BINOD BIHARI MAHTO KOYALANCHAL UNIVERSITYDHANBAD

DEPARTMENT OF BOTANY

SYLLABUS OF
UNDER GRADUATE (UG) PROGRAMME

FRAMED ACCORDING TO NATIONAL EDUCATION POLICY (NEP) 2020

With effect from Academic Session 2022-2026

BINOD BIHARI MAHTO KOYLANCHAL UNIVERSITY DHANBAD

Preamble

The objective of a B.Sc. (Honors) programme in Higher Education system is to prepare its students for the society. The current pattern is designed to provide a focused learning outcome based syllabus at the Honors level providing structured teaching-learning experiences catering to the needs of the students. The honors courses will prepare the students both academically and in terms of employability. The programme also inculcates various attributes at the Honors level.

These attributes encompass values related to emotional stability, social justice, creative and critical thinking, well-being and various skills required for employability, thus preparing students for continuous learning and sustainability. The new curriculum based on learning outcomes of BSc (Honours) Botany offers knowledge of areas including Plant Systematics, Plant Biotechnology, Resource Botany, Genetics, Ecology, Conservation biology, Physiology and Bioinformatics, Medicinal plants, Plant diseases management etc. The courses define clearly the objectives and the learning outcomes, enabling students to choose the elective subjects broadening their skills in the field of Botany. The course also offers skills to pursue research and teaching in the field of Botany and thus would produce best minds to meet the demands of society This curriculum framework for the bachelor-level program in Botany is developed keeping in view of the student-centric learning pedagogy, which is entirely outcome-oriented and curiosity-driven. To avoid a rote-learning approach and foster imagination, the curriculum is more leaned towards self-discovery of concepts.

The curriculum framework focuses on the pragmatist approach whereby practical application of theoretical concepts is taught with substantial coverage of practical and field works.

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Members of Borard of Studies of NEP 2020 graduate syllabus as per Guide lines of Binod Bihari Mahto Koyalanchal University , Dhanbad.

01	CHAIRMAN	Dr. Kalpana Prasad	Associate Professor, Head University Department of Botany BBMK University
02	MEMBERS	Dr. J. N. Singh	Associate Professor Principal R.S. P. College. Dhanbad
03		Dr. P.C. Thakur	Assistant Professor Department of Botany Chas College, Chas
04		Dr. Pallavi Praveen	Assistant Professor Department of Botany B.S. City College, Bokaro
05		Mrs. K. R Topno	Assistant Professor Department of Botany P.K.R. M. College, Dhanbad

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B. Sc. Botany Programme outcomes as per NEP 2020Discipline Core: Botany

By the end of the program the students will be able to:

PO1: Skill development for the proper description using botanical terms, identification, naming and classification of life forms especially plants and microbes.

PO2: Acquisition of knowledge on structure, life cycle and life processes that exist among plant and microbial diversity through certain model organism studies.

PO3: Understanding of various interactions that exist among plants and microbes; to develop the curiosity on the dynamicity of nature.

PO4: Understanding of the major elements of variation that exist in the living world through comparative morphological and anatomical study.

PO5: Ability to explain the diversity and evolution based on the empirical evidences in morphology, anatomy, embryology, physiology, biochemistry, molecular biology and life history.

PO6: Skill development for the collection, preservation and recording of information after observation and analysis- from simple illustration to molecular database development.

PO7: Making aware of the scientific and technological advancements- Information and Communication, Biotechnology and Molecular Biology for further learning and research in all branches of Botany..

PO8: Internalization of the concept of conservation and evolution through the channel of spirit of inquiry.

PO 9: To enable the graduates to prepare for national as well as international level competitive examinations like UGC-CSIR, UPSC, KPSC etc.

PO10: To enable the students for practicing the best teaching pedagogy as a biology teacher including the latest digital modules.

PO 11: The graduates should be knowledgeable and competent enough to appropriately deliver on aspects of global importance like climate change, SDGs, green technologies etc at the right opportunity.

PO 12: The graduate should be able to demonstrate sufficient proficiency in the hands-on experimental techniques for their area of specialization within biology during research and in the professional career.

