OFFICE OF THE REGISTRAR
KAKATIYA UNIVERSITY
WARANGAL - 506009

Phones: 0870 2438866, Mobile: (+91) 9849171737, E- mail: registrar@kakatiya.ac.in

No. 1996 /B3/KU/2023 Date: 28 - 11 - 2023

To
All the Principals of University/
Constituent/ Affiliated / Private Aided Colleges Offering M.Sc., Botay Course
Kakatiya University, Warangal

Sub: PG COURSES – SYLLABUS – Approval of scheme & syllabus of M.Sc., Botany (I & II Semesters) under CBCS pattern for the academic year 2023-2024 – Implementation of – Regarding.

Ref: Letter No. 398, dated 20/11/2023 of the Chairperson, Board of Studies in Botany, KU.

~!~

Sir / Madam,

I am to inform you that the Chairman, Board of Studies in Botany, KU has submitted the Scheme and syllabus of M.Sc., Botany Course (I & II Semesters) under CBCS pattern as recommended by the Board of Studies for implementation to the students seek admission into I year course from the academic year 2023-2024.

Keeping in view of the urgency of the commencement of class work, the Vice-Chancellor in anticipation of ratification by the Standing Committee of the Academic Senate has accorded approval to the scheme and syllabus of M.Sc., Botany Course (I & II Semesters) under CBCS pattern as recommended by the Board of Studies in Botany for implementation to the students seeking admission to the I year course from the academic year 2023-2024 onwards.

The same scheme and syllabus of the course shall be kept in the KU Website. **kakatiya.ac.in** for ready reference.

As such you are hereby informed to bring it to the notice of the students and staff concerned and initiate action accordingly.

Yours faithfully

REGISTRAR

Copy to:-

1. The Dean, Faculty of Science, KU
2. The Head Dept. of Botany, KU
3. The Chairperson, Board of Studies in Botany, KU
4. The Controller of Examinations, KU
5. The Additional Controller of Exams (P.G.)/ Confidential
6. The Secretary to Vice-chancellor, KU
7. The P.A to Registrar, KU
8. The Stack File

DEPARTMENT OF BOTANY, KAKATIYA UNIVERSITY, WARANGAL
M.Sc. BOTANY
w.e.f. Academic Year 2023-24

SEMESTER-I

Subject Code	Subject Paper	Theory/ Practical	Instruction Hrs./ Week	Credits	Evaluation		Total
					Internal *	External**	
BOT-101	Biology of Algae, Fungi, Bacteria and Viruses	Theory (Paper-I)	4	4	20	80	100
BOT-102	Biology of Bryophyta, Pteridophyta and Cycadophyta	Theory (Paper-II)	4	4	20	80	100
BOT-103	Systematics of Magnoliophyta and Economic botany	Theory (Paper-III)	4	4	20	80	100
BOT-104	Analytical Techniques, Biostatistics and Ethnobotany	Theory (Paper-IV)	4	4	20	80	100
BOT-Pr.105	Biology of Algae, Fungi, Bacteria and Viruses & Biology of Bryophyta, Pteridophyta and Cycadophyta	Practical (Paper I)	6+6=12	2+2=4	--	100	100
BOT-Pr -106	Systematics of Magnoliophyta and Economic botany & Analytical Techniques, Biostatistics and Ethnobotany	Practical (Paper II)	6+6=12	2+2=4	--	100	100
	SEMINARS	**--**	**--**	**01**	**25**	**--**	**25**
	Total		**40**	**25**	**105**	**520**	**625**

*Examination Duration: 1 hour; (Best of one out of two); **Examination duration: 3 hours;

***Examination duration: 4 hours.

1.  2.  3. 

4.  5.  6. 

DEPARTMENT OF BOTANY, KAKATIYA UNIVERSITY, WARANGAL
M.Sc. BOTANY
w.e.f. Academic Year 2023-24

SEMESTER-II

Subject Code	Subject Paper	Theory/ Practical	Instruction Hrs./ Week	Credits	Evaluation		Total
					Internal *	External**	
BOT-201	Cell Biology, Genetics and Cytogenetics	Theory (Paper-I)	4	4	20	80	100
BOT-202	Ecology, Phytogeography and Evolution	Theory (Paper-II)	4	4	20	80	100
BOT-203	Plant Development and Reproductive Biology	Theory (Paper-III)	4	4	20	80	100
BOT-204	Medicinal Botany and Horticulture	Theory (Paper-IV)	4	4	20	80	100
Pr-206	Cell Biology, Genetics and Cytogenetics & Ecology, Phytogeography and Evolution	Practical (Paper I)	6+6=12	2+2=4	--	100	100
Pr-207	Plant Development and Reproductive & Medicinal Botany and Horticulture	Practical (Paper II)	6+6=12	2+2=4	--	100	100
	SEMINARS	**--**	**--**	**01**	**25**	**--**	**25**
	Total		**40**	**25**	**105**	**520**	**625**

*Examination Duration: 1 hour; (Best of one out of two); **Examination duration: 3 hours;

***Examination duration: 4 hours; ****CBCS-OE-205: Economic Botany

1. B. Lalitha Ki 2. 3.

4. 5. 6. K. Shailaja

SEMESTER-I

THEORY SYLLABUS

Paper–I (BOT-101): BIOLOGY OF ALGAE, FUNGI, BACTERIA AND VIRUSES

Unit–I: ALGAE

1. Algae: (a) General characters, Classification, and Economic importance;
   (b) Thallus organization and Reproduction.
2. (a) General account of Chlorophyceae (Green Algae: *Chlorella* and *Scendesmus Fritschiella*); (b) General account of Xanthophyceae (Yellow-green Algae) and Bacillariophyceae (Diatoms).
3. (a) General account of Phaeophyceae (Brown Algae) – *Ectocarpus*; (b) General account of Rhodophyceae (Red Algae) – *Gelidium* and *Batrachospermum*.

