

**SYLLABUS FOR
BACHELOR OF SCIENCE IN BOTANY
(GENERIC ELECTIVE/GENERAL)
UNDER CHOICE BASED CREDIT SYSTEM**

**ACADEMIC SESSION
w.e.f. 2020-2023**



**FOR
ALL CONSTITUENT/AFFILIATED COLLEGES UNDER
BINOD BIHARI MAHTO KOYALANCHAL UNIVERSITY,
DHANBAD**

Members of Board of studies of CBCS under Graduate Syllabus as per Guide lines of the Binod Bihari Mahto Koyalanchal University, Dhanbad.

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B.Sc. BOTANY (HONS.) CURRICULUM

FIRST SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M.	TOTAL MARKS	
BOT-GE-101-T	BOTANY	04	60	15	06	60	24	75	30
BOT-GE-101-P	PRACTICAL BASED ON BOT-H-GE-101	02	30	05	02	20	08	25	10

SECOND SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M.	TOTAL MARKS	
BOT-GE-202-T	BOTANY	04	60	15	06	60	24	75	30
BOT-GE-202-P	PRACTICAL BASED ON BOT-H-GE-202	02	30	05	02	20	08	25	10

THIRD SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M.	TOTAL MARKS	
BOT-GE-303-T	BOTANY	04	60	15	06	60	24	75	30
BOT-GE-303-P	PRACTICAL BASED ON BOT-H-GE-303	02	30	05	02	20	08	25	10

FOURTH SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M	TOTAL MARKS	
BOT-GE-404-T	BOTANY	04	60	15	06	60	24	75	30
BOT-GE-404-P	PRACTICAL BASED ON BIO-H-GE-404	02	30	05	02	20	08	25	10

FIFTH SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M.	TOTAL MARKS	
BOT-G-DSE-501A-T/ BOT-G-DSE-501B-T/ BOT-G-DSE-501C-T	PLANT BREEDING / RESEARCH METHODOLODY / STRESS BIOLOGY	04	60	15	06	60	24	75	30
BOT-G-DSE-502A-T/ BOT-G-DSE-502B-T/ BOT-G-DSE-502C-T	NATURAL RESOURCE MANAGEMENT / BIOINFORMATICS/ ANALYTICALS TECHNIQUES IN PLANT SCIENCES	04	60	15	06	60	24	75	30
BOT-G-DSE-501 A/B/C –P & 502A/B/C-P.	PRACTICAL BASED ON BOT-H-DSE-501 A/B/C –P & 502A/B/C-P.	04	60	10	04	40	16	50	20

SIXTH SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M	TOTAL MARKS	
BOT-G-DSE-603A-T/ BOT-G-DSE-603B-T/ BOT-G-DSE-603C-T	ENVIRONMENTAL AND WASTE MANAGEMENT / BIOSTATISTICS / BIOFERTILIZERS	04	60	15	06	60	24	75	30
BOT-G-DSE-604A-T/ BOT-G-DSE-604B-T/ BOT-G-DSE-604C-T	INDUSTRIAL MICROBIOLOGY/ NURSERY AND GARDENING)/ HERBAL TECHNOLOGY	04	60	10	06	60	24	75	30
BOT-G-DSE-603A/B/C & 604A/B/C-P	PRACTICAL BASED ON BOT-H-DSE-603 A/B/C & 604 A/B/C	04	60	10	04	40	16	50	20

BOTANY GE (GENERIC ELECTIVE / GENERAL)
SEMESTER – I

BOT-GE-101-T (PLANT DIVERSITY-I AND CYTOGENETICS)

CREDITS-04 (THEORY)
FULL MARKS: 60

LECTURES: 60
TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

PLANT DIVERSITY-I AND CYTOGENETICS

UNIT-01- Plant Diversity-I

ALGAE:-General characteristics, Morphology and life-cycles of the following:
Nostoc, Chlamydomonas, Batrachospermum.

FUNGI:- general characteristics , morphology and life cycle of albugo, pucinia, alternaria , lichens-general account.

BRYOPHYTA:- General characteristics , morphology , anatomy and reproduction of marchantia.