Assessment: (Teaching, Learning and Evaluation)

Weightage for assessments (in percentage)

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	15	60
Practical	5	20
Projects Experiential Learning (Internships etc.)		

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MAJOR PAPERS

S.N.	Semester Details	Code	Subject	Credit
1.	Semester I	BOT101T	Microbes, Algae, Fungi and Bryophytes	4
2.		BOT102P	Practical	2
3.	Semester II	BOT201T	Pteridophytes, Gymnosperms and Angiosperms	4
4.		BOT202P	Practical	2
5.	Semester III	BOT301T	Morphology and Anatomy	4
6.		BOT302P	Practical	2
7.	Semester IV	BOT401T	Embryology and Cytogenetics	4
8.		BOT402P	Practical	2
9.	Semester V	BOT501T	Molecular Biology and Plant Biotechnology	4
10.		BOT502T	Economic Botany and Plant Breeding	4
11.		BOT503P	Practical	2
12.	Semester VI	BOT601T	Plant Physiology and Biochemistry	4
13.		BOT602T	Ecology and Biostatistics	4
14.		BOT603P	Practical	2
15.		BOT504R	Project -Local Plant Diversity	4
16.	Semester VII	BOT701T		4
17.		BOT702T		**4**
18.		BOT703T		4
19.		BOT704P	Practical	2
20.	Semeste	BOT801T		4
21.	rVIII	BOT802T		**4**
22.		BOT803T	Research Methodology	4
23.		BOT804P	Practical	2

CORE SPECIFIC ELECTIVE PAPERS (DSE)

S.N	**Semester Details**	**Subject: Botany**	Code	**Credits**
1.	Semester V	Algal and Fungal Biotechnology	**DSE 1**	3
2.	Semester VI	Herbal Technology	**DSE 2**	3
3.	Semester VII	Plant Propagation and Tissue Culture	**DSE 3**	3
4.	Semeste rVIII	Landscaping, Gardening and Green	**DSE 4**	3
		House Technology		

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Microbes, Algae, Fungi and Bryophytes (Course code: BOT101T)Credit: 4

Unit 1.

Microbes:

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).

Unit 2

Alga:

General characteristics; Range of thallus organization and reproduction; classification of algae; morphology and life-cycles of:- Nostoc, Oedogonium, Vaucheria, Fucus, Sargassum; Economic importance of algae.

Unit 3

Fungi:

Introduction-general characteristics, ecology and significance, cell wall composition, nutrition, reproduction and classification (G.C. Ainsworth); Rhizopus (Zygomycota) Penicillium (Ascomycota), Puccinia, Agaricus (Basidiomycota); Alternaria (Deutromycota), Symbiotic associations: Lichens- General account, reproduction and significance; Mycorrhiza: Ectomycorrhiza, Endomycorrhiza and their significance

Unit 4

Bryophyte:

General characteristics, adaptations to land habit, classification (up to family), morphology, anatomy and reproduction of Marchantia and Funaria; ecology and economic importance of bryophytes, volution of sporophytes among bryophytes.

Suggested reading

- Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
- Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
- Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
- Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology,John Wiley and Sons (Asia), Singapore. 4th edition.
- Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi, India.
- Pandey, S.N and Trivedi, P.S. (2015). A text book of Botany Vol.I Vikas publishing House Pvt/ Ltd, New Delhi.
- Vashishta, P.C., Sinha, A.K., Kumar, A. (2010). Bryophyta, S. Chand. Delhi, India.
- Parihar, N.S. (1991). An Introduction to Embryophyta Vol. I Bryophyta. Central Book Depot, Allahabad.

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Practical/ Lab course (Course code: BOT102P) Credit: 2

1. **EMs/Models of viruses –** T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.

Types of Bacteria from temporary/permanent slides/photographs; EM of bacterium; Binary Fission; Conjugation; Structure of root nodule; Gram staining technique

2 Study of vegetative and reproductive structures of Nostoc, Chlamydomonas (electron micrographs), Oedogonium, Vaucheria, Fucus and Sargassum through temporary preparations and permanent slides/specimens

3 Rhizopus and Penicillium: Asexual stages from temporary mounts.

Alternaria: Specimens/photographs and tease mounts.