Unit–II: FUNGI AND LICHENS

1. Fungi: General account, Vegetative and Reproductive structures, Heterothallism, Heterokaryosis and Para-sexuality. Assembling the Fungal Tree of Life (AFTOL). Higher-level Phylogenetic Classification of Fungi (Hibbert *et al*., 2007),
2. Morphology, Reproduction, Life Cycles and Economic Importance of:
   (a) Myxomycota- A General Account.
   (b) Eumycota: Mastigomycotina – *Albugo.*
   (c) Zygomycotina: *Rhizopus*.
   (d) Ascomycotina: *Saccharomyces, Pencillium.*
   (e) Basidiomycotina: *Melampsora, Ustilago*.
   (f) Deuteromycotina: *Fusarium, Colletotrichum.*
3. Lichens: Habitat, Habit, Morphology, Ecology, Reproduction and Economic importance.

Unit–III: BACTERIA AND VIRUSES

1. Cyanobacteria and bacteria: General Account; Recombinations and Economic importance.
2. Viruses: History, Morphology (Ultrastructure and Symmetry), Nucleic acid diversity, Nomenclature and International Committee on Taxonomy of Viruses (ICTV) classification.
3. Replication of viruses. (“T-even’ phages: (T2, T4 and T6) and Tobacco Mosaic Virus).

Unit–IV: PLANT PATHOLOGY

1. Plant Pathology: General account, Classification of Pathogens. Etiology of Diseases.
2. Plant diseases caused by fungi and their management: Mildews (Downy and Powdery), Rusts and Smuts.
3. Plant diseases caused by Bacteria (Bacterial Leaf blight of paddy and citrus canker), Viruses (Chilli mosaic) and *Phytoplasma* (Sesame phyllody). Plant disease and control measures.

Suggested Readings:

1) Alexopoulus. C.J., Mims. C.W. & Blackwell. M. 1996. Introductory Mycology. 4th Edition. Replika Press, North Delhi.
2) Aneja, K.R. 2003. Experiments in Microbiology, Plant Pathology and Biotechnology. New Age International Publishers, New Delhi.
3) Bold, H.C. & Wyne, M.J. 1978. Introduction to the Algae. Prentice-Hall., New Jersey.
4) Flint, S.J., Enquist. L.W., Krug. R.M., Racaniello. V.R. & Skalka. A.M. 2000. Principles of Virology, Molecular Biology, Pathogenesis and Control. ASM Press, Washington DC.
5) Fritsch, F.E. 1935. The structure and reproduction of Algae. 2 vols. Cambridge University Press.
6) Graham, J.E, Lee W. Wilcox & L.E. Graham. 2008. Algae. 2nd ed. Benjamin Cummings.
7) Kaur Sethi, I. & Surinder, K.W. 2011. Text Book of Fungi and the Allies. MacMillan Publishers, New Delhi.
8) Kumar, H.D. 2000. Introductory Phycology. East West Press., New Delhi.
9) Lee, R.W. 2007. Classification of Algae.
10) Matthew, R.H. 2004. Plant Virology. 4th Edition. Academic Press - An Imprint of Elsevier. California, USA.
11) Mehrotra, R.S. & Aneja, K.R. 2003. An Introduction to Mycology. New Age International Publishers, New Delhi.
12) Morris, I. 1967. An Introduction to the Algae. Cambridge University Press, UK.
13) Prescott et al. 2003. Microbiology. McGraw Hill Education, New York.
14) Prescott, G.W. 1969. The Algae – A Review. Houghton Mifflin Company, Boston.
15) Ram Reddy, S. & Reddy, S.M. 2007. Essentials of Virology. Scientific Publishers, Jodhpur.
16) Reddy, S.M. & Ram Reddy. S. 2000. Microbiology a Laboratory Manual. BSC Publishers & Distributors,
17) Round, F.E. 1986. The Biology of Algae. Cambridge University Press, New York.
18) Sharma, K. 2005. Manual of Microbiology Tools and Techniques. Ane Book, New Delhi.
19) Smith, G.E. (Ed.). 1950. Fresh Water Algae. Cambridge University Press, New York.
20) Smith, K.M. 1968. Plant Viruses. Elsevier, New York.
21) Stainer. R.T., Ingraham. J.L., Wheelis. M.L. & Painter P.R. 1987. General Microbiology. 5th Edition. MacMillan, London.
22) Sullia, S.B. & Shantharam, S. 2001. General Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Verma, H.N. 2003. Basics of Plant Virology. IBH Publishing Co. Pvt. Ltd., New Delhi

SEMESTER-I

THEORY SYLLABUS

PAPER–II (BOT–102): BIOLOGY OF BRYOPHYTA, PTERIDOPHYTA AND GYMNOSPERMS

Unit–I. BRYOPHYTA

1. Bryophyta: Introduction, Origin, Classification and Ecology Economic importance of Bryophyta.
2. Morphological distinction of Liverworts, Mosses and Hornworts. Morphology, Anatomy and Reproduction in: (i) Marchantiopsida: *Marchantia*; (ii) Sphagnopsida: *Sphagnum*. (iii) Bryopsida/Polytrichopsida: *Polytrichum*; (iv) Anthocerotopsida: *Anthoceros*.
3. Evolution of Gametopytes and Sporophytes in Bryophytes.

UNIT–II: PTERIDOPHYTA

1. Pteridophyta: Origin and Evolution in Pterodophytes.
2. Morphology, Anatomy and Reproduction in five representative Pteridophytes as per the Pteridophyte Phylogeny Group (2016):
   (i) Class Lycopodiopsida (Lycophytes) Club mosses, quill worts and spike mosses-*Equisetum*): Selaginellaceae, *Selaginella*. (ii) Class Polypodiopsida; Pteridaceae: *Polypodium*: Ophioglossidae; Ophioglossaceae: *Ophisglossum*. Psilotaceae: *Psilotum*.
3. Telome theory, Stelar evolution, Heterospory and Seed habit in Pteridophytes. General account of fossil Pteridophytes.

Unit–III: GYMNOSPERMS

1. Gymnosperms: Introduction, Evolution and Classification.
2. Morphology and Reproduction in the following examples as per the molecular classification(Linear sequence of subclasses) of Gymnosperms (Christenhusz *et al.*, 2011):
   Subclass I. CYCADIDAE: Cycadales: Williamsoniacae; *Williamsonia*;
   Subclass II. GINKGOIDAE: Gingkoales: Gingoaeae: *Gingko biloba*.
   Subclass III. GNETIDAE: Ephedrales: Ephedraceae: *Ephedra*. Economic importance of Gymnosperms in India.
   Subclass IV. PINIDAE: Pinales: Araucariacae*; Araucaria.*

UNIT-IV: PALEOBOTANY

1. Paleobotany: Scope and Objectives, Geological time scale.
2. Fossilization, Fossil types, Techniques in Palaeobotany.
3. General account of Fossil Gymnosperms with special reference to *Williamsonia* and *Pentoxylon*. Birbal Sahni Institue of Paleobotany; Contributions of Birbal Sahni.