UNIT-02- Cytology and Genetics

Cytology:- Structure of cytoplasm cell organelles – Mitochondria, Chloroplast, Ribosome ; Cell Division – Mitosis , Meiosis.

Genetics:- Principles of inheritance , Mendel's Law ; complimentary gene & Epistasis ; Gene- mutation and polyploidy

BOTANY GE (GENERIC ELECTIVE / GENERAL) PRACTICAL
SEMESTER – I

BOT-GE-101-P (PLANT DIVERSITY-I AND CYTOGENETICS)

PRACTICAL

F.M. – 20

Examination

Time- 03 hrs

1. Study of vegetative and reproductive structures by preparation of temporary slides from unit-1(algae , fungi , & bryophyte) - 06
2. Cytological slide preparation -04
3. Spotting - 05
4. Record -03
5. Viva -02

BOTANY GE (GENERIC ELECTIVE / GENERAL)
SEMESTER – II

BOT-GE-102-T (PLANT DIVERSITY-II AND PLANT PHYSIOLOGY)

CREDITS-04 (THEORY)

FULL MARKS: 60

LECTURES: 60

TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

PLANT DIVERSITY-II AND PLANT PHYSIOLOGY

UNIT-01- PLANT DIVERSITY-II :

Pteridophytes:-General characteristics, morphology, anatomy and reproduction of *Selaginella*, and *Pteris*.

Gymnosperms

General characteristics; morphology, anatomy and reproduction of *Pinus*. Ecological and economical importance.

UNIT-02 – PLANT PHYSIOLOGY

Transpiration - Mechanism and Significance.

Ascent of sap – Root pressure theory and transpiration pull theory.

Photosynthesis – Photophosphorylation , C_3 , C_4 - cycle

Respiration – Glycolysis, TCA- cycle.

Growth hormone- Auxin , Gibberellin

BOTANY GE (GENERIC ELECTIVE / GENERAL) PRACTICAL
SEMESTER – II

BOT-GE-102-P (PLANT DIVERSITY-II AND PLANT PHYSIOLOGY)

PRACTICAL

F.M. – 20

Examination

Time- 03 hrs

- | | |
|--|------|
| 6. Study of vegetative and reproductive structures by preparation of temporary slides from unit-1(Ptredophytes & gymnosperm) | - 06 |
| 7. To perform physiological experiment from the syllabus | -04 |
| 8. Spotting | - 05 |
| 9. Record | -03 |
| 10. Viva | -02 |

BOTANY GE (GENERIC ELECTIVE / GENERAL)
SEMESTER – III

BOT-GE-103-T (Anatomy, Embryology, Economic Botany)

CREDITS-04 (THEORY)
FULL MARKS: 60

LECTURES: 60
TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

Anatomy, Embryology, Economic Botany

Unit- 1- ANATOMY

Tissues – apical, lateral and intercalary meristem; simple and complex tissues, Anomalous secondary growth in Boerhaavia & Dracaena.

Unit-2- EMBRYOLOGY

Outlines of cycle of an angiospermic plant,
Types of ovules,
Types of Embyo Sacs, Development of Polygonum type.
Double fertilization.
Endosperm & polyembryony.

Unit-3- ECONOMIC & BOTANY

Morphology & uses of Following –
Cereal – Wheat
Legumes- gram
Timber- Seeshum, teak
Oil – Mustard, Sunflower
Medical – Tulsi , Neem & Amla

BOTANY GE (GENERIC ELECTIVE / GENERAL) PRACTICAL
SEMESTER – III

BOT-GE-103-P (Anatomy, Embryology, Economic Botany)

PRACTICAL

F.M. – 20

Examination

Time- 03 hrs

1. Identification of tissue (parenchyma ,collenchymas and sclerenchyma) - 06

Or

Anomalous secondary growth

- | | |
|---|------|
| 2. Embryo dissection / photograph of ovule | -02 |
| 3. plant identification (from economic botany) and uses - | 03 |
| 4. Spotting | - 05 |
| 5. Record | -02 |
| 6. Viva | -02 |

BOTANY GE (GENERIC ELECTIVE / GENERAL)

SEMESTER – IV

BOT-GE-104-T (Ecology, Taxonomy, Biotechnology)

CREDITS-04 (THEORY)

FULL MARKS: 60

LECTURES: 60

TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

Ecology, Taxonomy, Biotechnology

Unit – I ECOLOGY

Introduction,

Ecological adaptation – Hydrophytes, Xerophytes.