Puccinia: Herbarium specimens of Black Rust of Wheat and infected

Barberry leaves; section/tease mounts of spores on wheat and permanent slides ofboth the hosts.

Agaricus: Specimens of button stage and full grown mushroom.

Lichens: Study of growth forms of lichens (crustose, foliose and fruticose).

Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs).

4 Marchantia and Riccia: Morphology of thallus, rhizoids and scales, V.S. thallus through gemma cup, gemmae whole mount (all temporary slides), V.S antheridiophore, archegoniophore, L.S. sporophyte (all permanent slides).

Funaria- Morphology, whole mount leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, L.S capsule and protonema.

Suggested reading

- Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd. Ramnagar, New Delhi.
- Purohit, S.D., Kundra, G. K. and Singhvi, A. (2013). Practical Botany (part I). Apex

Publishing House Durga Nursery Road Udaipur, Rajasthan.
- Sambamurty, A.V.S.S. (2006). A text book of algae. I.K International Publishing House, Pvt. Ltd.

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NEP 2020 BOTANY (MAJOR) PRACTICAL (MJ- 1) P

Practical examination

Full marks: 25 Time: 03 Hrs.

1. Preparation of temporary slides of any one included in the syllabus.		06 marks
2. To detect the gram positive and gram negative bacteria through gram staining technique. Or Structure of bacteriophage or TMV through photographs		06 marks
3. Spotting	(2 x2 marks)	04 marks
4. Viva voce		04 marks
5. Class records/ Model / Chart.		05 marks
		25 marks

BINOD BIHARI MAHTO KOYLANCHAL UNIVERSITY DHANBAD

Pteridophytes, Gymnosperms and Angiosperms (BOT201T) Credit: 4

1. Pteridophytes

General characteristics, classification, early land plants (Rhynia); classification (upto family), morphology, anatomy and reproduction of Selaginella and Equisetum, heterospory and seed habit, stelar evolution.

2 Gymnosperms

General characteristics, classification (up to family), morphology, anatomy and reproduction of Cycas, Pinus.

3. Introduction to plant taxonomy

Identification, classification, nomenclature, functions of herbarium, important herbaria and botanical gardens of the world and India

Important flora, botanical nomenclature (principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations).

Classification: Types of classification-artificial, natural and phylogenetic Bentham and Hooker (up to series) and Hutchinson classification.

4 Taxonomy of plant families

Malvaceae, Fabaceae, Solanaceae, Lamiaceae, Asteraceae and Poaceae.

Suggested readings

 Vashishta, P.C., Sinha, A.K. and Kumar, A. (2010). Pteridophyta, S Chand and Company Ltd., Ramnagar, New Delhi, India.

 Vashishta, P.C., Sinha, A.K. and Kumar, A. (2010). Gymnosperms, S Chandand Company Ltd., Ramnagar, New Delhi, India.

 Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) LtdPublishers, New Delhi, India.

 Parihar, N.S. (1991). An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.

 Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.

 Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford and IBH Pvt. Ltd.,New Delhi. 3rd edition.

 Gangulee H.C., Kar, A.K. and Santra S.C. (2011). College Botany Vol II. 4th Edition New Central Book Agency.

 Parihar, N.S. (1976). Biology and Morphology of Pteridophytes. Central Book Depot.

Sharma, O.P. (1990). Textbook of Pteridophyta. MacMillan India Ltd. Delhi.

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Practical/ Lab course (BOT202P) Credit: 2

1 Selaginella: Morphology, whole mount leaf with ligule, strobilus, microsporophyll and megasporophyll (temporary slides), T.S. stem, L.S. strobilus (permanent slide).

Equisetum: Morphology, T.S. internode, L.S. strobilus, T.S and L.S. strobilus, whole mount sporangiophore,. spores (wet and dry) (temporary slides); T.S. rhizome (permanent slide).

Pteris: Morphology, T.S rachis, V.S. sporophyll, whole mount sporangium and spores (temporary slides), T.S. rhizome, whole mount prothallus with sex organs and young sporophyte (permanent slide).

