Syllabus for B.Sc. Botany (Program)
Kazi Nazrul University, Asansol

Semester – 1
Semester – II
Semester – III
Semester – IV

Semester – V

Semester – VI

Total Credit = 120

Core Course: Botany Program

Semester.	Papers	Name of the subject	Teaching Scheme In hours per week			Credit
			L	T	P	
I	1	Algae, Fungi and Bryophyta	4		4	6
II	2	Pteridophyta, Gymnosperms and Palaeobotany	4		4	6
III	3	Morphology, Plant Taxonomy and Plant Anatomy	4		4	6
IV	4	Plant Physiology and Ecology	4		4	6
		Total Credit				24

AECC – Ability Enhancement Compulsory Courses: English/ Modern Indian Language/EVS

AEEC – Ability Enhancement Elective Course

[i.e. Skill Enhancment Course (SEC)]

[Four papers are to be taken and each paper will have 2 credit]:

SEC 1 – Biofertilizers/ Ethnobotany

SEC 2 - Mushroom cultivation/Plant Biodiversity and Human Welfare

SEC 3 – Floriculture

SEC 4 – Nursery and Gardening

NB. This is to be noted that subject in which B.Sc. will be declared will depend on SEC subjects selected

Discipline Specific Elective Courses (DSE):
(Two papers are to be taken each carrying 6 credit)

DSE- 1 : Cell Biology, Genetics and Molecular Biology/ Stress Biology/

Plant Breeding

DSE-2: Economic Botany, Pharmacognosy and Plant Biotechnology /Natural Resource Management/Biostatistics

Other Disciplines of Choice: [One must be chemistry]

1. Chemistry, 2. Zoology, 3. ~~Physiology~~, 4. Microbiology, 5. ~~Physics,~~ 6. ~~Computer Science~~ etc

Detailed syllabus for B.Sc. (General)
Subject - Botany
SEMESTER – I

Theory – (Marks – 40+10 = 50)
Core Course: I (Theory)
(Algae, Fungi and Bryophyta) Algae -

General characteristics; Ecology and distribution;

Range of thallus organization and reproduction;

Classification of algae (Fritsch – 1935);

Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas*, *Zygnema*, *Vaucheria*, *Fucus*, *Polysiphonia*.

Economic importance of algae

Fungi -

Introduction- General characteristics, cell wall composition , nutrition, reproduction and classification (Gwyenne-Vaughan and Barnes, 1937)

General characteristics and life cycle of *Mucor* (Zygomycota), *Penicillium* (Ascomycota),

Agaricus (Basidiomycota) and Deuteromycetes;

Lichens: General account, reproduction and significance;

Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance

Bryophytes -

General characteristics, Classification (Proskauer, 1957),

Morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental details not to be included).

Ecological and Economic importance of bryophytes.

Internal assessment – (10) Practicals – (Marks - 20+30 = 50) Core Course: I (Practical) (Algae, Fungi and Bryophyta)

Study of following genera:*Oscillatoria, Oedogonium, Chara; Ascobolus, Agaricus; Marchantia, andFunaria***.**
Identification of all the genera included in the theoretical syllabus.

Wet specimen collection and preservation.

Internal assessment – 30

SEMESTER - II

Theory – (Marks 40+10 = 50)
Core Course-II (Theory)
(Pteridophyta, Gymnosperms and Palaeobotany)
Pteridophytes -

General characteristics, classification (Sporne, 1975) Early land plants (*Cooksonia* and *Rhynia*).

Morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Pteris*.

(Developmental details not to be included).

Heterospory and seed habit, stelar evolution. Economical importance of Pteridophytes.

Gymnosperms -

General characteristics,

Classification (Stewart and Rothwell, 1983),

Morphology, anatomy and reproduction of *Cycas* and *Pinus*. (Developmental details not to be included). Economical importance.

Palaeobotany –

Terminologies (Palaeobotany, Palynology, Palaeofloristics, Palaeoecology, fossils, subfossil) and their definition.

Types of fossils on the basis of mode of preservation.

Geological time scale and major events of plant lives.

