [McGraw Hill] 3. Madigan, M.T., Martinko, J.M. &Parker, J. Brock. Biology of Microorganisms [Prentice Hall] 4. Tortora, G.J., Funke, B.R. & Case, C.L……. Microbiology - An Introduction [Dorling Kindersley India Pvt. Ltd. for Pearson Education]) 5. Pelczar, M.J., Chan, P.C.S. & Krieg, N.R. Microbiology [Tata McGraw Hill] 6. Stanier, R.Y., Ingraham, J.L., Wheelis, M.L. &Painter, P.R…… General Microbiology [Macmillan Education Ltd.] 7. Banerjee, A.K. & Banerjee, N. Fundamentals of Microbiology and Immunology [New Central Book Agency] 8. Dey, N.C., Dey, T.K. & Sinha, D. Medical Bacteriology. Mycology....NCBA]

	Phycology 1. Chapman, V.J. & Chapman, D.J. The Algae [Macmillan, London] 2. Lee, R.E. 2015…edition 5 Phycology [Cambridge Univ. Press] 3. Kumar, H.D. &Singh, HN.Introductory Phycology [East-West Press Pvt. Ltd] 4. Sharma, O.P. Text Book of Algae [(Tata McGraw Hill] 5. Smith, G.M. Cryptogamic Botany Vol. 1 [McGraw Hill] 6. Vashistha, B.R., Singh, A.K. & Singh, V.P.....Algae [S. Chand & Co. Pvt. Ltd.] 7. Bold, H.C. &Wynne, M.J. Introduction to Algae: Structure &Reproduction [Prentice Hall]) 8. Ganguly, H.C. &Kar, A.K. College Botany Vol.-I [New Central Book Agency] 9. Chopra, G.L. A text book of Algae [S. Nagin & Co. New Delhi] 10. Hoek, C., Mann, D.G. &Jahns, H.M. 1995. Algae: an. [Cambridge Univ. Press]
SEMESTER II **T+P** **50+50** **Exam-50**	**Major (DSC) DS-2**
DS-2 (5), DS2T (3) Mycology 25 and Phytopathology 25	**Theory: 50 marks (45 lectures)** **Fungi-25 Marks** (23 lectures) **Unit 1:** Introduction to true fungi General characteristics; affinities with plants and animals; idea of Fungi as a separate kingdom of life; thallus organization; cell wall composition; nutrition; sexual (with reference to sporocarp) and asexual (spore forming bodies in deuteromycetes) reproduction; classification (Hawksworth et al 1995). Concepts of Molecular identification, Barcoding and Tree of Life. **Unit 2:** Chytridiomycota and Zygomycota Characteristic features and significance; thallus organisation; reproduction; life cycle with reference to *Synchytrium, Rhizopus*. **Unit 3:** Ascomycota

	General characteristics (asexual and sexual fruiting bodies); ecology; life cycle, heterokaryosis and parasexuality; life cycle with reference to *Saccharomyces, Penicillium, Neurospora, Ascobolus, Claviceps purpurea.* **Unit 4:** Basidiomycota General characteristics; ecology; black stem rust of wheat, life cycle with reference to spore forms; concept of macrocylic, microcyclic, demicyclic, heteroecious, autoecious rusts. *Puccinia* (physiological specialization), Loose and covered smut (symptoms only). *Agaricus*; bioluminescence, fairy rings and mushroom cultivation (general account). **Unit 5:** Allied Fungi General characteristics; status of slime molds; occurrence; types of plasmodia; types of fruiting bodies. **Unit 6:** Oomycota General characteristics; ecology; life cycle and classification, concept as a separate kingdom of life with reference to *Phytophthora, Albugo, Saprolegnia.* **Unit 7:** Symbiotic associations Lichen – Occurrence; general characteristics; growth forms and range of thallus organization; nature of associations of algal and fungal partners; reproduction; ecological and economic significance; Mycorrhiza - ectomycorrhiza, endomycorrhiza and their significance. **Unit 8:** Applied Mycology Role of fungi in biotechnology; application of fungi in food industry (flavour & texture, fermentation, baking, organic acids, enzymes, mycoproteins); secondary metabolites (pharmaceutical preparations); agriculture (biofertilizers); mycotoxins; biological control (mycofungicides, mycoherbicides, mycoinsecticides, myconematicides); medical mycology. **Phytopathology- 25 Marks** (22 lectures) **Unit 9**: Definitions and Concepts of plant disease: Parasite, Pathogen and Vector, Inoculum and Inoculum density, Infection, Susceptibility and Virulence, Etiology; symptoms - types; necrotroph, biotroph & hemibiotroph; disease, disease types,

	disease triangle, disease cycle (monocyclic & polycyclic); sporadic, endemic, epidemic and pandemic diseases with examples that had significant impact in human history; Koch's Postulates. **Unit 10:** Host - Parasite Interaction: recognition concept and infection. Disease development - role of enzymes, toxins, growth regulators. Defense strategies - structural and biochemical mechanisms (Constitutive and Induced). Roles of Phytoalexins, Phytoanticipins & PR proteins, elicitors, HR response. Genetics of Plant - Pathogen interaction - Flor's gene for gene hypothesis, Concept of R gene, Avr gene and Effectors. Resistance – systemic acquired and induced systemic resistance. **Unit 11:** Disease Management: Chemical, Biological, Cultural & Integrated management methods; quarantine; disease diagnosis, disease clinics and disease forecasting (preliminary ideas). **Unit 12:** Prevention and control of plant disease and role of quarantine. Casual organism, disease cycle and management of bacterial diseases – *Citrus* canker, Ralstonia wilt of Tomato, viral diseases – Tobacco Mosaic virus, Chilli Leaf Curl, Fungal and Oomycete diseases – Early and Late blight of potato, Black stem rust of wheat, Blast of Rice and Wheat, Downy Mildews (*Pseudoperonospora cubensis*) and Powdery Mildew of Cucurbits (*Podosphaera xanthii*), plant disease epidemiology- basic concepts, elements of disease, plant pathologist's contribution to crops and society.