2 Cycas: Morphology (coralloid roots, bulbil, leaf), T.S. coralloid root and rachis, V.S. leaflet and microsporophyll, whole mount spores (temporary slides), L.S.ovule, T.S. root (permanent slide).

Pinus: Morphology (long and dwarf shoots, male and female cones), T.S. needle and stem, L.S./T.S. male cone, whole mount microsporophyll and microspores (temporary slides), L.S. female cone, TLS and RLS stem (permanent slide).

3 Taxonomic Identification: Description of an angiospermic plant, study of vegetative and floral characters (description, V.S. flower, section of ovary, floral diagram/s, floral formula/e) and systematic position of the following families according to Bentham and Hooker's system of classification: Brassicaceae, Asteraceae, Solanaceae, Lamiaceae, and Liliaceae.(Plants can be chosen as per availability of local flora)

4 Herbarium techniques: Plant collection, preservation and mounting of two properly dried and pressed specimen of any wild plant with herbarium label (to besubmitted in the record book), digital/virtual herbarium.

Suggested readings

Pandey, B.P. (2014). Modern Practical Botany Vol. II. S. Chand and Company Ltd., New Delhi.

Bendre, A.M. and Kumar A. (2003). Manual of Practical Botany Vol. II. RastogiPublications, Meerut.

Santra S.C. and Chatterjee (2005). College Botany Practical Vol. II New Central Book Agency Pvt. Ltd.

BINOD BIHARI MAHTO KOYLANCHAL UNIVERSITY DHANBAD

Morphology and Anatomy (Course code: BOT301T) Credit: 4

1 Meristematic and permanent tissues: Types of tissues, Root and shoot apical meristems, Theories related to apical meristem, simple, complex and secretary tissues

2 Organs: Structure of dicot and monocot root, stem and leaf, root stem transition

3 Adaptive and protective systems: Epidermis, cuticle and stomata

4 Secondary growth: Structure and function of Vascular cambium, secondary growth in stem and roots, abnormal secondary growth

Suggested readings

- Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
- Pandey, B.P. (2001) Plant Anatomy. S. Chand and Company Ltd., New Delhi.
- Sharma, P.C. (2017). Text Book of Plant Anatomy. Arjun Publishing House.
- Menan, A.B. (2008). Introduction to Plant Anatomy. Neha Publishers and Distributors.
- Sharma, M.K. (2013) Plant Structures (An Introduction to Plant Anatomy). Vayu Education of India.

BINOD BIHARI MAHTO KOYLANCHAL UNIVERSITY DHANBAD

Practical/Lab Course (Course code: BOT302P) Credits: 02

1 Pollination and fertilization: Pollination mechanisms and adaptation, structure ofanther and pollen, development of male and female gametophytes, double fertilization.

Embryo and endosperm: Types of ovules and embryo sacs; embryo and endosperm; types of endosperm; dicot and monocot embryo; apomixes and polyembryony.

Heredity: (Pre-mandelian genetics, brief life history of Mendel, laws of Inheritance, modified mandelian ratios, lethal genes, co-dominance, incomplete dominance, chi square, pedigree analysis, multiple allelism, chromosome theory ofinheritance, sex-determination and sex-linked inheritance, cytoplasmic inheritance Linkage and crossing over: Linkage: concept and history, complete and incompletelinkage, bridges experiment, coupling and repulsion, recombination frequency, linkage maps based on two and three factor crosses.

2 Crossing over: Concept and significance, cytological proof of crossing over; mutations and chromosomal aberrations (types of mutations, effects of physicaland chemical mutagens, numerical chromosomal changes: euploidy, polyploidy and aneuploidy; structural chromosomal changes: deletions, duplications, inversions and translocations).

Suggested readings

 Bhojwani, S.S. and Bhatnagar, S.P. (2010). The Embryology of Angiosperms. Vikas
Publication House Pvt. Ltd. New Delhi. 5th edition.

 Johri, B.M. (1984). Embryology of Angiosperms. Springer-Verlag, Berlin

 Maheshwari, P. (1971). An Introduction to Embryology of Angiosperms. McGraw Hill Book
Co. London.

