

**KOLHAN UNIVERSITY – CHAIBASA
JHARKHAND**



**UNDER GRADUATE PROGRAMME
CHOICE BASED CREDIT SYSTEM (CBCS)
(Session 2017- 2020)**

SYLLABUS

(According Re- Revised Regulation of CBCS)

B. Sc. BOTANY HONOURS

B. Sc. BOTANY Honours (Semester I)

Course	Name of Paper	No. of credits	Full Marks	End Semester Exam	
				Full Marks	Pass Marks
CC- 1 Theory	Microbiology, Fungi, Plant Pathology	4	70	70	28
CC - 2 Theory	Algae & Bryophytes	4	70	70	28
CC (P) - 1 Practical	Practical based on CC 1 & CC 2	4	60	60	24
GE – 1 Theory	Biodiversity (Microbiology, Algae, Fungi & Archegoniate)	4	70	70	28
GE (P) – 1 Practical	Practical based on GE (P) - 1	2	30	30	12
AECC1 Compulsory	<u>MIL Communication</u>	2	50	50	20
	<u>Total Credits</u>	20	350	350	

B. Sc. BOTANY Honours (Semester II)

Course	Name of Paper	No. of credits	Full Marks	End Semester Exam	
				Full Marks	Pass Marks
CC - 3 Theory	Pteridophyte & Gymnosperm	4	70	70	28
CC - 4 Theory	Taxonomy	4	70	70	28
CC (P) - 2 Practical	Practical based on CC – 3 & CC - 4	4	60	60	24
G E - 2	Angiosperm & Plant Ecology	4	70	70	28
GE (P) - 2	Practical based on GE (P) - 1	2	30	30	12
AECC2 Compulsory	<u>Environmental Science</u>	2	50	50	20
	<u>Total Credits</u>	20	350	350	

CC Core Course (Botany)

GE General Elective

AECC Ability Enhancement Compulsory Course

B. Sc. BOTANY Honours (Semester III)

Course	Name of Paper	No. of credits	Full Marks	End Semester Exam	
				Full Marks	Pass Marks
CC5 Theory	Anatomy & Embryology	4	70	70	28
CC6 Theory	Economic Botany & Ethnobotany	4	70	70	28
CC7 Theory	Plant Physiology	4	70	70	28
CC (P) - 3 Practical	Practical based on CC- 5, CC -6, CC -7	6	90	50	20
Generic Elective -3	Anatomy, Embryology Economic Botany	4	70	70	28
GE (P) - 3	Practical based GE - 3	2	30	30	12
SEC 1	<u>Current Affairs</u>	2	50	50	20
	<u>Total Credits</u>	26	450	450	

B. Sc. BOTANY Honours (Semester IV)

Course	Name of Paper	No. of credits	Full Marks	End Semester Exam	
				Full Marks	Pass Marks
CC8 Theory	Plant Metabolism	4	70	70	28
CC9 Theory	Plant Biochemistry	4	70	70	28
CC10 Theory	Plant Biotechnology	4	70	70	28
CC10 Practical	Practical based on CC 8, CC 9 & CC 10	6	90	90	36
Generic Elective - 4	Plant physiology, Biochemistry & Biotechnology	4	70	70	28
GE (P) - 4	Practical based GE - 4	2	30	30	12
SEC2	<u>Personality Development</u>	2	50	50	20
	<u>Total Credits</u>	26	450	450	

CC Core Course (Botany)

GE General Elective

SEC Skill Enhancement Course

B. Sc. BOTANY Honours (Semester V)

Course	Name of Paper	No. of credits	Full Marks	End Semester Exam	
				Full Marks	Pass Marks
CC11Theory	Cytogenetics & Plant Breeding	4	70	70	28
CC12 Theory	Cell &Molecular Biology	4	70	70	28
CC (P) - 5	Practical based on CC12	4	60	60	24
DSE - 1 Theory	Cell & Molecular Biology	4	70	70	28
DSE - 2 Theory	Economic Botany & Biotechnology	4	70	70	28
DSE (P) - 1	Practical based on DSE – I & 2	4	60	60	24
	<u>Total Credits</u>	24	400	400	