Suggested Readings:

1) Arnold. C.A. 1974. An Introduction to Paleobotany. McGraw Hill Book Co. Inc., New York.
2) Chamberlain. C.J. 1935. Gymnosperms Structure and Evolution. University of Chicago Press, USA.
3) Evans. A.J. 1936. Morphology of Vascular Plants (Lower Groups). McGraw Hill Book Company, New York.
4) Parihar. N.S. 1996. Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
5) Sambamurthy. A.V.S.S. 2005. A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. IK International Pvt. Ltd.
6) Saxena. P. & Pathak. C. 2012. A Textbook of Pteridophyta. Wisdom Press, New Delhi.
7) Sharma. O.P. 1996. Gymnosperms. Pragathi Prakashan, Meerut.
8) Sharma. O.P. 2006. Pteridophyta. MacMillan India Ltd., New Delhi.
9) Sporne. K.R. 1962. The Morphology of Pteridophytes. Hutchinson University Library, London.
10) Sporne. K.R. 1965. Morphology of Gymnosperms. HUP. London.
11) Sporne. K.R. 1965. Morphology of Pteridophytes. HUP. London.
12) Sporne. K.R. 1967. The Morphology of Gymnosperms. Hutchinson University Library, London.
13) Stewart. W.N. & Rothwell. G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press, USA.
14) Vashista. P.C. 2005. Gymnosperms. S.Chand & Co., New Delhi.
15) Vashista. P.C. 2005. Pteridophyta. Rev. Ed. By Sinha & Anil. S.Chand & Co., New Delhi.

SEMESTER-I

THEORY SYLLABUS

PAPER–III (BOT-103): SYSTEMATICS OF MAGNOLIOPHYTA AND ECONOMIC BOTANY

Unit–I: INTRODUCTION AND ROLE OF TAXONOMY

1. Brief introduction and History of development of systems of classification till Angiosperm Phylogeny Group (APG).
2. Taxonomic Structure, Taxonomic Hierarchy. Evaluation of Taxonomic Categories.
3. Plant Identification: Traditional and Modern methods. Role of Botanical Gardens, Floras, eFloras and Monographs in Plant identification.

Unit-II: TAXONOMIC TOOLS, NOMENCLATURE AND EVIDENCE

1. Floristics and Herbaria: Definition, Functions, Herbarium preparation. Know about herbaria e.g. KEW and CNH and their Functions.
2. Nomenclature: Brief History. An account of International Code of Nomenclature (ICN) for Algae, Fungi and Plants. Schenzhen Code (2018).
3. Evidence for Systematics: Anatomy, Embryology, Palynology, Cytology, Genetics and Photochemistry. Molecular Systematics.

UNIT-III: SYSTEMATICS

1. Parallelism vs. Convergence; Phenetic vs. Phyletic systems; Numerical Taxonomy. Cladistics: A Brief Introduction.
2. System of Classification of Armen Takhtajan: Relative merits and demerits. Angiosperm Phylogenetic Group (APG): Formation to APG I–IV and updates.
3. Study of selective major clads of Magnoliophyta: Basal Angiosperms, MAGNOLIDS: Maganoliales: *Annonaceae*. MONOCOTS: Commelids: Arecales: *Areceae*; Zingiberales: Zingiberaceae; Poales: *Poaceae, Cyperaceae*. EUDICOTS: Ranunculales: *Menispermaceae*; ROSIDS: Fable: *Leguminosae*; Cucurbitales: *Cucurbitaceae*; Malphigiales: *Euphorbiaceae, Phyllanthaceae*; Myrtales: *Myrtaceae*; Sapindales: *Rutaceae, Meliaceae*; MALVIDS: Malvales: *Malvaceae*. SUPERASTERIDS: Santalales: *Santalaceae, Loranthaceae*; Caryophyllales: *Amaranthaceae, Cactaceae*. ASTERIDS: Ericales: *Spotaceae*; Gentianales: *Rubiaceae, Apocynaceae*; Solanales: *Convolvulaceae*, *Solanaceae*; Lamiales: Acanthaceae, Lamiaceae; Asterales: *Asteraceae*; Apiales: *Apiaceae*.

UNIT-IV: ECONOMIC BOTANY

1. Plants and Human welfare. Economic Products of Indian plants. Medicinal plants of India: General account and with special reference to Turmeric, Kalmegh, Rouwolfia, Jatamasi and Aswagandha, Tippateega.
2. General account of (i): Cereals: Paddy, Corn and Wheat; Millets: Bajra, Jowar, Fingermillate; (ii) Pulses (Bean, Lentils and Peas): Red gram, Black gram and Bengal gram.
3. (i)*Vegetables* (whole plant, leaves, flowers, ripe or young fruits, tubers, corms, rhizomes: Amaranthus, Purslane, Spinach, Cabbage, Cauliflower, Brinjal, Lady's finger, Scarlet, Sponge and Snake guards, Tomato, Carrot, Beet root, Yams, Potato and Sweet potato) and *Fruits* (Mango, Citrus, Banana, Pineapple). (ii) *Gums, Resins and Latex*: Gum Karaya (Kovil/Tabasi), Gum Arabic, Asafoetida, Amber, Incense, Turpentine and Rubber.

