**POST GRADUATE PROGRAMME**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

**(With effect from 2020………….)**

**SYLLABUS**

 **M. Sc. BOTANY**

**KOLHAN UNIVERSITY – CHAIBASA**

**JHARKHAND**

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**Kolhan University, Chaibasa**

 **[A] PROGRAMME OUTCOMES FOR M.Sc. BOTANY**

 A plant science is now an amalgamation of basic and applied science. Plants besides being the unique capability of plants to trap solar energy and provide food to all cannot be replicated by any system. A conventional study like plant identification is now being supplemented with molecular techniques like DNA Barcoding. The courses have been designed to benefit all Botany students to study various aspects of plant science including its practical applications. Keeping in mind that these students can take up teaching at different levels, research work in research institutes and or industry, doctoral work, environment impact assessment, biodiversity studies, entrepreneurship, scientific writing relevant topics have been included in the curriculum.

 Understanding the classification of plants from cryptogams to Spermatophyte. Identification of the flora in field. Study of biodiversity in relation to habitat correlate with climate change, land and forest degradation. Application of Botany in agriculture through study of plant pathology. Paleobotany to trace the evolution of plants.

 Understand the ultrastructure and function of cell membranes, cell communications, signaling, genetics, anatomy, taxonomy, ecology and plant Physiology and biochemistry. To understand the multi functionality of plant cells in production of fine chemicals. There wide spread industrial applications.

 Molecular and Physiological adaptations in plants in response to biotic and abiotic stress. Genes responsible for stress tolerance genetic engineering of plants.

 Students would be benefited with knowledge of core subjects like plant diversity, physiology and biochemistry, molecular Cytogenetics and application of statistics etc. which are offered in these subjects Modules on analytical techniques, plant tissue culture and phytochemistry would make them obtain skills in doing research. All the courses in the Programme are carefully designed to equip the students for competitive exams like CSIR NET, SET, JET, SLET etc. and to write research proposals for grants like CSIR, DST etc.

 Maintain a high level of scientific excellence in botanical research with specific emphasis on the role of plants. Create, select and apply appropriate techniques, resources and modern technology in multidisciplinary way. Practice of subject with knowledge to design experiments, analyze and interpret data to reach to an effective conclusion. They would identify, formulate and analyze the complex problems with reaching a substantiated conclusion. Logical thinking with application of biological, physical and chemical sciences. Learning that develops analytical and integrative problem-solving approaches. Student should be aware of ethical issues and regulatory considerations while addressing society needs for growth with honesty.

 **[B] PROGRAMME SPECIFIC OUTCOMES (PSO) OF M.Sc. BOTANY:-**

 Plant science is now an amalgamation of basic and applied science. Plants besides being the unique capability of plants to trap solar energy and provide food to all cannot be replicated by any system. Conventional studies like plant identification are now being supplemented with molecular techniques like DNA Barcoding. The courses have been designed to benefit all Botany students to study various aspects of plant science including its practical applications. Keeping in mind that these students can take up teaching at different levels, research work in research institutes and or industry, doctoral work, environment impact assessment, biodiversity studies, entrepreneurship, scientific writing relevant topics have been included in the curriculum.

 **CYTOGENETICS & MOLECULAR GENETICS , PLANT GENETIC RESOURCES & CROP IMPROVEMENT**

1. On the completion of this course the student learns about the genes in evolution of species and gene environmental interaction.

2. Student learns the population genetics, genetic counseling. Karyotype: Analysis and evolution (Banding techniques, in-situ Hybridization, FISH, GISH, autoradiography), genome analysis etc.

 3. In addition to this he also learns about chromosomal aberrations like structural changes as Inversion: Cytology and genetic inversions, Role in evolution, uses and chromosomal translocations: Orientation of multiples uses of interchanges, Robertson Translocations, multiples translocations, and Pseudo-isochrosomes.

4. Students also learn about the numerical changes in chromosomes: Haploidy-production of haploids, importance in crop improvement, triploids and tetraploids, cytology and genetics, aneuploids-monosomics and trisomics.

5. Student understands about the classical method of genetic engineering in chromosome engineering and crop improvement & plant breeding.

6. Students learn about the inbreeding depression and Heterosis.

7. Students also learn about Genetic fine structure: - Cistron, Recon and Muton & Plasmids. Episomes etc.

8. Students learn about DNA damages & repair

9. Students also learn about Mendelian principles and human genetics.

 **MICROBIOLOGY & PLANT PATHOLOGY**

 **1**. This specialization subject is based on the study of plant pathogens and the concept of disease in plants. Importance of plant disease. Student gain the knowledge and become a plant pathologist after completing this course.

2. Student learns about the mechanism of attack by plant pathogens: Microbial enzyme, toxins and growth regulators.

3. Student understands the variability in plant pathogens: Types of variation; mechanism of variability and effect of environmental on development of infectious disease of plants: Epidemiology. Plant disease forecasting. Transmission of plant diseases caused by viral pathogens.

4. Students learn about the methods of study of infectious diseases of plants: isolation of pathogens and tests of pathogenicity.

 5. Student increase the knowledge of about the Principles and methods of plant disease control, Control through regulatory methods: Plant quarantine, cultural and biological methods of control, control through physical means, chemical method for plant disease control: Fungicides, chemotherapy and use of resistant varieties.

6. Students learn and also performs the dissertation about the study of importance, symptoms, causal organism, disease cycle and control management of following diseases of crop plants by fungi, bacteria, viruses, viroid, and nematodes.

7. Students also increase the knowledge about the various fungal diseases: Rots diseases with special reference to fruit and stem end rot of papaya, Damping off of seedlings of crop plants, Downy mildews of cucurbits, Rust of wheat and Barley, Powdery mildew of pea, Smuts and Bunts: covered smut of Barley; loose smut of wheat and Bunt of Rice, Wilt of sugarcane Leaf spots: leaf spot of turmeric; Leaf blight of wheat. Blast disease of rice and mango anthracnose, Galls and other abnormalities: stem gall of coriander, leaf curl of Peach

8. Students learn also some important bacterial diseases: Citrus canker and Tundu disease of wheat

9. Some viral diseases: Mosaics of tobacco, papaya, potato & Grassy shoot of sugarcane.

 **M. Sc. Botany (Semester Wise Distribution of Courses)**

**Part – I**

**Semester – I**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Name Of Paper** | **Credit** | **Hrs./ Week** | **Full Marks** | **ESUE\*** | **SIA \*(For Theory) /Viva - Voce (For Practical)** |
| CC-1(CC-101) | **MICROBIOLOGY, PHYCOLOGY & MYCOLOGY** | 4 | 5(L) +1(T) | 100 | 70 | 30 |
| CC-2(CC-102) | **BRYOPHYTES & PTERIDOPHYTES** | 4 | 5(L) +1(T) | 100 | 70 | 30 |
| CC-3(CC-103) | **GYMNOSPERM & PALEOBOTANY** | 4 | 5(L)+1(T) | 100 | 70 | 30 |
| CC-4(CC-104) | **TAXONOMY, BIOSTATISTICS & ECONOMIC BOTANY** | 4 | 5(L)+1(T) | 100 | 70 | 30 |
| CC(P)-5[CC(P)-105] | **Practical Based on CCBOT101,102,103 & CCBOT104** | 6 | 12 | 100 |  |  |