Plant communities – Succession – Process & Types.

Eco-system structure, types – Pond, Grassland, Energy flow.

Tropic organisation, Food chain, Food Web, Ecological pyramid.

Pollution – Air & Water- Causes & Contol.

Unit-2- TAXONOMY

Introduction, identification, Classification, Nomenclature.

Taxonomic aids – herbarium & botanical Gardens.

Taxonomic hierarchy.

Principle & Rules of ICBN.

Classification – Benthom & Hooker and Hutchinson’s system.

Study of following families – Apocynaceae, Solanaceae, Poaceae.

Unit- 3- BIO-TECHNOLOGY.

Plant Tissue Culture- History, Requirement, Technique & Application

BOTANY GE (GENERIC ELECTIVE / GENERAL) PRACTICAL
SEMESTER – IV

BOT-GE-104-P (Ecology, Taxonomy, Biotechnology)

PRACTICAL

F.M. – 20

Examination

Time- 03 hrs

- | | |
|--|------|
| 1.Study of vegetative and floral characters of the families include in the syllabus with floral diagram, formula and systematic position | - 06 |
| 2. study of morphological adaptations of hydrophytes and xerophytes | -03 |
| 3. photographs from Biotechnology | -03 |
| 4.Spotting | - 05 |
| 5. Record | -02 |
| 6. Viva | -02 |

BOTANY GENERAL
SEMESTER – V

BOT-G-501A-T (PLANT BREEDING)

CREDITS-04(THEORY)

FULL MARKS: 60

LECTURES: 60

TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

PLANT BREEDING

UNIT 1: Introduction and objectives.

Unit 2:- Methods of Crop Improvement, Introduction, Selection, Hybridization.

UNIT 3:- Inbreeding, Inbreeding Depression, Heterosis.

Unit 4:- Role of Mutation, Polyploidy, Distant Hybridization, Role of Biotechnology in crop improvement.

BOTANY GENERAL

SEMESTER – V

BOT-G-501B-T (RESEARCH METHODOLOGY)

CREDITS-04(THEORY)

FULL MARKS: 60

LECTURES: 60

TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

RESEARCH METHODOLOGY

Unit 1: Basic concepts of research

Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs emperical).Research methods vs methodology. Literature-review and its consolidation; Library research; field research; laboratory research.

Unit 2: General laboratory practices

Common calculations in botany laboratories. Understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases.Preparation of solutions. Dilutions. Percentage solutions. Molar, molal and normal solutions.Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.

Unit 3: Data collection and documentation of observations

Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of tissue specimens and application of scale bars. The art of field photography.

Unit 4: Overview of Biological Problems

History; Key biology research areas, Model organisms in biology (A Brief overview): Genetics, Physiology, Biochemistry, Molecular Biology, Cell Biology, Genomics, Proteomics- Transcriptional regulatory network.

Unit 5: Methods to study plant cell/tissue structure

Whole mounts, peel mounts, squash preparations, clearing, maceration and sectioning; Tissue preparation: living vs fixed, physical vs chemical fixation, coagulating fixatives, non-coagulant fixatives; tissue dehydration using graded solvent series; Paraffin and plastic infiltration; Preparation of thin and ultrathin sections.

Unit 6: Plant microtechniques

Staining procedures, classification and chemistry of stains. Staining equipment. Reactive dyes and fluorochromes (including genetically engineered protein labeling with GFP and other tags). Cytogenetic techniques with squashed plant materials.

Unit 7: The art of scientific writing and its presentation

Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Powerpoint presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.

PRACTICAL

Marks -20

1. Experiments based on chemical calculations.
2. Plant microtechnique experiments.
3. The art of imaging of samples through microphotography and field photography.
4. Poster presentation on defined topics.
5. Technical writing on topics assigned.

SUGGESTED READINGS

1. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.
2. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.
3. Ruzin, S.E. (1999). Plant microtechnique and microscopy. Oxford University Press, New York, U.S.A.