DS2P (2) Mycology 10+15 and Phytopathology 10+15	**Practical – 50 marks** **Fungi: 25 marks** **1. Introduction to the world of fungi** (unicellular, coenocytic/septate mycelium, ascocarps & basidiocarps) through temporary slide preparation and permanent slides. **2.** Micrometry (measurement of reproductive unit). **3.** *Rhizopus* - study of asexual stage from temporary mounts and sexual structures through temporary slide preparation and permanent slides. **4.** *Aspergillus* and *Penicillium* - study of asexual stage from temporary mounts and sexual stage through temporary slide preparation and permanent slides. **5.** *Ascobolus* - sectioning through ascocarp and micrometry. **6.** *Agaricus* - specimens of button stage and full-grown mushroom; sectioning of gills of *Agaricus*, fairy rings and bioluminescent mushrooms to be shown. **7.** *Albugo* - study of symptoms of plants infected with *Albugo*; asexual phase study through section/temporary mounts and sexual structures through permanent slides. **8.** Lichens - study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. **9.** Mycorrhizae - ectomycorrhiza and endomycorrhiza (Photographs). **Phytopathology-25 marks** **10.** *Puccinia* - Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts. **11.** Phytopathology- Herbarium specimens of bacterial diseases- *Citrus* canker; viral diseases - TMV, Vein clearing symptom from any available specimen; fungal diseases - Early and Late blight of potato, Black stem rust of wheat and Blast of Rice, Powdery and downy mildew from any available specimen. **12.** Isolation of pathogen from diseased leaf, inoculation of fruit, demonstration of media preparation, pure culture isolation.

	Suggested Readings **Mycology and Phytopathology** 1. The Fifth Kingdom-An Introduction to Mycology 4th Edition. Bryce Kendricks. [Hackett Publishing Co.] 2. Essential Plant Pathology, Second Edition. G. L. Schumann and C. J. D'Arcy. [American Phytopathological Society] 3. Hungry Planet: Stories of Plant Diseases. 2012. Gail L. Schumann and Cleora J. D'Arcy [American Phytopathological Society] 4. H. S. Chaube and V. S. Pundhir. (2009). Crop Diseases and their Management. Prentice Hall (India). 5. Agrios, G.N. (2006) Plant Pathology, 5th edition, [Academic Press], U.K. 6. Webster, J. Introduction to Fungi. [Cambridge University Press] 7. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. Introductory Mycology [John Wiley & Sons Inc). 8.Moore-Landecker, E. Fundamentals of the Fungi 4th Ed [Prentice Hall] 9. Ingold, C.T. and Hudson H.J.The biology of the Fungi 6" Ed [Chapman & Hall] 10. Vashistha, B.R. Fungi [S. Chand & Co. Ltd.] 11. Sharma, P.D. Fungi and Allied Organisms [Narosa Pub. House] 12. Ganguly, H.C. and Kar, A.K.College Botany Vol. II [New Central Book Agency]

WEST BENGAL STATE UNIVERSITY

SYLLABI STRUCTURE IN BOTANY OF THE 3-YEAR UNDERGRADUATE/ 3-YEAR MULTIDISCIPLINARY PROGRAMME UNDER NEP BASED CREDIT SYSTEM

(w. e. f. 01.08.2023)

	Minor 1 (MA-1)
MA-1 (5) **T=50** **10+50** **P=50** **10+30** **Phycology** **Microbiology** **Mycology** **Phytopathology** **Archegoniate**	**Biodiversity (Microbes, Algae, Fungi and Archegoniate)** **Theory-50 Marks (45 Lectures)** **Unit 1: Microbes** (8 Lectures) Viruses – discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); economic importance; bacteria – discovery, general characteristics and cell structure; reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); economic importance. **Unit 2: Algae** (7 Lectures) General characteristics; ecology and distribution; range of thallus organization and reproduction; classification of algae (Lee 1989); morphology and life-cycles of *Nostoc*, *Oedogonium*, *Fucus*, *Polysiphonia*. Economic importance of algae. **Unit 3: Fungi and Phytopathology** (10 Lectures) Introduction - General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification (Hawksworth et al1995); true Fungi- general characteristics, ecology and significance, life cycle of *Rhizopus* (Zygomycota) *Penicillium* (Ascomycota), *Puccinia*, *Agaricus* (Basidiomycota); symbiotic associations – Lichens - general account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance

	Phytopathology: Terms & Definitions - Pathogen, Propagule, Vector, Inoculum, Infection, Symptoms (necrosis, wilt, spot, blight, hypoplastic & hyperplastic).// Disease & Disease Cycle, Disease Triangle, Disease Management // Koch's postulates // Phytoalexins.// Symptoms, Causal organisms, Disease cycle & Control measures of - (a) Tungro virus disease of rice & (b) Late blight of potato. **Unit 4: Introduction to Archegoniate** (2 Lectures) Unifying features of archegoniates, transition to land habit, alternation of generations. **Unit 5: Bryophytes** (6 Lectures) General characteristics, adaptations to land habit, classification (Proskauer 1954, up to class), range of thallus organization. Systematic position, morphology, anatomy and reproduction of *Marchantia*, *Anthoceros* and *Funaria* (developmental details not to be included). Ecology and economic importance of bryophytes with special mention of *Sphagnum*. **Unit 6: Pteridophytes** (7 Lectures) General characteristics, classification (Sporne 1975), early land plants (*Cooksonia* and *Rhynia*). Systematic position, morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Pteris* (developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economic importance of Pteridophytes. **Unit 7: Gymnosperms** (5 Lectures) General characteristics, classification (Sporne), systematic position, morphology, anatomy and reproduction of *Cycas* and *Pinus*. (developmental details not to be included). Ecological and economic importance. **Practical 50 Marks** **1.** Gram staining of bacteria from curd sample/culture. **2.** Study of vegetative and reproductive structures of *Nostoc* (electronmicrographs), *Oedogonium* (Preparation of temporary slides), *Fucus* and *Polysiphonia* through permanent slides. **3.** *Rhizopus* and *Penicillium* - Asexual stage from temporary mounts and sexual structures through permanent slides. **4.** *Puccinia* - herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves (permanent slides) of both the hosts. **5.** *Agaricus* - specimens of button stage and full-grown mushroom; sectioning of gills of *Agaricus*. **6.** Lichens - study of growth forms of lichens (crustose, foliose and fruticose). **7.** Mycorrhiza - ectomycorrhiza and endomycorrhiza (Photographs).

	8. *Marchantia* - morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae, v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides). **9.** *Funaria*- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores, permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema. **10.** *Selaginella*- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll, l.s. strobilus (permanent slide). **11.** *Equisetum* - morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry), t.s rhizome (permanent slide). **12.** *Pteris* - morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores, t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide). **13.** *Cycas* - morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores, l.s. ovule, t.s. root (permanent slide). **14.** *Pinus* - morphology of long and dwarf shoots, male and female cone, t.s. needle, stem, w.m. microsporophyll, w.m. microspores, l.s. female cone, female cone (permanent slide).
	Minor -2 (MA-2)
MA-2 (5) **T=50** **10+50** **P=50** **10+30** **Plant Ecology and Taxonomy**	**Plant Ecology and Taxonomy** **Theory – 50 Marks (45 Lectures)** **Unit 1:** (1 Lecture) Introduction. **Unit 2:** (2 lectures) Ecological factors – Soil - Origin, composition, soil profile; water- states of water in the environment; Light and temperature - variation optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes. **Unit 3:** (2 lectures) Plant communities - characters; Ecotone and edge effect; succession; processes and types. **Unit 4:** (6 Lectures) Ecosystem - structure; energy flow trophic organisation; food chains and food webs, Ecological pyramids; production and productivity; biogeochemical cycling; cycling of carbon, nitrogen. **Unit 5:** (4 Lectures) Phytogeography - principle biogeographical zones; Endemism. **Unit 6:** (2 Lectures) Introduction to plant taxonomy- identification, classification, nomenclature.

	Unit 7: (4 Lectures) Identification - functions of herbarium, important herbaria and botanical gardens of the world and India; documentation - Flora, Keys. **Unit 8:** (6 Lectures) Taxonomic evidences- from palynology, cytology, phytochemistry and molecular data. **Unit 9:** (2 Lectures) Taxonomic hierarchy - ranks, categories and taxonomic groups. **Unit 10:** (6 Lectures) Botanical nomenclature- principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication. **Unit 11:** (5 Lectures) Classification - types of classification - artificial, natural and phylogenetic. Classification of Bentham and Hooker (up to series), general idea of Cronquist's classification (1981). **Unit 12:** (4 Lectures) Numerical taxonomy and cladistics – characters, variations, cluster analysis, phenograms, cladograms (definitions and differences). **Practical = 50 Marks** **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 and analysis of two soil samples for carbonates, chlorides, nitrates, organic matter and by rapid field test. **3.(a)** Study of morphological adaptations of hydrophytes (*Nymphaea* petiole) and xerophytes (*Nerium* leaf) (four each). **3(b)** Study of biotic interactions of Stem parasite (*Cuscuta*), Epiphytes (Orchid root). **4.** Determination of minimal quadrat size for the study of herbaceous vegetation in the College/ suitable site by species area curve method. (Species to be listed). **5.** Quantitative analysis of herbaceous vegetation in the college campus /suitable site for frequency and comparison with Raunkiaer's frequency distribution law. **6.** Study of vegetative and floral characters of the following families (Description, V.S. of flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham and Hooker's system of classification): Brassicaceae – *Nastertium indicum*; Asteraceae – *Eclipta* and *Tridax*;

	Solanaceae – *Nicotiana plumbaginifolia*, *Solanum nigrum*, Lamiaceae - *Leonurus sibiricus*, *Leucas aspera* and *Ocimum sanctum*; Liliaceae - *Allium*. **7.** Mounting of a properly dried and pressed specimen of any ten wild plant with herbarium label (to be submitted with the record book).