B. Sc. BOTANY Honours (Semester VI)

Course	Name of Paper	No. of credits	Full Marks	End Semester Exam	
				Full Marks	Pass Marks
CC13 Theory	Ecology	4	70	70	28
CC14 Theory	Environmental Biology	4	70	70	28
CC (P) - 6	Practical based on CC14	4	60	60	24
DSE - 3 Theory	Genetics & Plant Breeding	4	70	70	28
DSE (P) - 2 Practical	Practical based on DSE-3	2	30	30	12
DSE - 4	Project	6	100	100	40
	<u>Total Credits</u>	24	400	400	

CC Core Course (Botany)

DSE Discipline Specific Elective

PART I

SEMESTER I

Core Course 1: Botany Paper I (Microbes, Fungi & Plant Pathology)

Full Marks: 70

Credits: 4

Time: 03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

MICROBIOLOGY

1. Classification of Kingdoms and their criteria (Whittaker 1969)
2. Virus- Discovery, General structure, replication, DNA virus (T-phage); Lytic and lysogenic Cycle, RNA virus and (TMV); Economic importance
3. Bacteria – Discovery, Modern concept about bacterial cell structure; Reproduction- Vegetative, asexual and recombination (conjugation, transformation and Transduction); Economic importance
4. Role of microbes in nitrogen fixation; organic matter decomposition
5. Industrial importance of micro organisms
6. General account of Mycoplasma and diseases caused by them.

FUNGI

1. Introduction – General characters, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and Classification;
2. True fungi – General characteristic, ecology and significance;
Life cycle of *Rhizopus*, *Peziza*, *Puccinia* & *Cercospora*
3. Economic Importance of fungi
4. General account of Lichens, classification & economic importance

5. General account , reproduction and significance; Mycorrhiza: ectomycorrhiza & Endomycorrhiza and their significance

PLANT PATHOLOGY

1. Important Plant diseases of Jharkhand; Etiology, symptoms and control of the following diseases:
 - I. Late blight of potato
 - II. Loose smut of wheat
 - III. Rust of linseed
 - IV. Red rot of sugar cane
 - V. Wilt of tomato
 - VI. Citrus canker (*Xanthomonas campestris* pv. *citri*)
 - VII. Bacterial blight of paddy (*Xanthomonas campestris* pv. *oryzae*)
 - VIII. Tundu disease of wheat
 - IX. Little leaf of brinjal
 - X. Tobacco mosaic virus
2. Pathogen attack and defense mechanisms: physical, physiological, biochemical and molecular aspects
3. Plant disease management: chemical, biological, development of transgenics, biopesticides

Core Course 2: Botany Paper II (Theory)
(Algae and Bryophytes)

Full Marks: 70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

ALGAE

1. General characteristics; Ecology & distribution; Classification of Algae:
2. Range of Thallus organization and Reproduction
3. Structure, Life history, and affinities of the following general
Nostoc, Volvox, Oedogonium, Chara, Vaucheria, Polysiphonia and Batrachospermum
4. Economic Importance of Algae

BRYOPHYTES

1. General Characteristics, adaptation to land habit, Classification,
2. Structure, life history & affinities of the genera mentioned below
Marchantia, Anthoceros, Sphagnum & Funaria
3. Sterilization of sporogenous tissues in Bryophytes
4. Vegetative reproduction in Bryophytes
5. Economic importance of bryophytes with mention of Sphagnum –

Botany Practical (Semester – I)
(Based on CC1 & CC2)
CC (P) - 1

Full Marks: 60

Credits: 4

Time: 6 Hrs

1. Gram staining of bacteria (5)
2. Study the symptom and identify two Plant disease (Alternate material to be provided)
(10)
3. Morphological and structural details of the forms belonging to Algae, Fungi & Bryophytes by preparing temporary stained microscopic slide preparation & studies
(3x15=45)
4. Comment upon the Spots (1- 5): 2x5 = 10
5. Field Study Report: 10
6. Viva Voce: 10
7. Class record, Herbarium, Chart, Model etc: 10

Suggested Readings

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Parihar, N.S. (1991). An introduction to Embryophyta Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.