**Semester – II**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Name Of Paper** | **Credit** | **Hrs./ Week** | **Full Marks** | **ESUE\*** | **SIA \*(For Theory) /Viva - Voce (For Practical)** |
| CC-6(CC-201) | **DEVELOPMENTAL BIOLOGY(EMBRYOLOGY)** | 4 | 5(L) +1(T) | 100 | 70 | 30 |
| CC-7(CC-202) | **ANATOMY & PLANT RESOURCE UTILIZATION & ETHNOBOTANY** | 4 | 5(L) +1(T) | 100 | 70 | 30 |
| CC-8(CC-203) | **PLANT PHYSIOLOGY** | 4 | 5(L)+1(T) | 100 | 70 | 30 |
| CC-9(CC-204) | **BIOCHEMISTRY** | 4 | 5(L)+1(T) | 100 | 70 | 30 |
| CC(P)-10[CC(P)-205] | **Practical based on CCBOT206,207,208 &CCBOT209** | 6 | 12 | 100 |  |  |

**\*ESUE -** End Semester University Examination **Group A** Cytogenetics & Molecular Genetics

**\*SIA** - Sessional Internal Assessment **Group B** Microbiology & Plant Pathology

**SEMESTER-III**

**\*ESUE** - End Semester University Examination **Group A** Cytogenetics & Molecular Genetics

**\*SIA** - Sessional Internal Assessment **Group B** Microbiology & Plant Pathology

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Name Of Paper** | **Credit** | **Hrs./ Week** | **Full Marks** | **ESUE\*** | **SIA \*(For Theory) /Viva - Voce (For Practical)** |
| **CC-11****(CC-301)** | **Cytology & Molecular Biology** | 4 | 5(L) +1(T) | 100 | 70 | 30 |
| **CC-12****(CC-302)** | **Genetic Engineering & Biotechnology** | 4 | 5(L) +1(T) | 100 | 70 | 30 |
| **Discipline Specific Elective-1****(DSE-301)-“A”** | **Group A Cytogenetics & Molecular Genetics** | 4 | 5(L) +1(T) | 100 | 70 | 30 |
| **Discipline Specific Elective-2****(DSE(P)-302)-“A”** | **Group A Cytogenetics & Molecular Genetics** | 6 | 12 | 100 | 80 | 20 |
| **Discipline Specific Elective-1****(DSE-301)-“B”** | **Group B Microbiology** | 4 | 5(L)+1(T) | 100 | 70 | 30 |
| **Discipline Specific Elective-2****(DSE(P)-302)-“B”** | **Group B Practical based on Microbiology** | 6 | 12 | 100 |  |  |
| **PROJECT(PR)-1****[PR-301]** | **Based on Elective Group** | 6 | 12 | 100 |  |  |

 **SEMESTER-IV**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Name Of Paper** | **Credit** | **Hrs./ Week** | **Full Marks** | **ESUE\*** | **SIA \*(For Theory) /Viva - Voce (For Practical)** |
| CC13(CC-401) | **Environmental Biology**  | 4 | 5(L) +1(T) | 100 | 70 | 30 |
| CC14(CC-402) | **Evolution & biodiversity conservation** | 4 | 5(L)+1(T) | 100 | 70 | 30 |
| **Discipline Specific Elective-3****(DSE-401)-“A”** | **Group “A” Plant Genetic Resources & Crop improvement** | 4 | 5(L) +1(T) | 100 | 70 | 30 |
| **Discipline Specific Elective-4****(DSE(P)-402)-“A”**  | **Group “A” practical on Plant Genetic Resources & Crop improvement** | 6 | 12 | 100 | 80 | 20 |
| **Discipline Specific Elective-3****(DSE-401)-“B”** | **Group “B” Plant pathology** | 4 | 5(L) +1(T) | 100 | 70 | 30 |
| **Discipline Specific Elective-4****(DSE(P)-402)-“B”** | **Group “B”** **Practical on Plant pathology** | 6 | 12 | 100 |  |  |
| **PROJECT(PR)-2****[PR-401]** | **Based on Elective Group** | 6 | 12 | 100 |  |  |

Part I

**SEMESTER I**

**CC-1(CC-101)**

**( MICROBIOLOGY, PHYCOLOGY & MYCOLOGY )**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

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

**MICROBIOLOGY**

1. Cell **S**tructure and Reproduction in Bacteria.
2. TMV & Bacteriophage – Structure and is multiplication.
3. Methods of transmission of plant viruses.
4. General account of Mycoplasma and its role in causing plant disease

**PHYCOLOGY**

1. Salient features and classification of Algae (Fritsch, 1935)
2. Range of thallus
3. Structure, Reproduction and economic Importance of Algae in **Cyanophyta & Chlorophyta.**
4. General Concept of life cycles pattern in Algae.

**MYCOLOGY**

1. Salient features and classification of fungi(Alexopolus)
2. Reproduction in Fungi.
3. Heterothallism and Para sexuality.
4. Mycorrhiza & their significance
5. Economic importance of Fungi.

 6. Symptoms, etiology and disease management of following diseases:

 (a). Late blight of potato

 (b). Black rust of wheat

 (c). Early blight of Potato

 (d). Citrus canker

 (e). Leaf curl of Papaya

**Reference books**

 1. Fritsch, F.E. The structure and reproduction of algae volume 1 and 2

 2. Robin South, G and Alan Whittick: Introduction to Phycology

 3. Morris, I: An Introduction to Algae

 4. Bold, H.C. and Wynne, M.D.: Introduction to the Algae structure and reproduction

 5. H. D. Kumar: Introductory Phycology

 6. John Webster and Roland W.S. Weber - Introduction to Fungi

 7. Alexopoulos C.J., C.W. Mims and M. Blackwell – Introductory Mycology

8. Mehrotra R.S. and K.R. Aneja – An Introduction to Mycology

 9. Smith, J.E. - The Filamentous Fungi

10. Change. S.T. and P.G. Miles - Edible mushrooms and their cultivation

11. Mosses, B.V.A. - Mycorrhizae 8. Powel, C and D. J. Bagyaraj - V.A. Mycorhizae

12. Berry, R. - Industrial mycology (Vol. I)

13. Jeffrey C. Pommerville - Alcamo’s Fundamentals of Microbiology

 14. Arora D.R. and B. Arora - Text book of Microbiology

**CC-2(CC-102)**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

**BRYOPHYTES**

1. General feature and classification of Bryophytes (Smith, 1955 Parihar, 1965.)
2. Range of thallus structure in Bryophytes.
3. Distribution of photosynthetic tissues in Bryophytes.
4. Evolutionary trend of progressive sterilization of sporogenous tissues
5. Ecology and economic importance of Bryophytes with special mention of *Sphagnum*

**PTERIDOPHYTES**

1. Classification of Pteridophytes (Smith, 1955, Sporne,1975)
2. Heterospory and seed habit.
3. Stellar organization and Evolution of Stele in Pteridophytes.
4. Telome theory: its merits and demerits.