WEST BENGAL STATE UNIVERSITY

SYLLABI STRUCTURE IN BOTANY OF THE 4-YEAR UNDERGRADUATE PROGRAMME (HONOURS/ HONOURS WITH RESEARCH) UNDER NEP BASED CREDIT SYSTEM

(w. e. f. 01.08.2023)

SKILL ENHANCEMENT COURSES FOR SEMESTER I & II (SEC-1 & SEC-2)

(Each SEC, 3 Credits, Classes 30 + Project)

(Affiliated colleges to choose any two from the list below for SEC-1 & SEC-2)

1. MUSHROOM CULTIVATION TECHNIQUE

2. FLORICULTURE AND GARDENING

3. TECHNIQUE OF VERMI COMPOSTING

4. TISSUE CULTURE TECHNIQUE AND MICROPROPAGATION

1. MUSHROOM CULTIVATION TECHNIQUE

(SKILL ENHANCEMENT COURSE- 3 Credit; Classes 30+ Project)

Objectives:

The course aims to make students understand the theoretical and practical details of mushroom cultivation technique. Knowledge so gained will provide them with the means for self-employment and also employment of others.

Learning outcomes:

The students will be able to distinguish edible and nonedible mushrooms and can choose the fast grown as well as nutritious mushrooms. They can develop their own nursery for livelihood and marketing purposes. The course will also equip the students with the basic skill needed to design and lay mushroom house.

Unit -1. Introduction to Mushrooms

Unit -2. Mushrooms -Taxonomical rank -History and Scope of mushroom cultivation - Edible and Poisonous Mushrooms-Vegetative characters

Unit -3: Common edible mushrooms-Button mushroom (*Agaricus bisporus*), Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotus sajorcaju*) and paddy straw mushroom (*Volvariella volvcea*).

Unit -3: Principles of mushroom cultivation- Structure and construction of mushroom house and sterilization of substrates. Spawn production culture media preparation- production of pure culture, mother spawn, and multiplication of spawn. Composting technology, mushroom bed preparation, spawning, spawn running, harvesting, oyster and paddy straw mushroom cultivation. Problems in cultivation - diseases, pests and nematodes, weed moulds and their management strategies.

Unit- 4: Health benefits of mushrooms-Nutritional and medicinal values of mushrooms. Therapeutic aspects- antitumor effects.

Unit -5: Post harvest technology -Preservation of mushrooms - freezing, dry freezing, drying, canning, quality assurance and entrepreneurship. Value added products of mushrooms.

Unit- 6: Training/ Workshop/ Field visit Sterilization and sanitation of mushroom house, instruments and substrates Preparation of mother culture, media preparation, inoculation, incubation and spawn production Cultivation of oyster mushroom using paddy straw/agricultural wastes

2. FLORICULTURE AND GARDENING

(SKILL ENHANCEMENT COURSE- 3 Credit; Classes 30+ Project)

Objectives:

The course aims to make students understand the theoretical and practical details of nursery and gardening. Knowledge so gained will provide them with the means for their employment and also of others.

Learning outcomes:

The students will be able to distinguish and choose the plant species amenable for nursery and gardening. They can develop their own nursery for livelihood and marketing purposes. The course will also equip the students with the basic skill needed to design and lay gardens.

Syllabus—3 Credit (Classes 30+ Project)

Unit-1. Introduction to Nursery and Gardening

Unit-2. Definition and types of nurseries; physical resources for nurseries, selection of nursery site, ecological conditions, important nursery operations.

Unit-3. Definition and components of gardens, types of gardening (landscape and home gardening). Scope and objective of gardening; garden landscaping with specific reference to Kew Botanical Garden, AJC Bose Indian Botanic Garden, Kolkata

Unit-5 Plant Propagation Methods- Seed dormancy – causes and methods of breaking it; seed germination, types and factors affecting it. Vegetative propagation, artificial and natural methods; Concept of soilless cultivation with special reference to sand culture and hydroponics.

Unit- 6: Training/ Workshop/ Field visit, establishment of nursery

3. TECHNIQUE OF VERMICOMPOSTING

(SKILL ENHANCEMENT COURSE- 3 Credit; Classes 30+ Project)

Objectives:

The course aims to make students understand the theoretical and practical details of nursery and gardening. Knowledge so gained will provide them with the means for their employment and also of others.

Learning outcomes:

The students will be able to distinguish and choose the earthworm species for vermicomposting. They can develop their own nursery for livelihood and marketing purposes. The course will also equip the students with the basic skill needed to design vermicomposting beds.

Syllabus- 3 Credit (Classes 30+ Project)

Unit-1. Introduction to Vermiculture. Definition, meaning, history, economic importance and value in maintenance of soil structure. Choosing the right worm. Useful species of earth worms, local species

Unit-2. Vermicomposting materials and their classification. Feeding habits and food for composting worms.

Unit-3. Vermicomposting methods such as –Small scale and large scale pit method; heap method, window method etc. Factors affecting vermicomposting such as pH, moisture, temperature.

Unit-4. Vermicomposting: general procedure in homes; Maintenance of vermicomposting beds. Harvesting the worms, Earthworm Predators, Parasites and pathogens.

Unit-5. Application of vermicomposting in Agriculture and Horticulture practices. Advantages of vermicomposting.