BOTANY GENERAL

SEMESTER – V

BOT-G-501C-T (STRESS BIOLOGY)

CREDITS-04(THEORY)
FULL MARKS: 60

LECTURES: 60
TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

STRESS BIOLOGY

Unit 1: Defining plant stress ; Acclimation and adaptation.

Unit 2: Environmental factors

Water stress; Salinity stress, High light stress; Temperature stress; Hypersensitive reaction; Pathogenesis– related (PR) proteins; Systemic acquired resistance; Mediation of insect and disease resistance by jasmonates.

Unit 3: Stress sensing mechanisms in plants; Calcium modulation, Phospholipid signaling.

Unit 2: Developmental and physiological mechanisms that protect plants against

environmental stress; Adaptation in plants; Changes in root: shoot ratio; Aerenchyna development; Osmotic adjustment; Compatible solute production.

Unit 3: Reactive oxygen species–Production and scavenging mechanisms

PRACTICAL

Marks - 20

1. Quantitative estimation of peroxidase activity in the seedlings in the absence and presence of salt stress.
2. Superoxide activity in seedlings in the absence and presence of salt stress.
3. Zymographic analysis of peroxidase.
4. Zymographic analysis of superoxide dismutase activity.
5. Quantitative estimation and zymographic analysis of catalase.
6. Quantitative estimation and zymographic analysis of glutathione reductase.
7. Estimation of superoxide anions.

SUGGESTED READINGS

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

BOTANY GENERAL
SEMESTER – V

BOT-G-502A-T (NATURAL RESOURCE MANAGEMENT)

CREDITS-04(THEORY)
FULL MARKS: 60

LECTURES: 60
TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

NATURAL RESOURCE MANAGEMENT

UNIT 1: Natural resources, Definition, types, Sustainable utilization- Concept, approaches, (Economical, Socio- cultural, Ecological).

UNIT 2: Land- Soil degradation and management- Water- Fresh water estuaries, wet lands, threats, and management strategies.

UNIT 3: Biological Resource - Biodiversity- Definition and types, Significance, threat and management.

Forest- Definition, Importance and management.

UNIT 4: Energy- Renewable and Non renewable sources.

UNIT 5: National and International efforts in resource management.

BOTANY GENERAL
SEMESTER – V

BOT-G-502B-T (BIOINFORMATICS)

CREDITS-04(THEORY)
FULL MARKS: 60

LECTURES: 60
TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

BIOINFORMATICS

Unit 1. Introduction to Bioinformatics

Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics.

Unit 2. Databases in Bioinformatics

Introduction, Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System.

Unit 3. Biological Sequence Databases

National Center for Biotechnology Information (NCBI): Tools and Databases of NCBI, Database Retrieval Tool, Sequence Submission to NCBI, Basic local alignment search tool (BLAST), Nucleotide Database, Protein Database, Gene Expression Database.

EMBL Nucleotide Sequence Database (EMBL-Bank): Introduction, Sequence Retrieval, Sequence Submission to EMBL, Sequence analysis tools.

DNA Data Bank of Japan (DDBJ): Introduction, Resources at DDBJ, Data Submission at DDBJ.

Protein Information Resource (PIR): About PIR, Resources of PIR, Databases of PIR, Data Retrieval in PIR.

Swiss-Prot: Introduction and Salient Features.

Unit 4. Sequence Alignments

Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), MSA by CLUSTALW, Scoring Matrices, Percent Accepted Mutation (PAM), Blocks of Amino Acid Substitution Matrix (BLOSUM).

Unit 5. Molecular Phylogeny

Methods of Phylogeny, Software for Phylogenetic Analyses, Consistency of Molecular Phylogenetic Prediction.

Unit 6. Applications of Bioinformatics

Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement

PRACTICAL

Marks - 20

1. Nucleic acid and protein databases.
2. Sequence retrieval from databases.
3. Sequence alignment.
4. Sequence homology and Gene annotation.
5. Construction of phylogenetic tree.