SEMESTER II

Core Course 3: Botany Paper III (Theory) (Pteridophytes and Gymnosperm)

Full Marks: 70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

PTERIDOPHYTES

1. General Characteristics & classification of Pteridophytes
2. Morphology, anatomy and reproduction of following genera: *Lycopodium*, *Selaginella*, *Equisetum*, *Pteris*
3. Heterospory and seed habit,
4. Steler evolution
5. Ecological & economic importance of Pteridophytes
6. Fossil Pteridophytes – *Rhynia* & *Calamites*

GYMNOSPERM

Morphology, anatomy and reproduction of following genera:
Pinus, *Taxus*, *Ginkgo* & *Gnetum*

1. Paleobotany:
 - a. A brief idea about geological area
 - b. Definition of Fossil, process and conditions
 - c. Detailed study of *Lyginopetris* and *Cycadeoidea*
 - d. A brief idea about the Plant Fossils of Rajmahal area

Core Course 4: Botany Paper IV (Theory)
(Taxonomy)

Full Marks: 70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

TAXONOMY

1. Classification of plants as proposed by Benthem & Hooker and Hutchinson
2. Idea about important rules of plant nomenclature with special reference to ICBN
3. Diagnostic features and economic importance of following families:
Ranunculaceae, Asclepiadaceae, Apocynaceae, Catharanthaceae, Euphorbiaceae,
, Liliaceae, Orchidaceae, Cyperaceae & Poaceae
4. Brief Knowledge of Numerical Taxonomy, Categories and taxonomic group
5. Modern trends in plant taxonomy – Taxonomy in relation to Anatomy,
Embryology, Palynology & Cytology

Botany Practical (Semester – II)
(Based on CC3 & CC4)
CC (P) - 2

Full Marks: 60

Credits: 4

Time: 6 Hrs

1. Morphological and structural details of the forms belonging Peridophytes & Gymnosperm by temporary stained microscopic slide preparation & studies (2x10=20)
2. Description & Identification of the family of the given Angiospermic material in semi-technical words (Floral characters, V. S. of flower, section of ovary, Floral Diagram and floral formula and systematic position according to Bentham & Hooker's system of classification) (25)
3. Identification of medicinal / economically important plant and its uses. (3x5 =15)
4. Comment upon the Spots (1- 5): 2x5 = 10
5. Field Study Report: 10
6. Viva Voce: 10
7. Class record, Herbarium, Chart, Model etc: 10

Suggested Readings

1. Simpson, M.G. (2006). *Plant Systematics*. Elsevier Academic Press, San Diego, CA, U.S.A.
2. Singh, G. (2012). *Plant Systematics: Theory and Practice*. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
3. Bhatnagar, S.P. and Moitra, A. (1996). *Gymnosperms*. New Age International (P) Ltd Publishers, New Delhi, India.
4. Parihar, N.S. (1991). *An introduction to Embryophyta*. Vol. I. Bryophyta. Central Book Depot, Allahabad.