Suggested Readings:

1) Angiosperm Phylogeny Group Website. 2015. Consult www.apgweb.
2) APG III. 2009. An Update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants: APG III. Bot. J. Linnaean Soc. 106: 105-121.
3) Davis. P.H. & Heywoos. V.H. 1973. Principles of Angiosperms Taxonomy. Rober.E.Kreiger Pu. Co., New York.
4) Gamble & Fischer. 1915-1935. Flora of Presidency of Madras. 3 vols. BSMS, Dehra Dun.
5) Grant. V. 1971. Plant Biosystematics. Academic Press, London.
6) Harrison. H.J. 1971. New Concepts in Flowering Plant Taxonomy. Hieman Educational Books Ltd., London.
7) Heslop-Harrison. J. 1967. Plant Taxonomy. English Language Books Soc. & Edward Arnold Pub. Ltd., UK.
8) Heywood. V.H., Brummit. R.K., Culham. A., & Seberg. O. 2007. Flowering Plant Families of the World. Firefly Books Ltd., New York.
9) Judd. W.S., Christopher. S. Campbell., Elizabeth A. Kellogg., Peter F. Stevens., & Micheal J. Donoghue. 2016. Plant Systematics: A Phylogenetic Approach. 4th Ed. Sinauer.
10) Lawrence. G.H.M. 1951. Taxonomy of Vascular Plants. McMillan, New York.
11) Mondal. A.K. 2011. Advanced Plant Taxonomy. New Central Book Agency Pvt. Ltd., Kolkata.
12) Naik. V.N. 1992. Taxonomy of Angiosperms. 2nd Edn. Tata McGraw Hill.
13) Pullaiah. T. 2005. Taxonomy of Angiosperms. Regency Publications, New Delhi.
14) Pullaiah. T. et al. 1997. Flora of Andhra Pradesh. 4 Vols. Scientific Publishers, Jodhpur
15) Radford. A.E. 1986. Fundamentals of Plant Systematics. Harper and Row Publications, USA.
16) Radford. A.E. et al. 1974. Vascular Plant Systematics. Harper & Row, New York.
17) Ravi Prasad Rao. B. 2012. Flora of Sri Krishnadevaraya University Campus. SKU, Anatapur.
18) Ravi Prasad Rao. B. 2014. Plant Name Directory. Anusha Printers, Hyderabad
19) Simpson, Micheal. G. 2006. Plant Systematics. Elseiver & Academic Press.
20) Singh, Gurucharan. 2012. Plant Systematics: Theory and Practice. Oxford & IBH, New Delhi.
21) Sivarajan. V.V. 1991. Introduction to Principles of Plant Taxonomy. Oxford & IBH.
22) Stace. C.A. 1989. Plant Taxonomy and Biosystematics. 2nd Edition. Edward Arnold Ltd., London.
23) Takhtajan. A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
24) Woodland. D.W. 1991. Contemporary Plant Systematics. Prentice Hall, New Jersey.

SEMESTER-I

THEORY SYLLABUS

PAPER-IV (BOT–104): ANALYTICAL TECHNIQUES, BIOSTATISTICS AND ETHNOBOTANY

Unit-I: ANALYTICAL TECHNIQUES

1. Principles and Applications of Microscopy: Light, Phase Contrast and Scanning and Transmission Electron Microscopes. Biochemical buffers; pH Measurement.
2. Centrifugation: Basic principles of Sedimentation; Ultracentrifugation. General Principles, Definition and Applications of Chromatography; Thin-layer Chromatography (TLC), Gas-Liquid Chromatography (GLC), High-Performance Liquid Chromatography (HPLC).
3. Electrophoresis: Principles and Applications; PAGE Agarose Gel Electrophoresis. UV-Visible Spectrophotometer. Introduction to Fluorescence Spectroscopy.

Unit-II: BIOSTATISTICS

1. Biostatistics: Scope and Role. Variables: Random, Discrete and Continuous. Populations: Methods of Sampling, Diagrammatic and Graphical representation of Data (Line, Bar and Pie Diagrams: Frequency Curve, Polygon and Histograms). Measures of Central Tendency. Measures of Dispersion: Range, Interquartile Range and Standard Deviation. Variance, Coefficient of Variance and Standard Error (SE).
2. Probability Theory and Applications. Normal, Binomial and Poisson distributions.
3. Correlation and Regression. Chi-Square Test. Student's t-test and Analysis of Variance (ANOVA).

UNIT-III: ETHNOBOTANY

1. Introduction, concept, cope and objectives.
2. Ethnic groups; Major and minor ethnic groups of Telangana and their life styles.
3. Forest Vs Ethnic groups, methodology of Ethnobotanical studies.

UNIT-IV: ETHNO MEDICINAL PLANTS

1. Plants and tribal medicine significance of the following plants in ethno medicinal practices (along with a brief note on their habitat and morphology)
   a) Gloriosa superba
   b) Butea monosperma
   c) Aerva lanata
   d) Pongania pinnata
   e) Moringa olerifolia
   f) Terminalia bellarica
   g) Ablemoschus esculentum
   h) Eugenia jambolona

Suggested Readings:

1) Bryan Bergeron M.D. 2008, Bioinformatics Computing.PHI Publications New Delhi.
2) Cantor, C.R. and P.R. Schimel. Biophysical chemistry by, W.H. Freeman & Co.,
3) Cooper, T.G. The tools of Biochemistry .Wiley Eastern.
4) David J.Holmes and Hazel peck. Analytical biochemistry.
5) Freeman Dyson 1999, Origin of life , Cambridge University Press
6) Glasel A. and M.P.Duetscher.1995. Introduction to Biophysical Methods for protein and nucleic acid Research. Academic Press.
7) Goon,A.M., Gupta,M.K. and Dasgupta,B.(1986) Fundamentals of Statistics (Vol.2). The world press Private limited, Calcutta.
8) Gupta,S.C. and Kapoor,V.K.(1993) Fundamentals of applied statistics. Sulthan Chand and Sons, New Delhi.
9) Gupta,S.P(2001) Statistical methods. Sulthan Chand and Sons, New Delhi.
10) Khan I and Khanum (2008) Fundamentals of Biostatistics, Ukaaz Publications, Hyderabad.
11) KJS Khurana and Rajeev Markanday 2015, IBPS Regional Rural Banking. S. Chand & Co. Pvt. Ltd, Delhi.
12) Morris, S.J.and P.Morris Separation Methods in biochemistry. Pitman.
13) Rachna sagar, Together with Computer Applications
14) Raghavarao, D.(1983) Statistical methods in agricultural and biological research. Oxford and IBH Publishing co., PVT.,LTD., New Delhi.
15) Rangaswamy,R.(1995) A Textbook of agricultural statistics. New Age International Publishers Limited, New Delhi.
16) Vanholdem K.E. and W.C.Johnson, 1998. Principles of Physical Biochemistry
17) Wilson & Walker 1986. Practical biochemistry: Principles & Techniques. Cambridge Univ.Press.
18) Alfonso Valencia & Blascheke. L. 2005. Developing Bioinformatics Skills. Orille's Publication.
19) Fundamentals of computers 2014, by Reema Thareja, Oxford University Press.