Internal Marks - 10
Practicals– (Marks – 20+30 = 50)

Pteridophytes – Study of stem anatomy and reproductive structure of *Selaginella*, *Equisetum* and *Pteris*

Gymnosperms - Morphoanatomical studies of *Cycas* (leaflet, rachis, microsporophyll),

Pinus (Stem, needle, male cone)

Identification includes all other genera included in the theoretic operation **Internal assessment – 30**

SEMESTER – III

Core Course – III (Theory)
(Marks 40+10 = 50)
(Morphology, Embryology, Plant Taxonomy and Plant Anatomy)
Morphology and Embryology –

Leaf – Types, modifications of leaf lamina, Phyllotaxy,

Stipule – Types and modifications

Inflorescences – Types with examples

Flower – Flower is a modified shoot, Morphology of different parts of a flower, Cohesion and adhesion.

Pollination and fertilization – Types and contrivances; fertilization – double fertilization/triple fusion; General structure of dicot and monocot embryo; endosperm types.

Fruits – Types with example.

Plant Taxonomy –

Introduction to plant taxonomy – Identification, Classification, Nomenclature; Definition: - Artificial, natural and phylogenetic classification; Concept of Binomial Nomenclature; Classification by Bentham & Hooker (upto series).

Functions of Herbarium and Botanical Gardens, Important Herbaria and Botanical Gardens of the world and India.

Taxonomic hierarchy – Ranks, Categories and Taxonomic Groups

Plant Anatomy –

Tissue – Meristematic and Permanent tissue, Their types; Root and shoot apical meristems; Simple and Complex Tissues

Tissue system – General idea of epidermal, vascular and ground tissue systems, Types of vascular bundles.

Organs – Primary structure of Stem, Root and Leaf.

Secondary growth – Secondary growth in typical stem and root (dicot only), Seasonal activity of cambium; Wood – heartwood and sapwood

Core Course - III (Practicals) (Marks 20+30 = 50)

7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formulae/ and Identification): –

   Brassicaceae, Solanaceae, Malvaceae, Fabaceae, Lamiaceae, Verbenaceae, Apocyanaceae and Asteraceae

8. Anatomical study of the sections of – Stem (Sunflower and Maize), Root (Chick Pea and *Canna*) and Leaf (*Nerium*)
9. Identification of types of fruits (berry, pome, capsule, pepo, hesperidium), inflorescences (verticillastor, cyathium, spikes, hypanthodium) and stipules (Adnate, interpetiolar, intrapetiolar, free lateral and ochreate) of angiosperms.
10. Identification from permanent slides – Stomata, Cystolith, Raphides, Stone Cells and Lenticels
11. Submission - Herbarium sheets – Maximum 10 from local flora with proper labeling and field record
12. **Internal assessment – 30**

SEMESTER – IV

Core Course – IV (Theory)
(Marks - 40+10 = 50)
Plant Physiology, Metabolism and Ecology-

Plant-water relations, Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

Mineral nutrition- Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements;

Translocation in phloem - Composition of phloem sap, General idea about Phloem loading and unloading.

Photosynthesis – Light Reaction (Photosynthetic Electron transport System and mechanism of ATP synthesis); Outline of C3, C4 and CAM pathways of carbon fixation; Photorespiration.

Respiration – Introduction, Glycolysis, Oxidative decarboxylation and TCA cycle; Oxidative phosphorylation.

Enzymes - Definition and properties; Mechanism of enzyme catalysis and enzyme inhibition.

Nitrogen metabolism - Biological nitrogen fixation – symbiotic and asymbiotic examples, mechanism of symbiotic N_2 fixation.

Plant growth regulators - Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Ecology –

Definition – Autecology and Synecology; Concept of energy flow; Food chain and food web.

Ecological pyramids – pyramids of biomass, energy and numbers.

Ecological Succession - Hydrosere

Ecological adaptations and adaptive characteristics of hydrophytes, xerophytes and halophytes

Phytogeography – Phytogeographical classification of India (D. Chatterjee, 1962); Concept of endemism.

Pollution – Air and water – Causes, effects and Remedies.

Core Course – IV (Practicals) (Marks 20+30 = 50)

Determination of isotonic concentration of cell sap by plasmolytic method.

To find the essentiality of CO2 in photosynthesis using *Hydrilla/ any other* aquatic plant. To study the effect of two environmental factors (light and humidity) on transpiration using *Colocasia* leaf.