PART II

SEMESTER III

Core Course 5: Botany Paper V (Theory) (Anatomy and Embryology)

Full Marks: 70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

ANATOMY

1. Meristem and permanent tissue
Root and short meristem, simple and complex tissue
2. Mechanical Tissues – Structure, distribution and function
3. Normal secondary growth and anomalous secondary growth: *Nyctanthus, Boerhavia, & Dracaena*
4. Organisation of tissue in relation to environment (Ecological anatomy)
5. Periderm – origin, structure & function

EMBRYOLOGY

1. Microsporogenesis
2. Male Gametophyte
3. Macrosporogenesis
4. Female Gametophyte (Types of Embryo sacs)
5. Fertilization
6. Endosperm – Types, structure & function
7. Embryo development – Dicot & monocot
8. Apomixis & Polyembryony – Definition, types and applications

Core Course 6: Botany Paper VI (Theory)
(Economic Botany & Ethnobotany)

Full Marks:70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

ECONOMIC BOTANY

1. Concept of origin & their importance with reference to Vavilov's work
2. Cereals – origin, morphology & uses (rice, maize & wheat)
3. Legumes – general account with special reference to gram and Soyabean.
4. Beverages – tea (morphology, processing & uses)
5. Oil & fats – general description with special reference to ground salt.
6. Fiber yielding plant – general description with special reference to cotton (botanical name, family, part of uses, morphology & uses)
7. Spices – general description with special reference to clove & black pepper (botanical name, family, part of uses, morphology & uses)

ETHNOBOTANY

1. Medico-ethnobotanical sources in India;
2. Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadiractha indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*.
3. Role of ethnobotany in modern medicine with special example *Rauwolfia serpentina*, *Trichopus zeylanicus*, *Artemisia*, *Withania*.
4. Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management)

Core Course 7: Botany Paper VII (Theory)
(Plant Physiology)

Full Marks:70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

PLANT PHYSIOLOGY

1. Plant-water relations: diffusion and osmosis,
2. Water potential and chemical potential,
3. Absorption or water,
4. Ascent of sap,
5. Transpiration,
6. Mechanism of stomatal movement
7. Mineral nutrition: nutrient uptake and transport mechanisms. role of carriers.
8. Transport of organic substances, path of translocation, mechanism of translocation

Botany Practical (Semester – III)

(Based on CC-5, CC- 6 & CC-7)

Full Marks: 90

Credits: 6

Time: 6 Hrs

1. Internal anatomy of primary and secondary tissues (Both normal and abnormal) of Angiospermic plant (20)
2. Dissection of embryo from a developing seed . (20)
3. Identification of medicinal / Ethnobotanically important plant and its uses. (10)
4. Perform Physiological experiment given to you by lot (30)
5. Comment upon the Spots (1- 5): $2 \times 5 = 20$
6. Field Study Report: 15
7. Viva Voce: 15
8. Class record, Herbarium, Chart, Model etc: 20

Suggested Readings

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
2. Hopkins, W.G Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
4. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
5. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.

SEMESTER IV

Core Course 8: Botany Paper VIII (Theory) **(Plant Metabolism)**

Full Marks: 70

Credits: 4

Time: 03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

PLANT METABOLISM

1. Photosynthesis; photosynthetic apparatus, pigments, photochemical reactions, electron transport pathways in chloroplast membranes, photophosphorylation. Calvin Cycle,
2. Crassulacean Acid Metabolism,
3. Hatch & Slack pathway,
4. Photorespiration
5. Respiration: Glycolysis, TCA Cycle and its regulation, electron transport in Mitochondria, oxidative phosphorylation,
6. Pentose Phosphate Pathway
7. Biological Nitrogen Fixation, Reduction Of N_2 Into NH_3
8. Phytohormones: General account, discovery, structure and mechanism of action, and roles of Auxins, Cytokinins, Gibberellins, Abscissic acid and Ethylene.
9. Physiology of flowering, photoperiodism, vernalization, role of pigments and hormones.
10. Physiology of tropic and nastic movements of plants.