MS-Office 2007 Training Guide by S. Jain

SEMESTER-I

PRACTICAL SYLLABUS

PAPER-I: BIOLOGY OF ALGAE, FUNGI, BACTERIA AND VIRUSES (AND) BIOLOGY OF, BRYOPHYTA, PTERIDOPHYTA AND GYMNOSPER

PHYCOLOGY (Identification of algae):

1) Chlorophyceae: *Pandorina, Hydrodictyon, Zygnema, Oedogonium, Cladophora*
2) Bacillariophyceae: *Cyclotella, Navicula, Pinnularia, Cymbella*
3) Phaeophyceae: *Laminaria, Ecto Carpus*
4) Rhodophyceae: *Batrachospermum, Gracilaria*
5) Cyanophyceae: *Nostoc, Anabaena, Oscilatoria, Tolypothrix, Scytonema*
6) At least 25 Algal samples to be submitted in the practical examination by each student

MYCOLOGY:

Section cutting of the following infected materials.

1) *Phytophthora* infected leaf material
2) Rust infected leaves of Jowar/Wheat/Barberry
3) Smut infected leaf of Jowar/Wheat
4) *Cercospora* infected groundnut leaf
5) *Alternaria* infected Mango leaf
6) Permanent Slides: Observation and identification.
   Phytophthora, Mucor, Rhizopus, Yeast, *Puccinia* (All stages), *Ustilago* (2 stages), *Colletotrichum, Alternaria.*
7) Fungal Specimens: Observation and identification.
   Agaricus, Puccinia infected leaf (Wheat, Barberry), Smut of *Sorghum, Polyporus,* Powdery Mildew, *Peziza.*

MICROBIOLOGY:

1) Gram staining of Bacteria.
2) Little leaf of Brinjal.
3) Leaf curl of *Papaya.*
4) Yellowing and vein clearing of Bhendi.
5) Lichenology: All types of Lichens.

BRYOPHYTA:

1) Hepaticopsida: *Marchantia, Sphagnum*
2) Anthoceratopsida: *Notothylas, Anthoceros*
3) Bryopsida: *Polytrichum*

PTERIDOPHYTA:

1) Psilophyta: *Psilotum*
2) Lycophyta: *Selaginella, Isoetes*
3) Sphenophyta: *Equisetum*
4) Pteropsida: *Ophioglossum, Adiantum*

CYCADOPHYTA(GYMNOSPERMS):

1) Cycadales: *Cycas*
2) Coniferales: *Taxus*
3) Ginkgoales: *Ginkgo*
4) Ephedrales: *Ephedra*
5) Gnetales: *Gnetum*

PALEOBOTANY: *Leginopteris, Glossopteris, Pentaxylon*

SEMESTER-I

MODEL QUESTION PAPER (PRACTICAL)

PAPER-I: BIOLOGY OF ALGAE, FUNGI, BACTERIA AND VIRUSES (AND) BIOLOGY OF, BRYOPHYTA, PTERIDOPHYTA AND GYMNOSPERMS

Time: **4 hours** *Max.Marks*: **100**

1) Identify and describe the structure with well labled diagram of the given algal mixture 20
Algal/Cyanobacterial mixture (A, B, C & D). (4x5)

A = Chlorophyceae

B = Bacillariophyceae

C = Phaeophyceae / Rhodophyceae

D = Cyanophyceae (Cyanobateria)

2) Take the section and draw with well labled diagram, of Plant material / Identify the given beactrium by gram staning method (E)
10

3) Describe the structure and draw a well labeled diagram of the given Gymnosperm material by preparing double stained permanent slide (F) 20

4) Identify the following Slides / specimens by suitable reasons 24

G= Bryophyta
H= Bryophyta
I=Pteridophyta
J= Pteridophyta
K=Fungi
L=Lichen

5) Algal Collection + Fungal infected Herbaria 10

6) Record + Slides (Permanent) 10

7) Viva-voce 06

SEMESTER-I

PRACTICAL SYLLABUS

PAPER-II: SYSTEMATICS OF MAGNOLIOPHYTA AND ECONOMIC BOTANY (AND) ANALYTICAL TECHNIQUES, BIOSTATISTICS, AND ELTSNO BOTANY

TAXONOMY:

Study of about 15 wild taxa representing different families and identification to species level

Plants of Magnoliophyta to be worked out for technical description and identification up to the species using Gamble and Fischer's Flora of the Madras Presidency as per Bentham and Hooker's Classification

MAGNOLIOPHYTA (Dicotyledonae):

POLYPETALAE: Annonaceae: *Annona squamosa, Polyalthia longifolia*
Menispermaceae: *Tinospora cordifolia*
Nymphaeaceae: *Nelumbo nucifera* or *Nymphaea pubescens*
Capparaceae: *Cleome viscosa*
Malvaceae: *Abutilon indicum* or *Sida acuta*
Rutaceae: *Murraya koenigii* or *Murraya paniculata* (*M. exotica*)
Meliaceae: *Azadirachta indica* or *Melia azadirachta*
Leguminosae: Papilionoideae: *Butea monosperma* or *Tephrosia* spp.
Caesalpinioideae: *Senna* spp. or *Bauhinia* spp.
Mimosoideae: *Acacia nilotica*
Combretaceae: *Combretum indicum*(*Quisqualis indica)* or *Terminalia* spp.
Cucurbitaceae: *Coccinia indica* or *Diplocyclos pamatus.*

GAMOPETALAE: Rubiaceae: *Oldenlandia umbellata*
Compositae/**Asteraceae:** *Blumia* spp. or *Eclipta prostata*
Apocynaceae: *Catharanthus pusillus*
Convalvulaceae: *Evolvulus alisinoides* or *Ipomoea aquatica*
Solanaceae: *Datura* spp. or *Solanum* spp.
Acanthaceae: *Barleria prionotis, B. cristata*
Verbenaceae: *Vitex negundo* or *Lantana camara*
Lamiaceae: *Ocimum* spp.