SUGGESTED READINGS

1. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
3. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

BOTANY GENERAL
SEMESTER – V

BOT-G-502C-T (ANALYTICALS TECHNIQUES IN PLANT SCIENCES)

CREDITS-04(THEORY)
FULL MARKS: 60

LECTURES: 60
TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

ANALYTICALS TECHNIQUES IN PLANT SCIENCES

Unit 1: Imaging and related techniques

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy; Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

Unit 2: Cell fractionation

Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl₂ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

Unit 3: Radioisotopes

Use in biological research, auto-radiography, pulse chase experiment.

Unit 4: Spectrophotometry

Principle and its application in biological research.

Unit 5: Chromatography

Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ionexchange chromatography; Molecular sieve chromatography; Affinity chromatography.

Unit 6: Characterization of proteins and nucleic acids

Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE

Unit 7:Biostatistics

Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

Practical

Marks -20

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation.
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry's methods.
8. To separate proteins using PAGE.
9. To separation DNA (marker) using AGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
11. Preparation of permanent slides (double staining).

SUGGESTED READINGS

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.
4. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

PRACTICALS (BOT-G-501A & 502 A)

40 MARKS

1. Hybridization techniques:
Emasculation and bagging.
2. Study of Cyanobacteria- Study with the help of Photographs.
3. Study of Biodiversity of the college campus.

EXAMINATION

FULL MARKS- 40

- | | |
|---|--------|
| 1. Hybridization techniques:
Emasculation and bagging. | 10 |
| 2. Study of Cyanobacteria- Study with the help of Photographs | |
| or | |
| Study of Biodiversity of the college campus | 08 |
| 3. Spotting | 5x2=10 |
| 4. Records/ projects | 06 |
| Viva- Voice | 06 |

BOTANY GENERAL
SEMESTER – VI

BOT-G-603A-T (ENVIRONMENTAL AND WASTE MANAGEMENT)

CREDITS-04(THEORY)

FULL MARKS: 60

LECTURES: 60

TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

ENVIRONMENTAL AND WASTE MANAGEMENT

1. Understanding Ecosystems, Population, Community, Components of Ecosystems.
2. Destruction of Ecosystem due to changing pattern of land use, Migration, Transportation, Urbanization, Industrialization, Environmental Impact Assessment.
3. Environmental impact assessment-
4. Sources, classification of waste
5. Impact of waste accumulation.
6. Need for management of waste.
7. Safe disposal of waste.
8. Legal provision of waste management.
9. Swacchh bharat Abhiyaan- Your suggestions

SUGGESTED READINGS

1. Ecology & Environment: Sharma , P.D.- Rastogi Publication- Meerut.

BOTANY GENERAL

SEMESTER – VI

BOT-G-603B-T (BIOSTATISTICS)

CREDITS-04 (THEORY)

FULL MARKS: 60

LECTURES: 60

TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

BIOSTATISTICS

Unit 1:Biostatistics

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

Unit 2:Collection of data primary and secondary

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

Unit 3:Measures of central tendency

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

Types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression.

Unit 5:Statistical inference

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

BOT-G-603B-P (BIOSTATISTICS) PRACTICAL

Marks – 20

- 1) Calculation of mean, standard deviation and standard error
- 2) Calculation of correlation coefficient values and finding out the probability
- 3) Calculation of 'F' value and finding out the probability value for the F value.

SUGGESTED READINGS

1. Biostatistic, Danniell, W.W., 1987. New York, John Wiley Sons.
2. An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian Medical College, Vellore
3. 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.

BOTANY GENERAL

SEMESTER – VI

BOT-G-603C-T (BIOFERTILIZERS)

CREDITS-04(THEORY)

FULL MARKS: 60

LECTURES: 60

TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

BIOFERTILIZERS

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

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

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

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

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

SUGGESTED READINGS

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.

4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad

BOT-G-603C-P (BIOFERTILIZERS) PRACTICAL

MARKS -20

01. Isolation and identification technique of *Rhizobium*
02. Biocomposting methods and types
03. Process of vermicomposting
04. VAM isolation.

BOTANY GENERAL

SEMESTER – VI

BOT-G-604A-T (INDUSTRIAL MICROBIOLOGY)

CREDITS-04(THEORY)

FULL MARKS: 60

LECTURES: 60

TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

INDUSTRIAL MICROBIOLOGY

UNIT-01-Biogas- Process & Importance- Need, Merit & scope.