 Rastogi, V.B. (2019). Genetics. 4th Edition. MEDTECH: A Division of Scientific International.

BINOD BIHARI MAHTO KOYLANCHAL UNIVERSITY DHANBAD

Embryology and Cytogenetics (course code: BOT401) **Credit: 4**

1 Pollination and fertilization: Pollination mechanisms and adaptation, structure ofanther and pollen, development of male and female gametophytes, double fertilization.

2 Embryo and endosperm: Types of ovules and embryo sacs; embryo and endosperm; types of endosperm; dicot and monocot embryo; apomixes and polyembryony.

3 Heredity: (Pre-mandelian genetics, brief life history of Mendel, laws of Inheritance, modified mandelian ratios, lethal genes, co-dominance, incomplete dominance, chi square, pedigree analysis, multiple allelism, chromosome theory of inheritance, sex-determination and sex-linked inheritance, cytoplasmic inheritance Linkage and crossing over: Linkage: concept and history, complete and incomplete linkage, bridges experiment, coupling and repulsion, recombination frequency, linkage maps based on two and three factor crosses.

4 Crossing over: Concept and significance, cytological proof of crossing over; mutations and chromosomal aberrations (types of mutations, effects of physicaland chemical mutagens, numerical chromosomal changes: euploidy, polyploidy and aneuploidy; structural chromosomal changes: deletions, duplications, inversions and translocations).

Suggested readings

· Bhojwani, S.S. and Bhatnagar, S.P. (2010). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.

· Johri, B.M. (1984). Embryology of Angiosperms. Springer-Verlag, Berlin Maheshwari,

· P. (1971). An Introduction to Embryology of Angiosperms. McGraw Hill Book Co. London.

· Rastogi, V.B. (2019). Genetics. 4th Edition. MEDTECH: A Division of Scientific International.

Practical/Lab Course (Course code: BOT402) Credits: 4

1 Pollination types and seed dispersal mechanisms (photographs and specimens)**2** Structure of anther (young and mature).

Types of ovules: anatropous, orthotropous, circinotropous, amphitropous,campylotropous.

Female gametophyte: Polygonum (monosporic) type of embryo sac development(permanent slides/photographs)

Ultrastructure of mature egg apparatus cells through electron micrographs (permanent slides/photographs)

3 Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.

Monohybrid cross (dominance and incomplete dominance) Dihybrid cross and gene interactions Pedigree analysis for dominant and recessive autosomal and sex linked traits. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1,13:3, 15:1, 12:3:1, 9:3:4).

4 Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes through photographs.

Photographs/permanent slides showing translocation ring, laggards and Inversion Bridge

Suggested reading

- Sundara, R.S. (2002). Practical Manual Anatomy and Embryology. Anmol Publisher, New Delhi.
- Singh, R.J. (2021). Practical Manual on Plant Cytogenetics. CRC Press, Taylorand Francis Group, Routledge.

Cell and Molecular Biology, and Biotechnology (Course code: BOT 501T)Credit: 4

1 Cell Biology: The cell theories, prokaryotic and eukaryotic cells, cell organelles (Mitochondria, Chloroplast, ER, golgi body, lysosomes, peroxisomes, glyoxisomes, nucleus, chromatin; DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure), cell membrane and cell wall; models of membrane structure, cell cycle (overview of cell cycle, mitosis and meiosis, molecular controls).

2 Molecular Biology: Genetic material (DNA: Miescher to Watson and Crick-historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material); DNA replication (Prokaryotes);

Transcription (Prokaryotes) Types of structures of RNA (mRNA, tRNA, rRNA); Translation (Prokaryotes), Regulation of gene expression (Prokaryotes: Lac operon and Tryptophan operon).

3 Plant tissue culture: Culture types on the basis of explants and media composition, General lab setup and instrumentation, micropropagation, brief account of protoplast culture, somatic embryogenesis with their applications.

4 Recombinant DNA techniques: Blotting techniques: Northern, Southern and Western Blotting, Molecular DNA markers i.e. RAPD, RFLP, SNPs, PCR, hybridoma and monoclonal antibodies, ELISA and Immunodetection.

Suggested readings

Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley and Sons. Inc.