MONOCHLAMYDAE: Amaranthaceae: *Achyranthus aspera* or *Amaranthus* spp.
Euphorbiaceae/Phyllanthaceae: *Phyllanthus amarus* or *Jatropha* spp.

LILIOPSIDA (Monocotyledonae)
Scitamineae: Cannaceae: *Canna indica*

- Study of flora of University/College campus
- Students should submit 75 herbarium specimens of common wild plant taxa along with field visit note book
- Construction of taxonomic keys
- Nomenclatural exercise

ECONOMICS BOTANY

I) Creals & millets rice wheat, maize, jawar & bajra
ii) pulses: redgram, blackgram and bengal gram
iii) vegtables: cabbage, califlower, spinch, brinjal bhendi snake groud, tomato, carrot, yams, sweet potato
iv) Fruits:mango, citrus, banana, pineapple
v) Gums, resimo & latex: gum arabic, asafoctida, amber, terpentine and rubber

PROBLEMS ON BIOSTATISTICS:

1) Measures of central tendencies: Mean, Median and Mode
2) Standard deviation (SD) and variance, coefficient variance (CV)
3) Tests of significance: 't' test and Chi-square test
4) Correlation of variance (ANOVA)

For Major questions:
The student has to generate data from the given plant material and apply measures of central tendencies, SD & CV to the solve the problem and interpret the results.

For Minor questions:
Problem-1: Calculate the mean, the variance, the standard deviation and the coefficient of variation from the recorded on the number of pods per plant in *Cymopsis tetragonoloba*
No of pods:

Sample A	40	46	47	39	42	54	50	49	40	41
Sample B	46	51	49	40	41	49	60	61	55	49

Problem-2: Calculate the mean, the variance, the standard deviation and the coefficient of variation of the following distribution

X	2	4	6	9	11	6	5	3
F	21	24	27	31	35	20	17	11

Problem-3: The following data were recorded on a number of fertile branches per plant and a
number of pods per plants in one of the variance of lentil. Calculate the correlation coefficient and test its significance

No of fertile branches	8	10	15	11	12	9	13	14	10	9
No of pods	45	55	70	80	65	70	90	90	76	67

Problem-4: Data recorded on the length of panicle and the number of grains per panicle in a variety of rice. Calculate the correlation coefficient and find out its level of significance

Length of panicle	10.5	12.0	15.5	12.5	15.0	11.0	16.0	14.0	16.5	13.5
No. of grains	75	80	85	108	110	85	105	110	112	107

Problem-5: In a Jojoba (*Simmondsia chinensis*) population, there are 525 female plants and 475 male plants. Calculate the χ^2 and interpret your results.

Problem-06: Number of tubers per plant was recorded in two strains of potato. Compare the results of two strains and give your conclusions.

Strain-1: 13 10 18 11 17 12 16 13 15 14 17 16 10 11 12 15 14 13 13 11 17 12 15 13 14 12 15 14 14 14 15 13 14 14

Strain-2: 21 16 15 24 16 23 22 17 19 18 21 20 16 17 23 21 20 15 19 20 18 22 17 24 19 19 20 20 19 19 22 22

Problem- 07: Following in the data recorded on nitrate content of water (mg/1) from two lakes. Analyze the data and show whether the two lakes are significantly different in nitrate content

Samples	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Lake 1	0.62	0.87	0.54	1.36	0.87	0.62	1.24	1.36	1.10	1.24
Lake 2	0.79	1.68	1.59	0.99	1.61	1.49	1.39	1.24	1.24	1.86

TECHNIQUES IN PLANT BIOLOGY

1) Separation and identification of amino acids by paper chromatography
2) Separation of pigments by paper chromatography
3) Separation and identification of sugars by TLC

SPOTTERS:

1) pH meter
2) Electron microscope (SEM / TEM)
3) High Performance Liquid Chromatography(HPLC)
4) Fluorescent Microscope
5) Spectrophotometer
6) Polyacrylamide gel (PAGE)
7) Microvave Oven

SEMESTER-I

MODEL QUESTION PAPER (PRACTICAL)

PAPER-II: SYSTEMATICS OF MAGNOLIOPHYTA AND ECONOMIC BOTANY (AND) ANALYTICAL TECHNIQUES, BIOSTATISTICS, AND ELTSNO BOTANY

Time: **4 hours** *Max.Marks*: **100**

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1) Describe the technical terms, draw the floral diagram and write floral formula of the given plant material (A) 20

2) Construct a key for the given 4 twigs (B) 10

3) Identify to the level of species using the flora for the given plant material (C) and (D) 14

4) Problem / Perform experiment 10

5) Slides and Specimens (8x3) = 24

F= Herobarium Skills

G= Economic Botany(Type of Fruit)

H= Creal / Millet/ Gum

I= Herborium Specimens

J= Analytical Technique

K= Analytical Technique

L= Ethnicfood

M= Ethno medicine / ethno veterinary medicine

6) Record + Herbarum + Field Note Book 16

7) Viva-voce 06

SEMESTER-II

THEORY SYLLABUS

Paper-I (BOT-201): CELL BIOLOGY, GENETICS AND CYTOGENETICS

Unit-I: CELL BIOLOGY

1. Chromosome: Structural details of Chromosomes of Prokaryotes and Eukaryotes.
2. Models of organization of Eukaryotic chromosomes. Types of special chromosomes: Lampbrush and Polytene.
3. Chromosome Banding: Q, C, G & R Banding. Cytological Techniques: Flow Cytometry, FISH and GISH.

Unit-II: GENETICS

1. Mendelian Laws of Inheritance – An overview; Linkage and Crossing-Over, Chromosomal mapping (Two-Point and Three-Point Mapping).
2. Multiple Allelism, Intergenic Interactions and failure of dominance.
3. Population Genetics – Hardy Weinberg's Law.

Unit-III: CYTOGENETICS-I

1. Mutations; Physical and Chemical Mutagens, Molecular Basis of Gene Mutations.
2. Transposable Elements- AC-DS System in Maize.
3. DNA Damage and Repair Mechanisms- Direct Repair, Mismatch Repair and SOS Repair, C–Value paradox. Ames Test.