**Reference books**

1. Smith, G.M. Cryptogamic Botany. Vol. II

2. Parihar, N.S.: Bryophyta

3. Parihar, N.S.1976: Biology and Morphology of Pteridophytes

4. Sporne, K.R. Pteridophyta

5. Rashid: Introduction to Pteridophyta

 6. Cavers, F. Inter-relations of Bryophytes.

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**SEMESTER - I**

**CC-3(CC-103)**

**GYMNOSPERMS & PALEOBOTANY**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all eight 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

**GYMNOSPERM**

1. Outline Classification of Gymnosperm and their distribution in India
2. General account of Ginkgoales.
3. Economic importance and evolutionary trends of Gymnosperm.

 **PALAEOBOTANY**

 1. Basic principles of Paleobotany-conditions of fossilization, different types of

 Sedimentary rocks bearing fossils.

Fossil Gymnosperms – ***Lyginopteris, Glossopteris, Williamsonia, Pentoxylon***

1. Modes of fossilization-kinds of Fossils-Techniques involve in the study of plant

 Fossils, Paleobotanical nomenclature.

 4. Principles of stratigraphy--- Litho-stratigraphy and chrono-stratigraphy

**References**

 1. Chamberlain, C.J. Gymnosperms: Structure and evolution

 2. Sporne K. R: The Morphology of Gymnosperms.

 3. Vashistha, P.C. 1978: Gymnosperms.

 4. Foster & Gifford. Comparative Morphology of Vascular Plants

 5. Delevoryas, T.1963. Morphology and evolution of Fossil Plants

 6. Arnold C.W. introduction to Paleobotany

 7. Shukla & Mishra: Essentials of Paleobotany

 8. Steward, W.N. 1988: Paleobotany & Evolution of plants

 9. Sergey, Moyen: Fundamentalist of Paleobotany – 1098

 10. Taylor, T.N. 1981. Introduction to Fossils

**SEMESTER - I**

**CC-4(CC-104)**

**TAXONOMY, BIOSTATISTICS & ECONOMIC BOTANY**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all eight 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

1. **The Species Concept**

 Taxonomic hierarchy, Concept of Species, Genus and Family and other

 Categories, Principals used in assessing relationship. International Code of

 Botanical Nomenclature (ICBN).

**2. Recent trends in Taxonomy** with special reference to Numerical taxonomy,

Palyno- Taxonomy, Chemotaxonomy, Cyto-taxonomy & Molecular

 Taxonomy

 **3. Phytogeography**: Principal of bio-geographical zones, Endemism

 **4. Distinctive Taxonomic features and economic importance of following**

 **Families:**

 Apocynaceae, Asclepiadaceae, Acanthaceae, Verbenaceae, Lamiaceae,

 Euphorbiaceae, Rubiaceae, Liliaceae & Poaceae.

**BIOSTATISTICS**

* 1. **Biostatistics and its role in Biology**
	2. **Measurements of central tendency and dispersal of mean, median and mode**
	3. **Chi square test, contingency table & analysis of variance**

ECONOMIC BOTANY

 1. Role of plants in relation to human WELFARE (ECONOMIC IMPORTANCE):-

1. Importance of forestry, their utilization and commercial aspects.
2. Timber YIELDING PLANTS and Petro plants WITH SPECIAL REFERENCE TO JHARKHAND
3. Avenue trees & IT’S IMPORTANCE
4. Ornamental plants of India
5. beverages & ITS CULTIVATION
6. Tannins, resins, fruit & nuts yielding plants.
7. Medicinal plants and aromatic plants WITH SPECIAL REFERENCE TO JHARKHAND

2. IUCN (International Union For Conservation Of Nature & Natural Resources) AND IT’S APPLICATION

3. Ethnobotany & its ROLE in plant conservation.

**References:**

 1. Lawrence: Taxonomy of Vascular Plants

 2. Sivarajan, V.V. (Ed. Robson). Introduction to Principles of Plant Taxonomy

 3. Heywood, V.H. Plant Taxonomy

 4. Naik, V.N. Taxonomy of Angiosperms (1988)

 5. Stace, C.R. Plant Taxonomy and biosystematics (2nd Ed.)

 6. Hutchinson, J. The families of flowering plants (3rd Ed.),1973

 7. Cronquist, R. The Evolution and classification of flowering plants (1988)

 8. Cronquist 1981. An integerated system of classification of flowering plants

 9. Takhtajan, K. Outline of classification of flowering plants. Botanical Rev. (46:225-359),1980

 10. Flowering plants. Origin and Dispersal (Trans. By Jeffry), 1969

 11. Jones, S.B. & Luchsinger, A.E. Plant systematics, 1988

 12. Davis, P.H. & V.H. Heywood. Principles of Angiosperm Taxonomy

 13. Henry & Chandrabose. An aid to Interntional Code of Botanical Nomenclature

 14. Bennet. Plant Nomenclature

 15. Dunn, C. and B.S. Veritt. An introduction to Numerical Taxonomy

 16. R.Jain, S.K. & Rao, .R. A Handbook of Field and Herbarium Methods.

 17. Herborne, J.B. & B.L. Turner. Plant Chemosystematics

 18. International code of Botanical Nomenclature – 2000. (Int. Association of

 Plant Taxonomist Pub.) Utrecht.

 19. Takhtajan1997. Diversity and Classification of flowering plants. Columbia Univ.

 Press, New York.

 20. Nordenstam B., El/Gazalay and Kasas M. 2000. Plant Systematics for 21stCentury.

 Portland Press Ltd., London.

 21. Woodland DW 1991, Contemporary Plant systematics, Prentice Hall, New Jersy

 22. Pagano M, Gauvreau K (2007) Principles of Biostatistics. Thomson India Edition, New

 Delhi.

 23. Rosencrantz WA (2009) Introduction to Probability and Statistics for Science,

 Engineering and Finance. CRC Press, Boca Raton.

 24. S.K. Jain, Manual of Ethno botany, Scientific Publishers, Jodhpur, 1995

 25. S.K.Jain (ed). Glimpses of Indian ethno botany, Oxford and IBH, New delhi-1981

 26. S.K.Jain (ed.) 1989. Methods and approaches in ethno botany. Society of ethnobatanists, Lucknow,

 India

 28. S.K.Jain 1990. Contribution of Indian ethno botany, scientific publishers, Jodhpur

 29. Colton C.M.1997. Ethno botany- practices and application. John Wiley and sons- Chichester

**CC(P)-5 [CC(P)-105]**

 **Full Marks: 100 Credits: 5 Time: 06 Hours**

1. Stain the provided material and find out the types of microbe/s present. 10 OR

 Identify the given plant disease material and its causal organism through preparation of

 temporary slide.