Core Course 9: Botany Paper IX (Theory)
(Plant Biochemistry)

Full Marks: 70

Credits: 4

Time: 03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

PLANT BIOCHEMISTRY

1. Plant case organelles & their roles: Mitochondria, chloroplast, Peroxisomes, Glyoxysomes Ribosome & nucleus
2. Cell wall, cell membrane & their biochemical properties
3. Amino acids and peptides, types of amino acid structure of protein
4. Protein synthesis
5. Enzymes - Nature, properties, types, classification, mechanism of action and factors enzyme activities

Core Course: Botany Paper X (Theory)
(Plant Biotechnology)

Full Marks: 70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

BIOTECHNOLOGY

1. Basic aspect of plant tissue culture, micro-propagation of embryo culture, pollen culture, and their applications.
2. Tools and techniques of recombinant DNA technology and their application with special reference to agricultural science.
3. Protoplast culture & somatic hybridization
4. Blotting techniques: northern, southern & western blotting, DNA fingerprinting, Molecular DNA markers, PCR & reverse transcriptase, ELISA.
5. Morphogenesis, photomorphogenesis, phytochrome
6. Role of plant tissue culture in growth, development and differentiation, totipotency organogenesis, embryogenesis
7. Protoplast culture and somatic hybridization
8. Micropropagation
9. Genetic engineering in plants and future of plant biotechnology

Botany Practical (Semester – IV)

(Based on CC8, CC9 & CC10)

Full Marks: 90

Credits: 6

Time: 6 Hrs

1. Perform Biochemical test for Carbohydrate, Proteins and lipids from Given material (20)
2. Separation of pigments by paper chromatography (30)
3. Perform Physiological experiment related Photosynthesis given to you by lot (30)
4. Comment upon the Spots (1- 5): $2 \times 5 = 20$
5. Field Study Report: 15
6. Viva Voce: 15
7. Class record, Herbarium, Chart, Model etc: 20

Suggested Reading

1. Fundamentals of plant physiology, V.K. Jain, S. Chand & Co.
2. A Textbook of plant Physiology, Biochemistry and Biotechnology, S. K. Verma & Mohit Verma, S. Chand & Co.
3. Plant Physiology, Taiz & Zeiger, Sinauer Associates.

PART III

SEMESTER V

Course: Botany Paper XI (Theory)
(Cytogenetics & Plant Breeding)

Full Marks: 70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

CYTOGENETICS & PLANT BREEDING

1. Cell division, it's regulation and significance: Mitosis and Meiosis
2. Morphology of Chromosomes including lampbrush chromosomes, B-chromosome and polytene chromosomes
3. Mendel's experiments and principles of inheritance: back cross and test cross; gene interactions and modified dihybrid ratio-complementary, supplementary, duplicate and epistatic factor
4. Quantitative genetics: quantitative traits and quantitative genetics; the multiple factor hypothesis; descriptive statistics.
5. Linkage and recombination: coupling and repulsion phases; two and three point test crosses with their significance in chromosome mapping; interference and coefficient of coincidence
6. Cytoplasmic inheritance shell coiling in snails, kappa particles in *Paramecium*, mitochondria in yeast and plastids in *Mirabilis jalapa*
7. Sex determination and sex-linked inheritance
8. Genetic code
9. Methods of plant breeding
10. Role of plant breeding in crop improvement

Core Course 12: Botany Paper XII (Theory)
(Cell and Molecular Biology)

Full Marks:70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

CELL & MOLECULAR BIOLOGY

1. Nucleic acids: compositions of nucleic acids and synthesis of nucleotides;
2. DNA structure; A, B, Z forms of DNA; denaturation and renaturation of DNA; Chromatin structure; DNA replication and recombination, DNA polymerases; different forms of RNA and their role
3. Gene structure, expression and regulation: gene organization in prokaryotes and eukaryotes; inducible, repressible, positive and negative gene regulation;
4. Interrupted genes in eukaryotes; RNA splicing; messenger RNA stability
5. Recombinant DNA technology: restriction endonucleases; prokaryotic and eukaryotic cloning vectors; genomic and cDNA libraries; Southern and northern analysis; various techniques of gene mapping and DNA fingerprinting (RFLP, RAPD, AFLP); chromosome walking; polymerase chain reaction; DNA Sequencing
6. Genetic Engineering: vectors for gene delivery; selectable markers and reporter genes; method of gene delivery;
7. Agrobacterium – the natural genetic engineer; salient achievements in crop biotechnology (with suitable examples) and prospects.