Comparison of the rate of respiration in any two parts of a plant.

Study of the anatomical adaptations of xerophytes (*Casuarina* stem) and hydrophytes (*Anhydra* stem)

Internal assessment – 30

Skill Enhancement Course

(For Botany Program)

SEC – 1: BIOFERTILIZERS

Unit-1: General account about the microbes used as biofertilizer.
Rhizobium – isolation, identification, mass production, Commercialization. (6 lectures)

Unit -2: General idea about Plant growth promoting rhizobacteria (PGPR) and Phosphate solubilizing bacteria (PSB) (6 lectures)

Unit- 3: Cyanobacteria (blue green algae) and Azolla as biofertilizer; Blue green algae and Azolla production.(6 lectures)

Unit -4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution; VAM fungi, and their influence on growth and yield of crop plants. (6 lectures)

Unit -5: Organic farming – Green manuring and organic fertilizers; Organic Compost and Vermicompost - production and application. (6 lectures)

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

OR

SEC – 1: ETHNOBOTANY

Unit 1: Ethnobotany Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context. (6 Lectures)
Unit 2: Methodology of Ethnobotanical studies a) Field work b) Herbarium c) Ancient Literature. (6 lectures)
Unit 3: Role of ethnobotany in modern Medicine; Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadiractha indica* b) *Ocimum sanctum* c) *Aloe vera*. d) *Eclipta alba* e) *Phyllanthus niruri* f) *Emblica officinalis* g) *Centella asiatica* h) *Saraca indica*. Role of ethnobotany in modern medicine with special example *Rauvolfia sepentina*, *Taxol brevifolia*, *Artemisia vulgaris*, *Withania somnifera*. (10 lectures)
Unit 4: 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. (8 lectures)

Suggested Readings

1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2) S.K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981
3) Lone et al,. Palaeoethnobotany
4) S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, - Lucknow, India.
5) S.K. Jain, 1990. Contributions of Indian ethnobotny.Scientific publishers, Jodhpur.
6) Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – - Chichester
7) Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India.Botanical Survey of India. Howrah.
8) Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA –SHREE Publishers, Jaipur-1996
9) Faulks, P.J. 1958.An introduction to Ethnobotany, Moredale pub. Ltd. 84

SEC – 2: PLANT DIVERSITY AND HUMAN WELFARE

Unit -1: Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agrobiodiversity and cultivated plant taxa. Values and uses of Biodiversity: Ethical and aesthetic values. (8 lectures)
Unit -2: Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss. (6 lectures)
Unit -3: Management of Plant Biodiversity: Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservation. (6 lectures)
Unit-4: Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation, Social approaches to conservation, Biodiversity awareness programmes, Sustainable development. (10 lectures)

Suggested Readings 1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi

OR

SEC – 2: MUSHROOM CULTURE TECHNOLOGY

Unit 1: Introduction and history. Types of edible mushrooms available in India - *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*; Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms.. (5 Lectures)

Unit 2: Methods of cultivation of edible mushrooms. Diseases of Mushroom fungi and methods of remedy (12 Lectures).

Unit 3: Storage and nutrition : Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in salt solutions. (8 Lectures)

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. (5 lectures)

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.

SEC 3 - FLORICULTURE

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; Role of plant growth regulators.

Unit 3: Ornamental Plants: Flowering annuals; Herbaceous perennials; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Cultivation of plants in pots; Indoor gardening.

Unit 4: Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers.

SEC 4 - **NURSERY AND GARDENING**

Unit 1: Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.**(4 Lectures)**

Unit 2: Seed dormancy; Methods of breaking dormancy; Seed storage: Seed banks, factors affecting seed viability.

Unit 3: Vegetative propagation: air-layering, cutting; treatment of cutting, rooting medium and planting of cuttings - Hardening of plants – green house, mist chamber.

Unit 4: Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components.
Unit 5: Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: brinjal, lady's finger, onion; Storage and marketing procedures.

Suggested Readings

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

Discipline Specific Elective Courses (DSE)

DSE – 1 (For program)

Cell Biology, Genetics and Molecular Biology

Credits: Theory 4, Practical 2

Lectures: 60

Unit 1: Basic Cytology (20 Lectures)

Principles of microscopy; Light Microscopy; Electron microscopy (EM)- SEM and TEM.