1. Stain and identify at least two genera given in **algal mixture (A)** with diagrams and

diagnostic features through preparation of temporary slide. 10

 3. Identify the given material (**B-Bryophyte**) with temporary slide preparation. 10

 4. Write a monograph on given material (**C-Pteridophyte**) with suitable temporary

 Slide Preparations. 15

 OR

 Identify the given material (**D-Gymnosperm**) with suitable slide temporary

 preparation.

1. Compare and comment upon the floral characters of the **materials E & F** provided to

 you. Identify the families by giving suitable reasons. Give floral formula & floral

 Diagram also. 15

1. Identify and comments upon spots [Include Economic Botany also] (1-5). 10
2. Viva–voce. 20
3. Practical records/ herbarium /field report/ charts/models etc. 10

**SEMESTER II**

**CC-6 (CC-201)**

**DEVELOPMENTAL BIOLOGY (EMBRYOLOGY)**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

1. **Micro-sporogenesis and Micro-gametogenesis, Mega-sporogenesis and Mega- gametogenesis.**
2. **Palynology: Pollen morphology and texture of pollen wall, Germination of pollen grain and double fertilization.**
3. **Endosperm: types, Cytology and morphogenetic nature.**
4. **Apomixis: Definition, causes, experimental induction and practical value of Poly-embryony.**

**SUGGESTED READINGS**:

 1. Barrett SCH (2008) Major Evolutionary Transitions in Flowering Plant Reproduction.

 Univ. of Chicago Press.

 2. Faegri K & van der Pijl L (1979) The Principles of Pollination Ecology. Pergamon

 Press, Oxford. 291 pp.

 3. O’Neill SD & Roberts JA (2002) Plant Reproduction, Sheffield Academic Press.

4. Raghavan V (1997) Molecular Embryology of Flowering Plants, Cambridge Univ. Press.

5. Raghavan V (2000) Developmental Biology of Flowering Plants, Springer Verlag, New

 York.

6. Richards AJ (1986) Plant Breeding System, George Allen and Unwin, UK.

7. Scott RJ and Stead AD (2008) Molecular and Cellular Aspects of Plant Reproduction.

 Society for Experimental Biology, Seminar Series 55.

8. Shivanna KR and Johri BM (1985) The Angiosperm Pollen: Structure and Function.

 New Delhi, India: Wiley-Eastern.

10. Shivanna KR and Rangaswamy NS (1992) Pollen Biology: A Laboratory Manual,

 Springer Publication

11. P.K.K. Nair. Pollen Morphology of angiosperms.

12. P.K.K. Nair: Essentials of Palynology

13. Moor & Moor: Pollen analysis

14. R.B. Knox, Pollen allergy

 15.M.R. Suxena : Palynology

**CC-7 (CC-202)**

**ANATOMY & PLANT RESOURCE UTILIZATION & ETHNOBOTANY**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

PLANT ANATOMY

1. **Organization of shoot apical meristem (SAM) and root apical meristem(RAM)**
2. **Mechanical tissue and their distribution, cambium and their role in growth**
3. **Anomalous secondary growth with reference Dracaena stem, Tinospora root & Bignonia stem**
4. **Periderm: Formation, function and healing of wounds.**

 **PLANT RESOURCE UTILIZATION & ETHNOBOTANY**

**Unit- I**

**Plant Biodiversity: - Plant** Biodiversity: Concept, status in India, utilization and concerns.

**Sustainable development**: - Basic Concepts. Origin of agriculture.

World canters of primary diversity of domesticated plants: - Plant introductions and secondary centres.

**Unit-II**

 **Origin, Botany, Cultivation and uses of:-**

 (i) Food, forage and fodder crops,

 (ii) Ornamental plants, plants used in sericulture, as petro crops, in narcotics & Fiber yielding

 Plants of Jharkhand

 (iii) Medicinal and aromatic plants in Jharkhand

 (iv) Vegetables, fruits and oil yielding crops of Jharkhand

 (v) Important timber yielding plants and non-wood forest products (NWFPs) such as bamboos

 and rattans etc. in Jharkhand.

 (vi). Plants used as avenue trees for shade, pollution control and aesthetics.

**Unit-III**

 **Ethno botany**: History, development and scope of ethnobotanical study.

* Interdisciplinary approaches of Ethno botany & ethnic groups of India.
* Applied Ethnobotany: Role of Ethnobotany in national priorities, health care and development of cottage industries in India.

**REFERENCES**

 1. Fahn, A. Plant Anatomy (4th Ed.), 1990.

 2. Easu, K. Anatomy of Seed Plants.

 3. Easu, K. Plant Anatomy, 2nd Ed. Wiley N.Y. 1965.

 4. Cutter, E.G. Plant Anatomy, Part I and II Edward Arnold; London, 1971 and 1978

 5. Metcalf and Chalk. Anatomy of dicots (2nd Edition) (1983). Clarendon Press, Oxford.

 6. Metcalf (1982-87) Anatomy of Dicots Vol. I to III

 7. meureth, J.D. 1988. Plant Anatomy. The Benjamin/Cummings Pub1. Inc., Menlo Park

 California.

 8. Carliquist. S. (1988). Comparative wood anatomy, Springer – Berlag, Berlin.

 9. Jeffrey, E.C. The Anatomy of woody plants.

 10. Rao, K.R. & K.B.S. Juneja (1971) A Hand book for identification of fifty important

 Timbers of India.

 11. Pearspm & Brown – Commercial Timbers

 12. Lyndon R.F. 1990. Plant development – The cellular basis. Unnin. Hyman, London.

 13. Steeves T.A. & Sussex 1. M, 1989, Pattersacin plant development 92nd Edition)

 Cambridge UNIT y Press, Cambridge.

 14. P.K.K. Nair. Pollen Morphology of angiosperms.

 15. P.K.K. Nair: Essentials of Palynology

 16. Moor & Moor: Pollen analysis

 17. R.B. Knox, Pollen allergy

 18. M.R. Suxena: Palynology

 19. P Maheshwari. Embrylogy of Angiosperms

 20. Bhojwani and Bhatnagar. Embryology of Angiospems

 21. K Essau. Plant Anatomy

 22. Cutter. Plant Anatomy

 23. S N Pandy. Plant Anatomy

 24. S N Panday. Economic Botany

 25. V Verma. Economic Botany

 26. Bendre. Economic Botany

**SEMESTER II**

**CC-8 (CC-203)**

**PLANT PHYSIOLOGY**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

1. **Absorption of water, Ascent of sap, Transpiration: types, mechanism of transpiration, factors affecting transpiration, guttation.**
2. **Mineral nutrition of plants: deficiency symptoms and diseases. Micro and Macro-elements.**
3. **Photosynthesis: photophosphorylation, C3, C4, and CAM path way, photorespiration.**
4. **Respiration, glycolysis, fermentation, Krebs cycle**
5. **Nitrogen metabolism: amino acid metabolism**
6. **Protein synthesis in prokaryotes & eukaryotes.**
7. **Biological nitrogen fixation.**
8. **Stomatal movement and biological clocks**

**References**

1. Principles of Plant nutrition 4th Edition by Mengel K. and E.A. Kirby International Institute of Polesh Switzerland 1987.