Botany Practical (Semester – V)
(Based on CC11 & CC12)

Full Marks: 60

Credits: 4

Time: 6 Hrs

1. Temporary slide of Mitosis or meiosis is to prepared and at least two stages to be shown (10)
2. Experiment on interaction of Gene & chi Square test (15)
3. Comment upon the Spots (1- 5): $2 \times 5 = 10$
4. Field Study Report: 05
5. Viva Voce: 10
6. Class record, Herbarium, Chart, Model etc: 10

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 Cummings Publishing, San Francisco

DSE1

Cell and Molecular Biology

Full Marks: 70

Credits: 4

Time:03 Hours

In all nine question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

Techniques in Biology: Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis.

Cell as a unit of Life: The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components.

Cell Organelles: Mitochondria: Structure, marker enzymes, composition; Semiautonomous nature; Symbiont hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA.

Chloroplast Structure, marker enzymes, composition; semiautonomous nature, chloroplast DNA.

ER, Golgi body & Lysosomes: Structures and roles.

Peroxisomes and Glyoxisomes:D Structures, composition, functions in animals and plants and biogenesis.

Nucleus: Nuclear Envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure (brief).

Cell Membrane and Cell Wall: The functions of membranes; Models of membrane structure;

The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of the membranes; Selective permeability of the membranes; Cell wall.

Cell Cycle: Overview of Cell cycle, Mitosis and Meiosis; Molecular controls.

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 and eukaryotes): bidirectional replication, semi-conservative, semi discontinuous RNA priming, θ (theta) mode of replication, replication of linear, ds- DNA, replicating the 5 end of linear chromosome including replication enzymes.

Transcription (Prokaryotes and Eukaryotes): Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; Translation (Prokaryotes and eukaryotes), genetic code.

Regulation of gene expression: Prokaryotes: Lac operon and Tryptophan operon; and in Eukaryotes.

Practical

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.
2. Study of the photomicrographs of cell organelles
3. To study the structure of plant cell through temporary mounts.
4. To study the structure of animal cells by temporary mounts-squamous epithelial cell and nerve cell.
5. Preparation of temporary mounts of striated muscle fiber
6. To prepare temporary stained preparation of mitochondria from striated muscle cells /cheek epithelial cells using vital stain Janus green.
7. Study of mitosis and meiosis (temporary mounts and permanent slides).
8. Study the effect of temperature, organic solvent on semi permeable membrane.
9. Demonstration of dialysis of starch and simple sugar.

10. Study of plasmolysis and deplasmolysis on *Rhoeo* leaf.
11. Measure the cell size (either length or breadth/diameter) by micrometry.
12. Study the structure of nuclear pore complex by photograph (from Gerald Karp) Study of special chromosomes (polytene & lampbrush) either by slides or photographs.
13. Study DNA packaging by micrographs.
14. 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 Cummings Publishing, San Francisco.

DSE2

Economic Botany and Biotechnology

Full Marks:70

Credits: 4

Time:03 Hours

In all nine question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

Origin of Cultivated Plants: Concept of centres of origin, their importance with reference to Vavilov's work

Cereals: Wheat -Origin, morphology, uses

Legumes: General account with special reference to Gram and soybean

Spices: General account with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses)

Beverages: Tea (morphology, processing, uses)

Oils and Fats: General description with special reference to groundnut

Fibre Yielding Plants: General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Introduction to biotechnology

Plant tissue culture: Micropropagation ; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications

Recombinant DNA Techniques: Blotting techniques: Northern, Southern and Western Blotting,

DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection. Molecular diagnosis of human disease, Human gene Therapy.

Practical

1. Study of economically important plants : Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and microchemical tests
2. Familiarization with basic equipments in tissue culture.
3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.
4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.

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.