The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape.

Structure and Functions of : Mitochondria, Chloroplast, ER, Golgi body & Lysosomes; DNA packaging in eukaryotes, euchromatin and heterochromatin.

Fluid Mosaic Models of membrane structure; Selective permeability of the membranes.

Unit 2: Cell Division (6 Lectures)

Mitosis and Meiosis; Cell cycle regulation (Brief knowledge)

Unit 3: Mendelian Genetics and Linkage and crossing over – (12 Lectures)

Mendel's laws of inheritance; Monohybrid and dihybrid cross; Test cross; Gene interactions (Incomplete dominance, codominance, complementary genes); Linkage – Coupling and Repulsion hypothesis, Linkage Map; Crossing over (Copy-choice, breakage and reunion and Holliday Model).

Unit 4: Mutation and Chromosomal aberration – (12 Lectures)

Mutations (Definition, Types – spontaneous and induced; point mutation, Frame Shift Mutation), Mutagenic agents (Base analogues, alkylating agents); Structural aberrations (Deletion, Duplication, Inversion and Translocation) and Numerical aberrations (Euploidy and aneuploidy – types and application); Induction of polyploidy.

Unit 5: Central Dogma – **(10 Lectures)**

Genetic code (Characteristic features); Fine structure of genes (prokaryote Vs eukaryotic gene); split gene concept; Process of: Replication, Transcription and Translation in *E. Coli*.

Practical

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.
2. Study of mitosis and meiosis (temporary mounts and permanent slides).
3. Study of plasmolysis and deplasmolysis on Rhoeo leaf.
4. Measure the cell size (either length or breadth/diameter) by micrometry.
5. Preparation of the karyotype and ideogram from given photograph of somatic metaphase chromosome.

Suggested Readings

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
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 Cumming Publishing, San Francisco.

DSE – 1 (For program)

Stress Biology

Credits: Theory 4, Practical 2

Lectures:60

Theory

Unit 1: Plants response to stress

(16 lectures)

Types of stresses – biotic and abiotic; Biotic stress- stress to pathogenesis; Abiotic stress – Droght, chilling and salt stresses (Effects of these stresses and mechanism of their tolerance)

Unit 2: Mechanism **(16 lectures)**

Cell signalling and molecular response to salt tolerance; Mechanism of hypersensitive response (HR)and systemic acquired resistance (SAR)

Unit 3: Developmental and physiological mechanisms that protect plants against

environmental stress **(14 lectures)**

Adaptation in plants to different stresses; Changes in root: shoot ratio; Compatible solute production.

Unit 4: **(14 lectures)**

Generation of Heat shock proteins and Reactive oxygen species– their role and management.

Practical

4. Detection of stress related compatible solutes viz. proline by colorimeter/spectrophotometric method in a plant under salinity stress.
5. Measurement of root:shoot ratio, and total wet weight of a plant under salt/drought stress
6. Effect of salt/temperature stress on seed viability and germination.

Suggested Readings

3. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
4. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.

DSE – 1 (Program)

Plant Breeding

(Credits: Theory-4, Practical-2)

THEORY

Lectures: 60

Unit 1: Plant Breeding **(10 lectures)**

Introduction, aims and objectives of plant breeding; Plant introduction, acclimatization and domestication.

Unit 2: Methods of crop improvement **(20 lectures)**

Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations.

Unit 3: Quantitative inheritance **(10 lectures)**

Concept, mechanism, examples of inheritance of Kernel colour in wheat, Skin colour in human beings.Monogenic vs polygenic Inheritance.

Unit 4: Inbreeding depression and heterosis **(10 lectures)**

History, genetic basis of inbreeding depression and heterosis;
Applications.

Unit 5: Crop improvement and breeding

(10 lectures)

Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.

Practical –

5. Calculation of central tendency – mean, mode and median of a data obtained from natural population.
6. Normal distributon curve using a continuous variation (Data May be provided).
7. Chi square test of goodness of fit for Mendelian ratios.
8. Demonstration of Breeder's kit.

Suggested Readings

3. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
4. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.