De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and MolecularBiology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.

Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.

Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G.P. (2009). The Worldof the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

BINOD BIHARI MAHTO KOYLANCHAL UNIVERSITY DHANBAD

Economic Botany and Plant Breeding (Course code: BOT502T) Credit: 4

1 Origin of cultivated plants (concept of centres of origin, their importance with reference to vavilov's work)

2 A brief knowledge of botany and commercial utilization and uses of the following plants:

1. Cereals and millets- Wheat, Rice and Maize, Ragi, Pearl millet
2. Sugar yielding plants- Sugarcane and Sugar beet
3. Fruits- Mango, Apple, Banana, Citrus and Litchi.
4. Fibers- Cotton, Jute, Hemp, Coir, Agave and Semal.
5. Vegetables- Root vegetables, stem vegetables and fruit vegetables.
6. Timbers- Teak, Shisham, Sal, Chir and Deodar.
7. Medicinal plants- Aconitum, Atropa, Cinchona, Rauwolfia, Ephedra, Withania, and Alovera.
8. Oils, Beverages, Fumitories, masticatories, Spices and Condiments yielding plants.

3 Plant breeding (introduction and objectives; breeding systems, important achievements and undesirable consequences of plant breeding); methods of cropimprovement; centres of origin and domestication of crop plants, plant genetic resources; acclimatization; selection methods.

4 Hybridization: for self, cross and vegetatively propagated plants – procedure, advantages and limitations; inbreeding depression and heterosis (history, genetic basis of inbreeding depression and heterosis; applications); crop improvement and breeding (role of mutations; polyploidy; distant hybridization and role of biotechnology in crop improvement).

Suggested readings

- Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan PublishersIndia Ltd., New Delhi. 4th edition.
- Pandey, B.P. (1999). Economic Botany. S. Chand, New Delhi. Singh,
- B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
- Acquaah, G. (2007). Principles of Plant Genetics and Breeding. Blackwell Publishing.

BINOD BIHARI MAHTO KOYLANCHAL UNIVERSITY DHANBAD

Lab Course (Course code: BOT503P) Credit: 2

1 Structure of prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.

Study of the photomicrographs of cell organelles, structure of plant cell through temporary mounts.

Study of mitosis and meiosis (temporary mounts and permanent slides).

Demonstration of the effect of temperature, organic solvent on semi permeable membrane.

Study of plasmolysis, deplasmolysis, Endo- and Exo-osmosis.

2 Instruments and equipments used in molecular biology The cell size measurements (either length or breadth/diameter) by micrometry.

Study the structure of nuclear pore complex by photograph (from Gerald Karp)

Study of special chromosomes (polytene and lampbrush) either by slides or photographs.

Study DNA packaging by micrographs.

Preparation of the karyotype and ideogram from given photograph of somaticmetaphase chromosome.

3 Study of economically important plants:

Cereals: Wheat, Rice, Maize

Millets: Fingermillet, Foxtail, Ragi

Pulses: Gram, Green gram, Pea, Pigeon pea, Soyabean, Chick pea

Timbers: Shisam, Sal, Teak, Deodar, Pine

Medicinal plants: Dhatura, Berginia, Hedychium, Poppy, Basil, Barberry

Beverages: Tea, Coffee

Oils: Mustard, Seseame, Coconut, Linseed, Groundnut, Castor, Laung, Sandal wood, Mentha

Spices: Coriander, Cardmum, Curcuma, Cinamom, Laung, Cumin, Thyme, Nigella, Cinamom leaf

Fibers: Jute, Coconut, Hemp, Urtica, Cotton

Sugars and starch yielding plants: Sugarcane, Potato, Beet rootFruits and vegetables cultivated in the area.

Gums and Resins.

4 Hybridization techniques - Emasculation, Bagging (For demonstration only).

Induction of polyploidy in plants (For demonstration only).

Suggested readings

- Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
- Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
- Pandey, B.P. (1999). Economic Botany. S. Chand, New Delhi.

BINOD BIHARI MAHTO KOYLANCHAL UNIVERSITY DHANBAD

Plant Physiology and Biochemistry (BOT601T) **Credit: 4**

1 Plant-water relations: Importance of water, water potential and its components; transpiration and its significance; factors affecting transpiration; root pressure andguttation.