Unit-5. Training/ Workshop/ Field visit/ establishment of vermicomposting unit.

4. TISSUE CULTURE TECHNIQUE AND MICROPROPAGATION

(SKILL ENHANCEMENT COURSE- 3 Credit; Classes 30+ Project)

Objectives:

The objective of the course is to provide basic and applied training in the subject for development of skills for a successful career in entrepreneurship, generate technically trained human resource for tissue culture industries and as instructors in institutions.

Learning outcomes Entrepreneurs who wish to establish their own labs will be benefitted with the lab to land training; researchers in plant tissue culture who have a focus on commercial applications such as crop improvement, secondary metabolite production, and various strategies for inducing genetic interference; persons who want to understand basic laboratory setup, handling of explant tissue, nutrient medium and establishing the culture, and incubation of cultures.

Unit-1. Introduction to plant tissue culture: Definition, brief history, principle and significance of tissue culture; cellular totipotency – cytodifferentation: factors affecting vasculartissue differentiation, cell cycle and TE differentiation; organogenic differentation: induction, factors affecting shoot bud differentiation

Unit- 2. Laboratory organization and Instrumentation: Design and layout for wash area, media preparation, sterilization and storage room, transfer area for aseptic manipulations, culture rooms, and observation/data collection areas. labwares, good laboratory practices, good safety. Working principle, maintenance and management of following instruments: Laminar air flow, autoclave, distillation unit, pH meter, orbital shaker, microscope, deep freezer, growth chamber Sterilization: Importance,

Unit-3. Tissue culture media and role of plant hormones: Introduction, Types of Media and its importance; Preparation of stocks, pH and Buffers and their significance in media. Media Constituents (Vitamins, Unidentified supplements, carbohydrate for energy source, Nitrogen source and organic supplements, complex substances, hormones, Activate charcoal). Role of Plant hormones (auxins, cytokinins, abscissic acid, ethylene and gibberellins) in plant development.

Unit-4. Aseptic techniques: Methods of sterilization of equipment, culture media and explants:- Washing and preparation of glassware's, packing and sterilization, media and surface sterilization, aseptic workstation, precautions to maintain aseptic conditions.

Unit-5. Micropropagation: Meristem culture for the production of virus free plants. Nucellus culture for clonal propagation and large scale multiplication, strategies of micropropagation.

Stages of micropropagation via axillary shoot proliferation in monocots and dicots and methods of micropropagation through organogenesis. Micropropagation - direct and indirect somatic embryogenesis. Low-cost methods for micropropagation.

Structure of the 4-year Undergraduate Programme (Honours)

Table 1: Semester-wise and Course category-wise distribution of credits

SEM	Major (DSC)	Minor	MDC	AEC	SEC	VAC	Internship	Total Credits
I	DS-1 (5)	MA-1 (5) MB-1 (5)	MD-1 (3)	AE-1 (3)	SE-1 (3)	VA-1 (3)		27
II	DS-2 (5)	MA-2 (5) MB-2 (5)	MD-2 (3)	AE-2 (3)	SE-2 (3)	VA-2 (3)	(4**)	27
Exit with certificate								(4**) + 54
III	DS-3 (5)	MA-3 (5) MB-3 (5)	MD-3 (3)	AE-3 (3)	SE-3 (3)			24
IV	DS-4 (5), DS-5 (5) DS-6 (5), DS-7 (5)						(4**)	20
Exit with diploma								(4**) + 98
V	DS-8 (5), DS-9 (5) DS-10 (5), DS-11 (5)							20
VI	DS-12 (5), DS-13 (5) DS-14 (5), DS-15 (5)						(4**)	20
Exit with Major after 3 years	75	30	9	9	9	6		(4**) +138
VII	DS-16 (5), DS-17 (5)	SM-1 (5) SM-2 (5)						20
VIII	DS-18 (5), DS-19 (5) DS-20 (5), DS-21 (5)							20
Credit	105	40	9	9	9	6	4	182

DS: Discipline specific core course, MA: Minor discipline 1, MB: Minor discipline 2, SM: Special Minor courses from the same discipline, either MA or MB, but of higher level. Credit distribution: (a) Lab-based Courses: L = 3, T/P = 2, (b) Non-Lab based courses: L = 4, T/P = 1 (c) field-based courses: P = 5, (d) Music as a Major/Minor discipline, credit distribution: L = 1/2, P = 4/3

Structure of the 4-year Undergraduate Programme (Honours with Research)

Table 1A: Semester-wise and Course category-wise distribution of credits

SEM	Major (DSC)	Minor	MDC	AEC	SEC	VAC	Internship /Research	Total Credits
I	DS-1 (5)	MA-1 (5) MB-1 (5)	MD-1 (3)	AE-1 (3)	SE-1 (3)	VA-1 (3)		27
II	DS-2 (5)	MA-2 (5) MB-2 (5)	MD-2 (3)	AE-2 (3)	SE-2 (3)	VA-2 (3)	(4**)	27
Exit with certificate								(4**) + 54
III	DS-3 (5)	MA-3 (5) MB-3 (5)	MD-3 (3)	AE-3 (3)	SE-3 (3)			24
IV	DS-4 (5), DS-5 (5) DS-6 (5), DS-7 (5)						(4**)	20
Exit with diploma								(4**) + 98
V	DS-8 (5), DS-9 (5) DS-10 (5), DS-11 (5)							20
VI	DS-12 (5), DS-13 (5) DS-14 (5), DS-15 (5)						(4**)	20
Exit with Major after 3 years	75	30	9	9	9	6	(4**)	(4**) + 138
VII	DS-16 (5), DS-17 (5)	SM-1 (5) SM-2 (5)						20
VIII	DS-18 (5), DS-19 (5)						15	25
Credit	95	40	9	9	9	6	19	187