2. Mineral nutrition of crop plants. H. Marshener academic Press 1986.

 3. Plant Physiology by F.B. Salisbury and C.W. Ross. Wordsworth Biology series.

4. Growth and differentiation in plants by Warering and Phillips, Pergamon press.

 5. Plants Cell structure and metabolism. J.L. Hall, Flower and Roberts, ELBS, Longman.

6. Advanced Plant Physiology by M.B. Wilkinson, ELBS, Longman

7. Introduction to Plant Physiology by G.R. Noggle and G.J. Fritz, Printice Hall Press

8. Cell Biology by C.B. Powar, Himalaya Publishing

9. Plant Physiology by R.N. Devlin and F.H. Witham, CBS 1986

10. Introduction to plant physiology W.G. Hopkins and Norman P.A. Huner

 11. Plant Physiology. Lincoln Taiz and Eduardo Zeiger

**CC-9(CC-204)**

 **BIOCHEMISTRY**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

 1. **Phytohormones: Role of Auxin, Gibberellins, Cytokinins, ABA, Ethylene.**

 **2. Enzymes: nature, properties, classification, mode and mechanism of**

 **action.**

 **3. Germination, Seed dormancy, Photoperiodism, Vernalisation, senescence**

 **4. Lipid metabolism: biosynthesis of fatty acids, oxidation of fats,**

 **Triglycerides, glyoxylate cycle, α and β -oxidation of lipids.**

 **5. Vitamins and Coenzymes: structure, occurrence of all water soluble and fat**

 **Soluble vitamins and coenzymes activity.**

**References:**

1. Plant Physiology, biochemistry and molecular biology. David, T: Dennis and Davis Turnip.

 Longman. Scientific and technical U.K. 1990.

2. Plant Biochemistry, Voet, D and Voet J.G. International

3. Outlines of biochemistry. 5th edition Con E.E. and Stump P.K. 1995. Willey

4. Principles of biochemistry, Lehnenger, A.L. 1982 CBS Publication

5. Biochemistry, Strayer W.H. 1976. Foreman Company.

6. Introduction to Plant Physiology. Willium G. Hopkins and Norman P. A. Huner

 7. Plant Physiology. Lincoln Taiz and Eduardo Zeiger. International Edition

8. Plant Biochemistry. P.M. Dey and J.B. Harborne

9. Plant Biochemistry. Hans-Walter Heldt 10. Physicochemical and Environmental Plant

 Physiology. Park S. Nobel

SEMESTER II

CC (P)-10 [CC (P)-205]

**Full Marks: 100 Credits: 6 Time: 06 Hours**

1. Prepare a temporary slide of the given material “A” (ecological anatomy). 10

 Leaf of *Casuarina /* Stem of *Hydrilla /* Stem *of Calotropis /* Leaf *of Nerium.*

1. Prepare a temporary slide of the given material “B”(secondary growth) 10

 *Boerhaavia/ Achyranthus/ Amaranthus/ Dracaena*

1. Give the economic importance of given materials “C” & “D” (From Syllabus) 10
2. Dissect the embryo and describe the stage of the embryo. 10
3. Perform any one of the physiological experiments given by lottery:- 15
* To compare the rate of imbibition of starchy and oily seeds.(Gram seeds, Mustard seed, wheat, ground nuts.)
* To compare the rate of cuticular and non-cuticular transpiration. (*Opuntia* stem).
* To study the phenomenon of plasmolysis. ( *Tradescantia* or *Rhoeo discolour* peel*)*
* To determine the Diffusion Pressure Deficit (DPD) of potato tuber.
* To measure the rate of transpiration by Ganong’s photometer.
* To measure the rate of transpiration by Farmer’s photometer.
* To separate major plant pigments by Chromatographic technique.
* To determine the evolution of O2 by Wilmott’s bubbler (By NaHCO3 Conc.)
1. Test for glucose / Starch /Protein/ Phytochemical/ Vitamin /Tennin/ Phenol 10
2. Point out the spots (2X5) 10
3. Viva–voce. 15
4. Practical records/ herbarium/ field report/ charts etc. 10

Part III

SEMESTER III

**CC-11(CC-301)**

**CYTOLOGY & MOLECULAR BIOLOGY**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

**CYTOLOGY**

1. **Organization of Plant Cell, Including Structure and Functions of Cell Organelles.**
2. **Cell Wall: Structure and Function**
3. **Plasma Membrane: Structure, Models and Functions: Sites of ATPase, Ion Carriers; Channels and Pumps; Receptors.**
4. **Ribosome: Site of protein synthesis, initiation, elongation, termination.**
5. **Chromatin organization, packaging of DNA, Histones, Euchromatin, Heterochromatin.**
6. **Cell Division and Cell Cycle: -Mitosis, Meiosis, Cell Cycle Regulation, Role of Cyclin and Cdk.**
7. **Structure and Function of Cell Organelles: Mitochondria, Chloroplast, Lysosome, ER.**

molecular biology

1. **RNA – types, structure and function.**
2. **Protein sorting, targeting of protein organelles.**
3. **Karyotype analysis, chromosomal aberration: structural and numerical.**
4. **Robertsonian translocation, RNA splicing, site specific recombination.**
5. **C value paradox, proto-oncogenes, oncogenes, Tumour suppressor genes, Cancer.**
6. **DNA replication and repair mechanism.**

**References:**

1. Advances in Genetics (Vol. 49). J C Hall, J C Dunlap and Theodore Friedman (Eds), Academic Press. 2. Genetics- Principles and Analysis (4 Ed.) D H Hartl and E W Jones. Jones and Bartlett Publishers, Massachusetts.

3. A Primer of Conservation Genetics. Richard Frankham, J D Ballou and D A Briscoe.

 Cambridge University Press.

4. Genetics – A conceptual approach – Benjamin Pierce

 5. Bacterial and Bacteriophage Genetics. Edward Birge, Springer Publications

6. Molecular Biology of the Cell (2e). AB Bray, D Lewis, J Raff, M Robert and Walter. Garland

 Publishing Inc., New York

 7. The Science of Genetics. A G Atherly, J R Girton and J F McDonald. Saunders College

 Publishing, Fort Worth, USA.

 8.Cell and Molecular Biology- Concept and Experiments. G Karp. John Wiley and Sons Inc.,

 USA.