DSE - 2

Economic Botany, Pharmacognosy and Biotechnology

(Credits: Theory-4, Practicals-2)

THEORY

Lectures: 60

Unit 1: Origin and economic importance of Cultivated Plants (14 Lectures)

Concept of centres of origin, their importance with reference to Vavilov's work; Origin, morphology, Economic Importance of - Paddy, Potato, Tea, Mustard, Cotton, Coconut, Sugarcane and Sal.

Unit 2: Pharmacognosy (14 Lecture)

Definitions – Pharmacognosy, Pharmacopoea, Pharmacology, Folk Medicine, Materia Medica; Drug – Drug adulteration, Drug evaluation. Active Principle and Uses of : *Rauwolfia serpentine*, *Ocimum sanctum*, *Adhatoda vasica* and *Aloe vera*.

Unit 3: Plant tissue culture (14 Lectures)

Micropropagation; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications; Protoplast isolation and fusion. Applications of Tissue culture.

Unit 4: Recombinant DNA Techniques (18 Lectures)

Enzymes and Tools: Restriction Endonuclease, Ligase, DNA Polymerase I; Vectors – Plasmid and Phage vector; Basic cloning strategies; Isolation of genes by – Library screening and PCR. Application of Genetic Engineering (Insulin, Flavr Savr tomatoes, Bt cotton and Golden rice).

Practical

1. Field visit and study of plant diseases (preparation of disease exicatti).
2. Qualitative test of starch, protein and lipid.

3. Organoleptic and Microscopic studies of – Ginger (rhizome), Adhatoda (leaf) and (Strychnos (seed)

Suggested Readings

1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

DSE – 2 (Program)

Natural Resource Management

(Credits: Theory-4, Practical-2)

THEORY

Lectures: 60

Unit 1: Natural resources **(2 Lectures)**

Definition and types.

Unit 2: Sustainable utilization **(8 Lectures)**

Concept, approaches (economic, ecological and socio-cultural).

Unit 3: Land **(8 lectures)**

Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management.

Unit 4: Water **(8 lectures)**

Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.

Unit 5: Biological Resources **(12 lectures)**

Biodiversity-definition and types; Significance; Threats; Management strategies; Bio-prospecting; IPR (Intellectual Property Rights); CBD (Concservation of Biological Diversity); National Biodiversity Action Plan).

Unit 6: Forests **(6 lectures)**

Definition, Cover and its significance (with special reference to India); Major and minor forestproducts; Depletion; Management.

Unit 7: Energy (6 lectures)

Ren ewable and non renewable sources of energy, Biomass and energy; Biofuel

Unit 8: Contemporary practices in resource management (8 lectures)

EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management

Practical

3. Project work and Report Submission.
4. Viva on the project done.

Suggested Readings

4. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
5. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
6. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

DSE – 2 (Program)

Biostatistics

(Credits: Theory-4, Practical-2)

THEORY

Lectures: 60

Unit 1:Biostatistics (12 lectures)

Definition - statistical methods - basic principles. Variables - measurements, functions, limitations and uses of statistics.

Unit 2:Collection of data primary and secondary (12 lectures)

Types and methods of data collection procedures - merits and demerits. Classification - tabulation and presentation of data - sampling methods.

Unit 3:Measures of central tendency (14 lectures)

Mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation - merits and demerits; Co- efficient of variations.

Unit 4:Correlation (12 lectures)

Types and methods of correlation, regression, simple regression equation.

Unit 5:Statistical inference (10 lectures)

Hypothesis - simple hypothesis - student 't' test - chi square test.

Practical

4) Calculation of mean, standard deviation and standard error mean
5) Calculation of correlation coefficient and regression values.
6) Interpretation of a continuous variation by a binomial curve with a given value of mean and standard deviation.

Suggested Readings

4. Biostatistic, Danniel, W.W., 1987.New York, John Wiley Sons.

5. An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian Medical College, Vellore

6. Statistical Analysis of epidemiological data, Selvin, S., 1991. New York University Press. 4. Statistics for Biology, Boston, Bishop, O.N. Houghton, Mifflin.

5. The Principles of scientific research, Freedman, P. New York, Pergamon Press.

6. Statistics for Biologists, Campbell, R.C., 1998.Cambridge University Press.