DS: Discipline specific core course, MA: Minor discipline 1, MB: Minor discipline 2, SM: Special Minor courses from the same discipline, either MA or MB but of higher level. Credit distribution: (a) Lab-based Courses: L = 3, T/P = 2, (b) Non-Lab based Courses: L = 4, T/P = 1 ; (c) field-based courses: P = 5, (d) Music as a Major/Minor discipline, credit distribution: L = 1/2, P = 4/3

Structure of the 3-Year Multidisciplinary UG Programme

Table 2: Semester-wise and course category-wise distribution of credits

SEM	Core course (A)	Core course (B)	Core course (C)	MDC	AEC	SEC	VAC	Internship	Total credits
I	MA-1 (5)	MB-1 (5)	MC-1 (5)		AE-1 (3)		VA-1 (3)		21
II	MA-2 (5)	MB-2 (5)	MC-2 (5)		AE-2 (3)		VA-2 (3)	(4**)	21
Exit with certificate									(4*) + 42
III	MA-3 (5)	MB-3 (5)	MC-3 (5)		AE-3 (3)	SE-1 (3)			21
IV	MA-4 (5)	MB-4 (5)	MC-4 (5)	MD-1 (3)		SE-2 (3)		(4**)	21
Exit with diploma									(4**) + 84
V	MA-5 (5)	MB-5 (5)	MC-5 (5)	MD-2 (3)		SE-3 (3)			21
VI	MA-6 (5)	MB-6 (5)	MC-6 (5)	MD-3 (3)		SE-4 (3)		(4**)	21
Credits	30	30	30	9	9	12	6	4	(4**) + 126

MA: Core course from discipline 1, MB: Core course from discipline 2, MC: Core course from discipline 3.

Credit (5) distribution: (a) Lab-based Courses: L = 3, T/P = 2, (b) Non-Lab based Courses: L = 4, T/P = 1

(c) field-based courses: P = 5, (d) Music as a Major/Minor discipline, credit distribution: L = 1/2, P = 4/3

UG Certificate: Students who opt to exit after completion of the first year and **have secured 54 credits (Table 1, 1A)** or **have secured 42 credits** (**Table 2**) will be awarded a UG certificate **if, in addition**, **they complete one vocational course of 4 credits or a 4-credit work-based learning/internship/apprenticeship** during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

UG Diploma: Students who opt to exit after completion of the second year and **have secured 98 credits (Table 1, 1A)** or **have secured 84 credits (Table 2)** will be awarded the UG diploma **if, in addition**, **they complete one vocational course of 4 credits or a 4-credit work-based learning/internship/apprenticeship** during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.

3-year UG Degree: Students who wish to undergo a 3-year UG programme will be awarded UG Degree in the Major discipline after successful completion of three years, **securing 142 credits (Table 1, 1A) which includes 4-credit of summer internship/apprenticeship**.

3-year Multidisciplinary UG Degree: Students who wish to undergo a 3-year Multidisciplinary UG programme will be awarded UG Degree (B.A./B.Sc./B.Com.) after successful completion of three years**, securing 130 credits (Table 2) which includes 4-credit of summer internship/apprenticeship.**

4-year UG Degree (Honours): Students who wish to undergo a 4-year UG programme (Honours) will be awarded UG degree (Honours) after successful completion of a four year degree progamme with **182 credits (Table 1) which includes 4-credit of summer internship/apprenticeship.**

4-year UG Degree (Honours with Research): Students **who secure 75% marks and above in the first six semesters** and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. The students **who secure 187 credits, including 15 credits from a research project/dissertation (Table 1A)**, will be awarded UG Degree (Honours with Research).

WEST BENGAL STATE UNIVERSITY

DRAFT ADVISORYFOR EVALUATION

OF

4-year Undergraduate Programme
and
3-year Undergraduate Programme

Under Curriculum and Credit Framework for Undergraduate Programmes

Based on

National Education Policy, 2020

(To be approved by the Competent Authority)

(w.e.f Academic Session 2023-24)

WEST BENGAL STATE UNIVERSITY

DRAFT ADVISORY FOR EVALUATION OF UG PROGRAMMES

UNDER NEP 2020 (2023-24)

[NB. The student can enter within 7 years to complete the course but not in the same session after exiting. Intra-college exit will not be allowed. All disputes relating to evaluation will be resolved by the local jurisdiction.]