Mineral nutrition: Essential elements, macro and micronutrients; criteria of essentiality of elements; role of essential elements; transport of ions across cell membrane, active and passive transport, carriers, channels and pumps

2 Photosynthesis: (photosynthetic Pigments (Chl a, b, xanthophylls, carotene); hotosystem I and II, electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; photorespiration).

Respiration (glycolysis, anaerobic respiration, TCA cycle; oxidative phosphorylation, glyoxylate cycle).

3 Nitrogen metabolism: Biological nitrogen fixation; nitrate and ammonia assimilation.

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

4 Biochemistry: General introduction to carbohydrates, lipids and proteins. Enzymes (structure and properties; mechanism of enzyme catalysis and enzyme inhibition, factors affecting enzyme action).

Suggested readings

 Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th
Edition.

 Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley and
Sons, U.S.A. 4th Edition.

 Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.

Ecology and Biostatistics (Course code: BOT602T) Credit: 4

1 Ecological factors: Soil (Origin, formation, composition, soil profile) Plant adaptation in relation to water (Hydrophytes and xerophytes), light (Sciophytes and heliophytes) and temperature

Pollution: Water, Soil and Radioactive.

2 Ecosystem: Types, structure, energy flow, trophic organization, food chains and food webs, ecological pyramids.

Biogeochemical cycles: Cycling of carbon, nitrogen and phosphorous.

Population: Characteristics, Growth curves, Ecotypes and Ecads

Plant communities: Characteristics, plant succession, Biological spectrum Biodiversity conservation

3 Biostatistics: Definition and scope of statistics, sampling techniques, representation of data: tabular, graphical etc

Measures of central tendency: Arithmetic mean, mode, median.

4 Measures of dispersion: range, mean deviation, variation, standard deviation;Chi-square test for goodness of fit

Regression analysis

Suggested reading

- Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
- Shukla, R.S. and Chandel P.S. (2005). A text book of Plant Ecology. S. Chandand Company Ltd., Ram Nagar, New Delhi.
- Rastogi, V.B. (2015). Biostatistics. Medtech, 3rd Edition.
- Banerjee, P.K. (2006). Introduction to Biostatistics. S. Chand and CompanyLtd., Ram Nagar, New Delhi.
- Singh, J.S. Singh S.P. and Gupta, S.R. (2014). Ecology, Environment and Resource Conservation. S. Chand and Compony Pvt. Ltd., New Delhi.

Practical/lab Course (Course code: BOT603P) Credit: 2

1 Demonstration of process of diffusion, osmosis and plasmolysis

Demonstration of transpiration in dorsivental leaf by four leaf and cobalt chloride method.

Determination of rate of transpiration by Ganong's/Farm photometer

Demonstration of the effect of light intensity and bicarbonate concentration on O2 evolution in photosynthesis by Wilmott' s bubblar

Determination of R.Q of different respiratory substrates by Ganong's respirometer

Demonstration of anaerobic respiration in germinating seeds.

2 Test of carbohydrates, proteins and fats.

3 Observation and study of different ecosystems mentioned in the syllabus.

Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, rain gauge and lux meter.

Determination of pH, and analysis of soil samples for soil moisture, organic carbon, nitrogen and phosphorus.

Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.

Study of ecological adaptations in hydrophytes and xerophytes.

Study of biotic interactions of: stem parasite (Cuscuta), root parasite (orobanche), epiphytes, predation (insectivorous plants) through specimen or diagrams.

Determination of minimum quadrat size for the study of herbaceous vegetation byspecies area curve method (species to be listed).

Quantitative analysis of herbaceous vegetation in the college campus for frequency, density, abundance and A/F ratio.

Population structure study of dominant tree species of the locality.

4 Analysis of statistical data: mean, median and mode by analyzing the given data of individual, discrete and continuous series, standard error and deviation

Numerical based on correlation coefficient

Numerical based on chi square value

Representation of data by making graphs and diagrams etc.

Comment upon given graphs, diagrams etc.

Suggested readings

- Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.
- Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.