 9. Principles of Genetics. D P Snustad and M J Simmons, John Wiley and Sons Inc., USA

10. Principles of Genetics. Gardner and Snustad. John Wiley and Sons Inc., USA

SEMESTER III

**CC-12(CC-302)**

**GENETIC ENGINEERING & BIOTECHNOLOGY**

**Full Marks: 70 Credits: 4 Time: 03 Hour**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

**GENETIC ENGINEERING**

1. **Tools of Genetic Engineering: Restriction endonuclease, Gel electrophoresis, ligases, probes,**

 **cloning vectors: plasmids, cosmids, phage vectors, BAC, YAC vectors.**

**2. Nucleic Acid Hybridization: Northern, Southern, and Western blotting techniques.**

**3. Gene transformation in Plants: Vector mediated gene transformation, Agrobacterium the**

 **natural genetic engineer, methods of direct gene transfer in plants, Transgenic plants, T DNA,**

 **Z DNA**

 BIOTECHNOLOGY

1. **Biotechnology: Basic concepts, principles and scopes.**
2. **Plant cell and tissue culture: totipotency, somatic embryogenesis, artificial seeds and their advantages and limitations.**
3. **Anther and pollen culture: introduction, protocol for anther and pollen culture, significance, use of haploids in crop improvements**
4. **Protoplast culture: introduction, isolation and culture of protoplasts, somatic hybridization, cybrid techniques, advantages and uses.**
5. **Somaclonal variations: introduction, causes, method of selection and uses of somaclonal variation.**
6. **Intellectual property rights (IPR), possible ecological risks and ethical concerns.**

**References**

 1. Razdan. Plant Tissue Culture

 2. Vasil. Plant Tissue Culture

 3. P K Gupta. Elements of Biotechnology

 4. Chawala. Introduction to Plant Biotechnology

 5. C B Pawar. Cell Signalling

 6. Biology of Plants. American Society of Plant Physiologists Maryland, USA.

SEMESTER III

**DISCIPLINE SPECIFIC ELECTIVE-1 [DSE-301-“A’]**

**GROUP A - SPECIAL PAPER (THEORY)**

**CYTOGENETICS & MOLECULAR GENETICS**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

1. **Genetic fine structure: Cistron, Recon & Muton); transposons, plasmids, episomes, mitochondrial and chloroplast DNA.**
2. **DNA damage and repair: thymine dimer ,6-4 photoproducts, photo reactivation, excision repair**
3. **Concept about molecular mutation: physical mutagens: ionizing and non-ionizing radiations, radioactive and biological half-life. Effect of various kinds of radiations on plants, chromosomes and DNA, ld50. Chemical and environmental mutagenesis, site directed mutagenesis.**
4. **Mendelian principle: Dominance, Segregation, Independent assortment, gene, allele, multiple allele, pseudo-alleles, co-dominance, incomplete dominance, Gene interaction, pleiotropy, phenocopy, linkage and crossing over.**
5. **Gene mapping**
6. **Human genetics: pedigree analysis, karyotypes, genetic disorders, quantitative genetics, heritability and its measurements.**

**References**

1. Alberts B, Johnson A, Lewis J, Raff Martin, Roberts K and Walter P. (2007) Molecular Biology of the Cell. Garland Publ., New York.

2. Bonifacino JS, Dasso M, Harford JB, Liipincott-Schwartz J and Yamada KM. (2004) Short Protocols in Cell Biology. John Wiley & Sons, New Jersey.

3. Bregman AA (1987) Laboratory Investigations in Cell Biology. John Wiley & Sons, New York.

 4. Hawes C and Satiat-Jeunemaitre B (2001) Plant Cell Biology: Practical Approach. Oxford

 University Press, Oxford. 3

 5. Hirt RP and Horner DS (2004) Organelles, Genomes and Eukaryote Phylogeny: An

 evolutionary synthesis in the age of genomics. CRC Press.

 6. Karp G. (2008) Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons.

 7. Lodisch H, Berk A, Kaiser CA, Krieger M, Scott MP, Bretscher A, Ploegh H and Matsudaire P

 (2008) Molecular Cell Biology. WH Freeman & Co., New York.

8. Ruzin SE (1999) Plant Microtechnique and Microscopy. Oxford Univ. Press, Oxford.

9. Wischnitzer S. (1989) Introduction to Electron Microscopy. Pergamon Press, New York

SEMESTER III

Discipline specific elective(p)(2)

DSE(P)-302[‘A’]

**GROUP A (SPECIAL PAPER) - PRACTICAL**

**PRACTICAL BASED ON CYTOGENETICS & MOLECULAR BIOLOGY**

**Full Marks: 100 Credits: 6 Time: 06 Hours**

 1. Comment on any two of the given Instruments / Topics: 7.5X2=15

(a). Gel Electrophoresis (b) Any one genetic disorder in Human

 (c). Plasmid Vector (d). Tissue culture in any plant part (Anther/Pollen/Protoplast)

 (e). Operon concept (f). IPR (Patent/Copyright/Trademark etc.)

1. Prepare a temporary slide from a given material (A) and draw any two stages of the cell division (Mitosis/Meiosis) 25
2. Perform the chi- square test on the given material..20
3. Comments upon the spots (1-5):- 10

 (a). Permanent slides on cell divisions, (b) Ratios & backup (c). DNA model

 (d). Frame shift mutation (e). DNA replication (f). Work of Mendel/Morgan.

1. Viva –voce 20
2. Class record, Charts. 10

SEMESTER III

PROJECT(PR)-1 [PR-301]

 **Full Marks: 100 Credits: 6 Time: 06 Hours**

* 1. **Introduction**
	2. **Review of Literature**
	3. **Methodology (Up to Collection of Data)**

SEMESTER III

**Discipline Specific Elective-1(DSE-301)-“B”**

**MICROBIOLOGY**

 **Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

1. **Role of microbes in agriculture, industry and medicines.**
2. **Mycorrhiza: a general account and its role.**
3. **Microbes pathogenic to human beings with special reference to HIV & AIDS.**
4. **Symptoms caused by: -**

 **(a). Plant pathogenic bacteria**

 **(b).Plant virus**

**(c). Mycoplasma**

1. **General account of infection and immunology, antigen–antibody reaction, serology**
2. **Transmission of plant viruses.**
3. **Important plant diseases caused by plant pathogenic bacteria: -**

**(a).Bacterial blight of Potato**

 **(b). Citrus canker**

 **(c). Leaf spot of Tomato**

1. **Important plant diseases caused by plant viruses and mycoplasma**

 **(a).Leaf curl of Tomato**

 **(b). Leaf curl of Papaya**

 **(c). Yellow vein mosaic of Bhindi**

**SUGGESTED READINGS:**

1. Williamson VM, Kumar A (2006) Nematode resistance in plants: the battle underground. Trends in Genetics 22: 396–403.

2. Davis EL, Hussey RS, Baum TJ (2004) Getting to the roots of parasitism by nematodes. Trends in Parasitology 20: 134–141.