- **MAJOR & MINOR/CORE**

- FOR LAB-BASED SUBJECTS: 3CR THEORY + 2 CR PRACTICAL
  MARKS ALLOTTED: 50 (END SEM) + 50 (PRACTICAL+INTERNAL)

  INTERNAL COMPONENT (20) BROKEN DOWN INTO—

  ATTENDANCE—10; CIA—10 (EVALUATION BY COLLEGE)

  PRACTICAL (30) –

  LAB NOTEBOOK—5; EXPERIMENT/GRAND VIVA—25 (EVALUATION BY UNIVERSITY) **

  ** MODALITY OF EVALUATION WILL BE DECIDED BY THE RESPECTIVE UG-BOS.

  MARKS CALCULATION: (3X50+2X50)/5

- FOR NON-LAB BASED SUBJECTS: 4 CR END SEM+ 1 CR INTERNAL
  MARKS ALLOTTED: 50 (END SEM) + 50 (INTERNAL)

  INTERNAL COMPONENT BROKEN DOWN INTO—

  ATTENDANCE –10

  CONTINUOUS EVALUATION: HOME ASSIGNMENT/PRESENTATION (20);
  WRITTEN EXAMINATION (20)

  MARKS CALCULATION: (3X50)+(2X50)/5

- PASS MARKS-40% PER PAPER COMBINING END SEMESTER EXAM AND INTERNAL COMPONENT FOR SUBJECTS WITHOUT

PRACTICAL. FOR SUBJECTS WITH PRACTICAL THE STUDENT WILL HAVE TO SECURE 40% MARKS IN PRACTICAL AND 40% IN THEORETICAL TO QUALIFY.

- **MARKS ALLOTTED FOR ATTENDANCE:**

Marks allotted for attendance: 10

75% and above--10

65%--74%--08

55%-64%--05 (to be allowed for examination with condonation fee)

Less than 55%--Barred from appearing in the university examination.

- **MDC—50 MARKS**

- EVALUATION BY COLLEGE. EVALUATION PATTERN TO BE DECIDED BY UG-BOS.
  ** FOR BBA COURSES MDC WILL BE PROVIDED BY THE CONCERNED UG-BOS.

- **SEC—50 MARKS**

- EVALUATION BY COLLEGE. EVALUATION PATTERN TO BE DECIDED BY UG-BOS. SE COURSES ARE TO BE RETAINED FROM EXISTING CBCS FOR THE BENEFIT OF THE TEACHERS. EXISTING MARKS OF 25 WILL BE DOUBLED TO PRODUCE MARKS FOR 3 CREDIT SECS OF 50 MARKS. FOR 4 YEAR HONOURS 3 DIFFERENT SEC COURSES WILL HAVE TO BE TAKEN. FOR 3 YEAR MULTIDISCIPLINARY PROGRAMME 2SECS FROM ONE DISCIPLINE AND 2 FROM ANOTHER WILL HAVE TO BE TAKEN.
  ** FOR BBA COURSES SEC WILL BE PROVIDED BY THE CONCERNED UG-BOS.

- **AECC—50 MARKS**

- MCQ QUESTIONS TO BE SET BY UNIVERSITY.

- **VAC—50 MARKS**

- MCQ TO BE SET BY COLLEGES IN ENGLISH.

**** ALL VA COURSES ARE THEORETICAL EXCEPT YOGA & MEDITATION (2 CR THEORY + 1 CR PRACTICAL)**

- **HONOURS WITH RESEARCH**

- Students who secure an average of 75% marks and above in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year for obtaining a Bachelor degree (Honours with Research) in his/her major discipline.
- Such candidates must secure **95 credits** out of the total credits of **187** from discipline-specific major courses and also needs to secure 15 credits through a Research project to be awarded a Bachelor degree (Honours with Research) in his/her major discipline.
- A student selected for pursuing 4-year Honours with Research programme is required to complete a research project and submit a dissertation to the concerned university department for examination and evaluation in the 8th semester.
- The concerned UG-BOS will form a board comprising one university faculty, one external expert and the supervisor. This research project/dissertation work carries 15 credits and 300 marks.
- The concerned candidate must score **150** or above out of the 300 marks allotted for Research/Dissertation work to pass or qualify for being awarded the degree of UG Honours with research in his/her major discipline.
- Plagiarism check for dissertation/project report should be done by the candidate from the university library against a fee, and the report should be attached with the dissertation/report maintaining UGC norms. Dissertation with similarity index more than 10% as per UGC norms will be referred back to the concerned board for decision.
- A full-time teacher in a substantive post holding a doctoral degree in a discipline will be able to act as supervisor for 15 credit dissertation/ research project at the UG level. Colleges with one faculty in a discipline capable for supervising the UG research project can take another co-supervisor from a different college under WBSU.

Guidelines for Dissertation/Project Report:

- **Word count-5000 excluding bibliography**
- **Font—Times New Roman 12**
- **Line Spacing—1.5**
- **Referencing—Any standard referencing format as per subject requirement (MLA/Chicago/APA or as deemed suitable)**
- **Footnotes/Endnotes wherever applicable.**

Evaluation of Dissertation/Project Report:

- **300 MARKS TO BE DIVIDED AS:**
  DISSERTATION/PROJECT REPORT—200
  PRESENTATION—50
  VIVA VOCE—50

- **GUIDELINES FOR 4-CREDITS INTERNSHIP PROGRAMME/WORK-BASED VOCATIONAL PROGRAMME AS PER UCCF**
  [For 4-Years' Undergraduate Programme with Major/Research and/or for 3 Years' Undergraduate Programme with Multidisciplinary Courses]

Internship as per NEP 2020

It has been envisaged in the National Education Policy 2020 (NEP 2020) that a student shall undergo internship at the undergraduate level. This course, as enshrined in the NEP2020 will require a student to undergo "professional activity or work experience, or cooperative education activity with an entity external to t/he education institution", normally this activity will be under the supervision of an expert belonging to the external institution/agency. Such an agency maybe industry, government organizations/NGOs, commercial organization, research laboratories, crafts persons etc. Students shall also be expected to maintain daily logs detailing their day-to-day activity in details along with a 1000 words report.