UNIT-02-Bioremediation, Role of microbes in waste management, Bioremediation of
a) Hydrocarbons b) Industrial wastes c) Xenobiotics, Biomining, Bioreactors.

UNIT-03-Microbial flora of water- water pollution, sewage, algal bloom. BOD, COD, Eutrophication.

UNIT-04-Microbes in Agriculture Biological fixation, Mycorrhizae, Isolation of root nodule bacteria.

UNIT-05-Microbial products of Industrial value- Organic acids, Alcohols, Antibiotics, Downstream processing & uses.

SUGGESTED READINGS:-

- 1.** Pelzar. M.J. JR. Chen E.C.S. Krieg, N.R (2010) Microbiology- An application based approach, Tata MC Graw Hill Education pvt. Ltd. New Delhi
- 2.** Tortora, G.J. Funke, B.R. Case, C.L. (2007), Microbiology, pearson Benjamin Cummings, San Francisco, U.S.A. 9th edition
- 3.** Dubey, R.C. – 2015, A. Text book of Biotechnology S. Chand & Co. Pvt. Ltd- New Delhi.
- 4.** Ramawat, K.G. & Goyal, Shaily- 2015, Comprehensive BiotechnologyS.chand & Co. New Delhi.

BOTANY GENERAL

SEMESTER – VI

BOT-G-604B-T (NURSERY AND GARDENING)

CREDITS-04 (THEORY)

FULL MARKS: 60

LECTURES: 60

TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

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.

Unit 2: Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion – Seed production technology - seed testing and certification.

Unit 3: Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants – green house - mist chamber, shed root, shade house and glass house.

Unit 4: Gardening: definition, objectives and scope - different types of gardening – landscape and home gardening - parks and its components - plant materials and design – computer Applications in landscaping - Gardening operations: soil laying, manuring, watering, Management of pests and diseases and harvesting.

Unit 5: Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - 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.

BOT-G-604B-P (NURSERY AND GARDENING) PRACTICAL

MARKS -20

01. Study of vegetative propapagation
 - a. Natural method- In bryophyllum,
 - b. Artificial methods- cutting (china rose), grafting(mango), layering (rose) , “gootee” (lemon)
02. Study of seed dormancy.
03. Computer applications in landscaping.

BOTANY GENERAL

SEMESTER – VI

BOT-G-604C-T (HERBAL TECHNOLOGY)

CREDITS-04 (THEORY)

FULL MARKS: 60

LECTURES: 60

TIME: 03 HRS.

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

HERBAL TECHNOLOGY

Unit 1:Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants.

Unit 2:Pharmacognosy - systematic position m edicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka.

Unit 3:Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster).

Unit 4:Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds)

Unit 5:Medicinal plant banks micro propagation of important species (*Withania somnifera*, neem and tulsi- Herbal foods-future of pharmacognosy).

SUGGESTED READINGS

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book Distributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH publishing Co.
5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
6. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.
7. Pharmacognosy, Dr.C.K.Kokate et al. 1999. Nirali Prakashan.

BOT-G-604C-P (HERBAL TECHNOLOGY) PRACTICAL

MARKS -20

01. Culture of any medicinal plant mentioned in the syllabus.
02. Determination of secondary metabolites by TLC methods.
03. Systematic positioned uses of tulsi, ginger, fenugreek and Indian goose berry

**BOT-G-603A & 604A (ENVIRONMENTAL AND WASTE MANAGEMENT
& INDUSTRIAL MICROBIOLOGY PRACTICAL)**

FM-40

1. Study of Plant Community/ Vegetation of College Campus by Quadrat method, measurement of frequency and density.
2. Study of microbial flora of water samples.
3. Project on Waste management for clean, green Campus.
4. Principles and functioning of instrument in Microbiology Laboratory (any two)

EXAMINATION

F. M.- 40

Time- 3 hrs

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|--|----|
| 1. Study of Plant Community by Quadrat method- frequency & density | 15 |
| 2. Description of one Instrument of Microbiology- Laboratory. | 05 |
| 3. Spotting – 2 photographs (from syllabus) | 05 |
| 4. Viva voice | 05 |
| 5. Records/ Project | 10 |