Unit-IV: CYTOGENETICS-II

1. Structural Alterations in Chromosomes – Deletions, Duplications, Inversion and Translocation (Robertsonian Translocations).
2. Numerical Changes in Chromosomes: Aneuploids and Euploids; Cytogenetics of Aneuploids, Autopolyploids and Allopolyploids.
3. Chloroplast and Mitochondrial Genomes. Genome study in Rice.

Suggested Readings:

1) Lewin. B. 2000. Genes VII. Oxford University Press, New York.
2) Gupta. P.K. 1995. Cytogenetics. Rastogi & Co., Meerut.
3) Glick. B.R. & Thompson. J.E. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boc Raton, Florida.
4) Sybenga. J. 1973. General Cytogenetics. American Elsevier Pub. Co., New York.
5) Swanson, Merz & Young. 1967. Cytogenetics. Prentice Hall India.
6) Lewis. K.R. & John. B. 1963. Chromosome Marker. J & A Churchill Co., London.
7) Alberts. B., Breyer. D., Hopkin. K., Johnson. A.D., Lewis. J., Raff M., Roberts. K. & Watter. P. 2014. Essential Cell Biology. 4th Edition. Garland Publishers, New York.
8) Karp. G. 2013. Cell and Molecular Biology – Concepts and Experiments. 7th Edition. Wiley Global Education, USA.
9) Alberts. B., Johnson. A., Lewis. J., Raff. M., Roberts. K., & Walker. P. 2007. Molecular Biology of the Cell. 5th Edition. Garland Publishers, New York.
10) Schaffer. S.W. 2007. Mitochondria: The Dynamic Organelle. 1st Edition. Springer Verlag.
11) Wilson. J., & Hunt. T. 2007. Molecular Biology of the Cell. 5th Edition. The Problems Book. 2nd Edition. Garland Publisher, New York.
12) Celis. J.E. (Ed.). 2006. Cell Biology: A Laboratory Hand Book. 3rd Edition. Elsevier, USA.
13) Lodish. H., Berk. A., Kaiser. C.A., Kreiger. M., Scott. P.M., Bretcher. A., Ploegh. H., & Matsudaira. P. 2004. Molecular Cell Biology. 5th Edition. W.H. Freeman and Co., New York.
14) Kleinsmith. L.J. & Kish. V.M. 1995. Principles of Cell and Molecular Biology. 2nd Edition. Harper Collins College Publishes., New York, USA.
15) Powar. C.B. Cell Biology.
16) Singh. R.J. 2014. Plant Cytogenetics. 2nd Edition. CRC Press, India.
17) William. K., Cummings. S., Spencer. M.R., & Charlotte. A. 2013. Essentials of Genetics. Pearson Books, Delhi.
18) Hartwell L. 2011. Genetics: From Genes to Genomes, Study Guide and Solution Manual. 4th Edition. Nero.
19) Bass. H. & Birchler. J. 2011. Plant Cytogenetics: Genome Structure and Chrmosome Function. Springer, New York.
20) Russel. P.J. 2009. Genetics – A Molecular Approach. 3rd Edition. Pearson Benjamin Cummings, San Francisco, USA.
21) Roy. D. 2009. Cytogenetics. Alfa Science International Ltd., UK.
22) Gupta. P.K. 1995. Cytogenetics. Rastogi & Co., Meerut.
23) Sybenga. J. 1992. Cytogenetics in Plant Breeding. Springer London Ltd.
24) Swanon. M. & Young. 1982. Cytogenetics. Prentice Hall, India

SEMESTER-II

THEORY SYLLABUS

PAPER-II (BOT-202): ECOLOGY, PHYTOGEOGRAPHY AND EVOLUTION

Unit-I: ECOSYSTEM ORGANISATION

1. Structure and Function: Energy flow and mineral cycling (CNP) primary production and decomposition. Structure and function of some Indian ecosystems; Errestrial (forest, grass land) and aquatic (fresh water marine, estuarine)
2. Global Biogeochemical Cycles of Carbon, Nitrogen, Phosphorous and Sulphur.
3. Ecological Succession: Mechanisms, Sub-Climax theory. Homeostasis and Self-regulation, Raman Margalef's Model of Ecological succession.

Unit-II: ENVIRONMENTAL HAZARDS AND MANAGEMENT

1. Pollutants, kinds Air, water, Soil, Sound, Heavymetal pollution, Effects on plants and Ecosystems. Strategies for pollution waste water treatment.
2. Ozone Depletion, Acid rains, UV radiation and their effects; Green House gases Global warming Impact on plant and Ecosystem, restoration.
3. Eutrophication and Biomagnifications. Bioremediation .

Unit-III: PHYTOGEOGRAPHY

1. Introduction, Principles, Theory of Tolerance, Theory of Continental Drift and Plate Tectonics.
2. Endemism- Endemic Plants of India. Major Terrestrial Biomes.
3. Phytogeographical Zones of India

Unit-III: EVOLUTION

1. Origin of Life, Theories of organic evolution – Lamarckism and Darwinism. Fitness and Natural Selection.
2. Mechanisms of Speciation, Genetic Polymorphism and Selection.
3. Molecular Evolution: Molecular Divergency- Protein and Nucleotide Sequence Analysis, Molecular Clocks. Origin and Evolution of Cultivated Plants with special reference to Paddy and Wheat.