SEMESTER VI

Course: Botany Paper XIII (Theory)
(Ecology)

Full Marks:70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

PLANT ECOLOGY

1. Autecology and synecology,
2. Biological spectrum
3. Ecological factors: climatic, edaphic, topographical and biotic factors
4. Population ecology: Characteristics and acquaintance with population models
5. Community structure, types of ecosystems (grassland, aquatic, forest and ecological pyramids)
6. Community dynamics: Succession, Xerosere, Hydrosere,
7. Concept of climax community
8. Flow of energy and biogeochemical cycles
9. Ecological adaptation: Hydrophytes, Xerophytes, Halophytes

Course: Botany Paper XIV (Theory)
(Environmental Biology)

Full Marks:70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

ENVIRONMENTAL BIOLOGY

1. Soil: types, formation, physiochemical nature, water holding capacity, soil profile and soil erosion and conservation
2. Non-conventional source of energy
3. Biodiversity and it's conservation
4. MAB programme,
5. Resource ecology,
6. Plant indicators
7. Environmental pollution: Air pollution, water pollution, sound pollution, nuclear pollution and their control measures.
8. Major vegetational belts of India
9. Environmental management: Soil, water and air
10. Bioindicators

Botany Practical (Semester – VI)

(Based on CC13 & CC14)

Full Marks: 60

Credits: 4

Time: 6 Hrs

1. Quantitative analysis of herbaceous vegetation of the college campus for frequency and comparison with Raunkiaer's frequency distribution law (15)
2. Ecological anatomy of the given material (10)
3. Comment upon the Spots (1- 5): $2 \times 5 = 10$
4. Field Study Report: 05
5. Viva Voce: 10
6. Class record, Herbarium, Chart, Model etc: 10

Suggested Readings

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.

DSE3

Genetics and Plant Breeding

Full Marks:70

Credits: 4

Time:03 Hours

In all **nine** question of equal value will be set, out of which a student shall have to answer five questions. Q1 will be compulsory, consisting of 10 questions of one marks each. Any four questions shall have to be answered by the examinees out of the remaining eight questions carrying 15 marks each.

Heredity:

1. Brief life history of Mendel
2. Terminologies
3. Laws of Inheritance
4. Modified Mendelian Ratios: 2:1- lethal Genes; 1:2:1- Co- dominance, incomplete dominance; D9:7; 9:4:3; 13:3; 12:3:1.
5. Chi Square
6. Pedigree Analysis
7. Cytoplasmic Inheritance: Shell Coiling in Snail, Kappa particles in Paramecium, leaf variegation in *Mirabilis jalapa*, Male sterility.
8. Multiple allelism
9. Pleiotropism
10. Chromosome theory of Inheritance.

Sex-determination and Sex-linked Inheritance:

Linkage and Crossing over: Linkage: concept & history, complete & incomplete linkage, bridges experiment, coupling & repulsion, recombination frequency, linkage maps based on two and three factor crosses. Crossing over: concept and significance, cytological proof of crossing over.

Mutations and Chromosomal Aberrations: Types of mutations, effects of physical & chemical mutagens. Numerical chromosomal changes: Euploidy, Polyploidy and Aneuploidy ; Structural chromosomal changes: Deletions, Duplications, Inversions & Translocations.

Plant Breeding: Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding.

Methods of crop improvement: Introduction: Centres of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants - Procedure, advantages and limitations.

Quantitative Inheritance: Concept, mechanism, examples. Monogenic vs polygenic Inheritance.

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.

Practical

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Chromosome mapping using point test cross data.
3. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
4. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
5. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes through photographs.
6. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion

Bridge.

7. Hybridization techniques - Emasculation, Bagging (For demonstration only).
8. Induction of polyploidy conditions in plants (For demonstration only).

Suggested Readings

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley - India.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5 edition.
3. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
5. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
6. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
7. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford - IBH. 2nd edition.
8. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing

DSE4
PROJECT
(To Be Assigned)