Objectives of Internships

The main aim of the internship is to expose the student to "real-life" working situation or as per NEP, "on-site experiential learning". Briefly the following objectives may be put forward:

- To experience in professional environment, which otherwise cannot be simulated in a classroom.
- To explore career alternatives and obtain hands on training.
- To apply knowledge to practice
- To explore and put to test ones potentialities
- To develop respect towards a profession
- To develop integrate work culture in character

- To work in a group for a common goal
- To develop communication skills and working in a group
- To develop the art of reporting/registering/documenting an activity
- To develop self confidence and self respect

Guidelines for organizing Internship

As per present UCCF a student intended to do the internship in the fifth (5) semester, can engage herself/himself in an internship under NCC/NSS/Industrial Internship/Research Internship/ local administration as per the following schedule:

Table 1

Name	Duration	Nature of Internship Project	No. of Credits
Internship Assessment through Projects	**120 hours**	**Intra/Inter-Institutional Activities related to NSS/NCC** **Or** **Industrial/NGO/MSME/Rural Internship/Innovation/Incubation Center/ Local administration/Research Laboratory**	**4**

Assigning the Students for Internship

The students entitled for the Internship must be duly nominated/assigned by the HOD of the concerned Department from, choices mentioned in Table 1, and should be forwarded by the competent authority of the College.

Step 1: It is advisable that the college procure proper written agreement of the institution/agency (please refer to Table1) well in advance of the commencement of the internship. The College may take a prior survey of the student's need/interest/choice.

Step 2: There should be a proper documentation of the allocation of the internship eg. Allocation letter/ consent letter from institution/agency under which the internship will be performed. All such documentation should be preserved by the College.

Step3: Students joining letter to the internship program issued by host institution/agency should be preserved by College.

Step 4: The host College must ensure the submission of a detailed project report (1000 words) describing the objectives, the work done during the internship and its practical/social impact. The student shall also maintain a daily log book detailing her/his daily activity. This report should also mention the total hours spent in the activity.

Step 5: After successful completion of Internship the College along with the host institution/agency (under which the internship was completed) will evaluate the students' performance.

Step 6: Certificate of completion and experience should be issued by College along with the host institution/agency (under which the internship was completed).

Important points for evaluation

The daily log book is to be signed by candidate and supervisor under whom the internship is being done. This shall serve as proof of attendance and shall be required to be submitted to the College.

Evaluation should take into account:

1. Regularity and timely attendance (maintained in log book)
2. Proper documentation (as per 1000 word report and log book)

Allocation of Marks

The total marks allocated will be 50 marks sub-divided into:

1. The Internship Mini Project Report – 30 Marks
2. Viva-voce by college 20 Marks

➢ LETTER GRADE & GRADE POINT:

1. **Letter Grade and Grade Point:**
The 10-point grading system of the UGC, as described below, will be adoptedfor assessment and examination of the performance of students in various courses of the undergraduate programmes.

Letter Grade is used to signify the level of qualitative/quantitative academic achievement of a student in a Course, while the **Grade Point** is used to indicate the numerical weight of the Letter Grade on a 10-point scale. Letter Grades 'O' to 'P'indicate successful completion of a Course, while Letter Grades 'F' and 'Ab' indicate 'fail' and 'Absent' respectively.

Table : Letter Grades and Grade Points

Letter Grade	Grade Point	% of Marks	SGPA/CGPA	Description
O (Outstanding)	10	90 – 100	9.0 – 10.0	Outstanding
A+ (Excellent)	9	80 – 89	8.0 – 8.9	First Class Exemplary
A (Very Good)	8	70 – 79	7.0 – 7.9	First Class Distinction
B+ (Good)	7	60 – 69	6.0 – 6.9	First Class
B (Above Average)	6	55 – 59	5.5 – 5.9	High Second Class
C (Average)	5	50 – 54	5.0 – 5.4	Second Class
P (Pass)	4	40 – 49	4.0 – 4.9	Pass
F (Fail)	0	00 - 40	0.0 - 4.0	Fail
Ab	0	---	---	Absent

COMPUTATION OF SGPA AND CGPA:

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

SGPA (Si) = $\sum$(Ci x Gi) / $\sum$Ci
Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

Example for Computation of SGPA

Semester	Course	Credit	Letter Grade	Grade point	Credit Point (Credit x Grade)
I	Course 1	3	A	8	3 X 8 = 24
I	Course 2	4	B+	7	4 X 7 = 28
I	Course 3	3	B	6	3 X 6 = 18
I	Course 4	3	O	10	3 X 10 = 30
I	Course 5	3	C	5	3 X 5 = 15
I	Course 6	4	B	6	4 X 6 = 24
		20			139
	SGPA				139/20=**6.95**

ii. The Cumulative Grade Point Average (CGPA) is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

CGPA = $\sum$(Ci x Si) / $\sum$ Ci

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

Example for Computation of CGPA

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6
Credit: 21 SGPA:6.9	Credit: 22 SGPA:7.8	Credit:25 SGPA:5.6	Credit: 26 SGPA:6.0	Credit: 26 SGPA: 6.3	Credit 25 SGPA 8.0