3. Plant Nematology (2006) Edited by Perry and Moens, CABI. Plant virology and insect-plant interactions:

4. Mathew’s Plant Virology by Roger Hull (2001) Academic Press, NY. Plant-fungi interactions:

5. Plant resistance mechanisms (SAR, ISR) - Strange RN, (2003) Introduction to Plant Pathology, John Wiley & Sons, USA. 33

6. Signal transduction; Molecular diagnostics; transgenic approaches for crop protection - Dickinson M, (2003) Molecular Plant Pathology, Bios Scientific Publishers, London.

SEMESTER III

**Discipline Specific Elective(P)-302-[“B”]**

**GROUP B - SPECIAL PAPER (PRACTICAL)**

**MICROBIOLOGY**

**Full Marks: 100 Credits: 5 Time: 06 Hours**

1. Stain the given cultured material “A” and identify the type of microbe on the basis of gram negative or gram positive. 10
2. Prepare a temporary slide of nodular root “B” & study the internal structures. 15
3. Determine the value of one small division of ocular micro meter in microns. Measure ten spores of the given material and calculate the average size of the spore given to you. 15
4. Make suitable stained temporary preparations of materials “C” & “D” to exhibit the structure of the pathogen in it. Identify the pathogen with reasons and suitable diagram. Leave your preparation for examination. 10
5. Comment upon the spots (1-5) 10
6. Give the name of the disease and causal organism of the specimens 1 to 5. 10
7. Viva-voce. 20
8. Class records, charts, models, herbarium, field reports etc. 10

SEMESTER III

PROJECT[PR-301]

**GROUP B (SPECIAL PAPER) - PRACTICAL**

**PRACTICAL BASED ON MICROBIOLOGY**

**Full Marks: 100 Credits: 6 Time: 06 Hours**

* 1. **Introduction**
	2. **Review of Literature**
	3. **Methodology (Up to collection of Data)**

SEMESTER IV

**CC-13 [CC-401]**

**ENVIRONMENTAL BIOLOGY (THEORY)**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

**The Environment And Population:**

1. Physical and biotic environment;
2. Biotic and Abiotic interaction,
3. concept of habitat and niche,
4. Population ecology, characteristics or a population; population growth curves.

 **Ecological Factors and Ecosystem Organization:**

1. Climatic factors, Topographic factors, Edaphic factors, Biotic factors,
2. Trophic structure, Food chain and Energy flow in ecosystem, Ecological pyramids, Biogeochemical cycle in terrestrial and aquatic ecosystem,
3. Types of soil, Major biomes.
4. Water ecological adaptations (Hydrophytes, Xerophytes, Mesophytes, Halophytes),
5. Ecological Succession, concept of climax.
6. Community ecology, symbiosis, level of species diversity and its measurements.
7. Environmental pollution, global environmental change, Root cause of biodiversity loss, acid rain, ozone layer depletion, greenhouse effect, global warming.

**References:**

J. S. Singh, S. P. Singh and S. R. Gupta, Ecology, environment and resource conservation by

 Anamyapublication, New Delhi.

2. K. V. Krishnamurthy, An advanced Text book on Biodiversity, Principles and practices –

 Oxford IBH , New Delhi.

3. Begon and Harper 1986, Population ecology

4. Kormondy 1996, Concept of ecology

5. Kumar H.D. Concept of ecology

6. Odum, E. P. 1971. Fundamentals of Ecology, Saunders, Philadelphia

7. Odum, E. P. 1983. Basic Ecology, Saunders, Philadelphia.

8. Chapman, J. L. and Reiss, M. J. 1988, Ecology, principles and Applications, Cambridge University Press, Cambridge, U. K.

9. Heywood, V. H. and Watson, R. T. 1985. Global Biodiversity Assessment, Cambridge University Press, Cambridge, U. K.

10. Treshow, M. 1985. Air pollution and plant life, Wiley Interscience.

11. Das. Concept of ecology

12. Nebel, B. J & Wright, R. T. 1981, Environmental Science – the way the world work Prentice Hall.

SEMESTER IV

**CC-14[CC402]**

 **EVOLUTION & BIODIVERSITY CONSERVATION**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

**EVOLUTION**

 (1). ORIGIN OF LIFE AND EVOLUTIONARY THOUGHTS: -

 (a). Lamarckism, Darwinism concepts of variation & adaptation,

 (b). Evolution, evolution and origin of prokaryotic & eukaryotic cells,

 (c). Methods of studies and mechanisms of evolution,

 (d). The Evolutionary Time scale; Eras, periods and epoch,

 (e). Origin of new genes

 (f). Population genetics,

 (g). Speciation: Introduction, types and importance

**BIODIVERSITY CONSERVATION**

1. Concept of biodiversity (α, β, γ) diversity, Mega diversity zones and hot spots..
2. **Principle of conservation**, IUCN & Red data book, **Strategies for conservation– in situ** conservation: International efforts and Indian initiatives, protected areas in Indian sanctuaries, national parks, biosphere reserves, wetlands, mangroves and coral reefs, conservation of wild biodiversity. **Strategies for conservation – ex situ conservation** Principles and practices, botanical gardens. Field gene banks, Seed banks, in vitro repositories and cryobanks. BSI, NBPGR, ICAR, CSIR & DBT.
3. Remote sensing, national park, sanctuaries, biosphere reserves, coral reef, BSI, CSIR, DBT, NBPGR (National bureau of plant genetic resources),
4. Convention on biological diversity (CBD), Kyoto protocol and carbon trading.
5. Forest managements: -forest types found in India, strategies for conservation and management of forest with special reference to deforestation, Chipko movement, Social forestry and biosphere reserve.

**References:**

 1. Textbook of Biodiversity- K V Krishnamurthy, Science Publishers, Inc, USA, 2003.

 2. Plant Conservation and Biodiversity, Series: Topics in Biodiversity and Conservation, Vol. 6, Hawksworth, David L.; Bull, Alan T. (Eds.) Reprinted from Biodiversity and Conservation, 20073.

3. Plant Biodiversity and Taxonomy, M.P.Singh, B.S. Singh and Soma Day, Daya Books, 2002.

4. Restoration and endangered species (1996) edt. Bowles M.L. and Whelan C.J. Cambride

 University press.

 5. Preservation and valuation of Biological resources (1990) orians G.H, Brown G.M., Kunin.

 W.E. and Swierbinski J.E. University Washington Press.

6. Paradise Lost? The ecological economics of Biodiversity 1994, Barbier E.B., Burgess J.C. and

 Folke C., Earthscan London.

SEMESTER IV

**Discipline Specific Elective(3)-[DSE—401] “A”**

**GROUP A - SPECIAL PAPER (THEORY)**

**GROUP A-PLANT GENETICS RESOURCES & CROP IMPROVEMENTS**

 **Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

**PLANT GENETIC RESOURCES**

1. Plant Genetic Resources (PGR): Definition and significance, Global and Indian Scenario.
2. Theory of Centres of Origin of crop Plants. Law of Homologous series of Genetic Variation.
3. Reproductive systems in crop plants.
4. Self-incompatibility system in plants.
5. Male Sterility and its significance.
6. The Gene Bank: Basic Concept and Objectives. Role of Gene Banks in Plant Genetic Resource Conservation. Procedure of making cDNA library and its advantages. Chromosome specific library. Concept of Genomic Library.

**CROP IMPROVEMENTS**

1. Principle and objectives of crop improvements
2. Plant Introduction and Acclimatization, Procedure and purpose Merit and Demerits.
3. Concept of inbreeding, Heterosis & Hybrid Vigour and their applications in crop Improvements.
4. Somatic Embryogenesis, Artificial seed &Hybrid seed Technology and their role in crop improvements.
5. Mutation Breeding: Use of chemical and physical mutagen, introduction of mutation. Limitation of Mutation Breeding, Achievements more through Mutation Breeding.
6. Application of Genetic Engineering Techniques in crop improvement.

**SUGGESTED READINGS:**

 1. Acquaah G (2007). Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd.

 USA.

 2. Allard RW (1999). Principles of Plant Breeding (2nd Edition), John Wiley and Sons.

 3. Hartl DL and Jones EW (2007). Genetics – Analysis of Genes and Genomes, 7th edition,

 Jones and Barlett publishers.

 4. Hartwell LH, Hood L, Goldberg ML, Reynolds AE, Silver LM, Veres RC (2006). Genetics –

 From Genes to Genomes, 3rd edition, McGraw Hill.

 5. Lewin B (2008). Genes IX, Jones and Barlett Publishers.

 6. Singh RJ (2002). Plant Cytogenetics, 2nd edition, CRC Press.

 7. Smartt J and Simmonds NW (1995). Evolution of Crop Plants (2nd Edition) Longman.

SEMESTER IV

**Discipline Specific Elective-4**

**DSE(P)-4 “A”**

**GROUP A - SPECIAL PAPER (PRACTICAL)**

**PLANT GENETICS RESOURCES & CROP IMPROVEMENTS**

**& ECOLOGY**

**Full Marks: 100 Credits: 6 Time: 06 Hours**

1. Prepare a temporary slide of given material “A” (Ecological anatomy). 10

2. Determine the PH value of soil of different places through PH indicator or PH paper.

 (At least three places). 10

 3. To determine the frequency or density of various species occurring in a given area by

 Quadrates method. 10

4. To determine the vegetational cover of an area. 10

5. To demonstrate the phenomenon of “Emasculation” technique in given flowering plant

 species. 10

6. Comments upon the given spotting materials (5 items) 10

7. Demonstrate the experiment of ovule culture/ anther culture for the development of haploid

 Plant. 10

8. Class records and field reports. 10

9. Viva-voce. 20

SEMESTER IV

**Discipline Specific Elective-3 (THEORY)**

**DSE-401 “B”**

**GROUP** B **- SPECIAL PAPER**

**PLANT PATHOLOGY**

**Full Marks: 70 Credits: 4 Time: 03 Hours**

In all **eight** 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 mark each. Any four questions shall have to be answered by the examinees out of the remaining seven questions carrying 15 marks each.

 1. History and modern approaches of pathology**.**

 **2. General symptoms of plant diseases caused by fungi.**

 **3. Mechanism of attack: -**

 **(a).Enzymes: Role of enzymes in pathogenesis.**

 **(b).Toxins: Types and their role in pathogenesis.**

 **4. Physiology of Diseased Plants with special references to:**

**(a). Osmo regulation**

**(b). Respiration**

**(c). Photosynthesis**

 **5. Mechanism of Defence:**

 **(a). Structural Defence Mechanism**

 **(b). Biochemical Defence Mechanism**

 **6. Control Measures of Plant Diseases: -**

 **(a). Cultural practices**

 **(b).Biological**

 **(c). Chemical control (fungicide)**

 **(d). Plant Quarantine**

 **7. Important Plant Diseases caused by the Fungi (symptoms, Etiology and Control)**

* 1. **Late Blight of Potato**
	2. **Loose Smut of Wheat**
	3. **Rust of Linseed**
	4. **Tikka disease of Groundnut**
	5. **Blast of Rice**
	6. **Red Rot of Sugarcane**
	7. **Covered Smut of Wheat**

**References:**

1. Plant Pathology by R. S. Mehrotra, first edition, McGraw-Hill Education publication,

 1982.

2. Plant Pathology by George N Agrios, fifth edition, Academic Press, London, 2005.

3. Plant Nematode: Morphology, Systematics, Biology and Ecology by M. R. Khan, first

 edition, Science Publishers, 2008.

4. Plant Pathogenesis and Resistance by Jeng-Sheng Huang, first edition, Springer,

 Netherlands, 2001.

1. Plant Pathology by R. S. Mehrotra and Ashok Agarwal, second edition, Tata McGrawHill

 Education, 2003.

1. Biocontrol of Plant Diseases by P. C. Trivedi, first edition, Aavishkar Publishers and

 Distributors, 2007.

 7. Concise Encyclopedia of Plant pathology by P. Vidhyasekaran, first edition, CRC Press,

 2004.

 8. Topics in Mycology and Pathology by L. N. Nair, first edition, New Central BookAgency

 Kolkata, 2007.

 9. Fundamentals of plant pathology by A.K. Sinha, Kalyani Publishers

10. Disease of crops plants of India by Rangswami and Mahadevan, Prentice Hall

 Publication

SEMESTER IV

**DSE-4 (PRACTICAL)-GR(B)**

**DSE (P)—402 “B”**

**GROUP B - SPECIAL PAPER+ EVS (PRACTICAL)**

**Full Marks: 100 Credits: 5 Time: 06 Hours**

1. Prepare a temporary slide of given material “A” (Ecological anatomy). 10

2. Determine the PH value of soil of different places through PH indicator or PH paper.

 (At least three places). 10

3. To determine the frequency or density of various species occurring in a given area by

 Quadrates method. 10

4. To determine the vegetational cover of an area. 10

5. Make suitable stained preparations of material ‘B’ and study the symptoms, etiology of

 the disease and comment upon the host parasite relationship. Identify the Pathogen given

 suitable diagrams and reasons. 10

6. Give the name of the disease and causal organism of the specimens (5) 10

7. Comment upon the spots.1-5 10

8. Class records and field reports. 10

9. Viva-voce. 20

SEMESTER IV

**PROJECT (2)**

**PR—2[PR—401]**

**(TO BE ASSIGNED ON ELECTIVE CORE PAPER)**

**Full Marks: 100 Credits: 6 Time: 06 Hours**

 **4. Observation**

 **5. Results and Discussion**

 **6. Conclusion**

 **7. References**