Suggested Readings:

1) Alan Beebay & Anne-Maria Brennan. 2008. First Ecology. 3rd Ed. Oxford University Press.
2) Ambasht. R.S. & Ambasht. N.K. A Textbook of Plant Ecology. CBS Publishers & Distributers, New Delhi.
3) Begon Michael, Colin Townsend & John. L. Harper. 2005. Ecology, From Individuals to Ecosystems. 4th Ed. Black Well Publishing, Oxford.
4) Cain, S.A. 1944. Foundations of Plant Geography. Harper & Bros, NY. 4. Good, R.D. 1974. The Geography of flowering Plants. 3rd edition, Long Mans, London.
5) Dash. M.C. 2009. Fundamentals of Ecology. Tata McGraw Hill Pub., New Delhi.
6) Eddy Van Der Maarel & Janet Franklin. 2012. Vegetation Ecology. 2nd Ed. Wiley-Blackwell.
7) Ernst-Detlef Schulze, Erwin Beck, Klaus Muller-Hohenstein. 2010. Plant Ecology. Springer, Berlin.
8) Freeman Dyson 1999,Origin of Life, Cambridge University Press
9) Girard, James. 2014. Principles of Environmental Chemistry. 3rd Ed. Jones & Bartlett.
10) Magurran. A.E. 1988. Ecological Diversity and its Measurement. Croom Helm, UK.
11) Manuel. C. Molles Jr. 2013. Ecology – Concepts and Applications. 6th Ed. McGraw Hill.
12) Moore P.D. & Chapman. S.B. 1986. Methods in Plant Ecology. Blackwell Scientific, Oxford, UK.
13) Odum. E.P. & Gary W. Barrett. 2005. Ecology. Thomson Brooks / Cole, Singapore.
14) Odum. E.P. 1971. Fundamentals of Ecology. W.B.Saunders, Philadelphia.
15) Paul Davies , 2003 Origin of life, Penguin Publishers, UK
16) Richard T. Wight & Boorse. D.F. 2013. Environmental Science: Towards a Sustainable Future. 12th Ed. Benjamin-Cummings.
17) Ricklefs. R.E. & Gary L. Miller. 2000. Ecology. 4th Ed. W.H.Freeman & Co., New York.
18) Sharma. P.D. 2015. Ecology and Environment. Rastogi Publications, Meerut.
19) Smith. R.L. 1996. Ecology and Field Biology. Harper Collins, New York.
20) Stiling. P. 2002. Ecology, Theory and Applications. Prentice-Hall of India, New Delhi.
21) Symposium on Origin and Phytogeography of Angiosperms 1974. BSIP Publication
22) Teresa Andesirk, Gerald Audesirk and Bruce, E. Byers. 2003. Biology-Life on Earth. 6th edition. Prentice Hall University of Massachusetts, Amherst.
23) Tom Hennigan & Jean Lightner. 2013. The Ecology Book. Master Books.
24) Valentine, D.H. 1972. Taxonomy, Phytogeography and Evolution. Academic Press, London. New York.
25) Webber, P and Punnett, N. 1999. Physical geography and people Stanley. Thomas (Pub) Ltd. England.

SEMESTER-II

THEORY SYLLABUS

PAPER-III (BOT-203): PLANT DEVELOPMENT AND REPRODUCTIVE BIOLOGY

Unit-I: MERISTEMS, TISSUE SYSTEM AND ANATOMY

1. Meristems: Types and Organisation of Shoot and Root Apical Meristems.
2. Epidermal, Ground and Vascular Tissue Systems. Ultrastructure of Xylem and Phloem.
3. Stem: Anatomy of Node, Primary Structure and Normal and Anomalous Secondary Growth. Eg:- Dracaena, Boehharvia, Bignonia.

Unit-II: MORPHOGENESIS

1. Symmetry and Polarity – General Account.
2. Speed Germination and Seeding growth: Metabolic activities during seed germination and seedling development, Hormonal control of seedling growth.
3. Vascular Tissue Differentiation: Wood development in relation to Environmental Factors.

Unit-III: EMBRYOLOGY – I

1. Male Gametophyte: Anther wall, Microsporogenesis and Pollen development: Pollen Morphology (incl. SEM and TEM).
2. Pollination and types; Pollen Storage, Viability, Pollen Allergy
3. Female Gametophyte: Ovule development, Types of Ovules, Megasporogenesis, Development and Ultra-structure of Female gametophyte.

Unit-IV: EMBRYOLOGY - II

1. Pollen- Pistil Interaction – Fertilization.
2. Fruit and Endosperm development: Nutrition of embryo. Embryogeny, Apomixis and its significance. Experimental Embryology.
3. Seed Development and seed dispersal mechanisms detailed study.

Suggested Readings:

1) Carlquist, S. 1961. Comparative plant Anatomy, Holt, Rinehart & Winston, New York.
2) Faegri, K.A. & Vander Pijl, L. 1971. The Principles of Pollination ecology, Pergamon Press, Oxford, London.
3) Fahn, A. 1990. Plant Anatomy.
4) Iwanami *et.al.,* 1988. Pollen: Illustrations and Scanning Electromicrographs, Spinger-Verlag, Berlin.
5) Johri, B.M. 1984. Embryology of Angiosperms, Springer-Verlag, Berlin.
6) Mauseth, J.D. 1988. Plant Anatomy. The Benjamin Cumminds Publication Co., Inc, Reading.Reading.
7) Raghavan, V. 1976. Experimental embryogenesis in Vascular Plants, Academic Press, London.
8) Shivanna, K.R. & Johri B.M. 1989. The Angiosperm Pollen: Structure and Function, Wiley Eastern Ltd., New Delhi.
9) Shukla, A.K., Vijayaraghavan, M.R. & Chaudhary, B. 1998. Biology of Pollen, APH Publication Company, New Delhi.
10) Wardlaw, C.W. 1968, Morphogenesis in Plants, Methuen & Co., London.

SEMESTER-II

THEORY SYLLABUS

PAPER - IV (BOT-204): MEDICINAL BOTANY AND HORTICULTURE

Unit- I: PLANTS AND MEDICINE – I

1. Introduction, History, Scope and Importance of Indigenous Systems of Medicine.
2. Traditional medicine (AYUSH) Ayurveda, Siddha, Unnai and Homeopathy and Ethnomedicine.
3. Different types of Crude Drugs – Based on Origin and Applications, CIMAP.

Unit - II: PLANTS AND MEDICINE – II

1. Wild and potential Drug-Yielding plants and their therapeutic values with special reference to Sarpagandha, Ashwagandha, Ginger and Vasica.
2. Endangered medicinal plants and their conservation, NBRI, patent laws.
3. Principles of Pharmacognosy - Phytomedicine and applications.

Unit-III: HORTICULTURE- I

1. Introduction, scope for economic development of outdoor, indoor and roof gardens.
2. Applications: Bonsai, floriculture, floral arrangements and bouquet preparation. commercial production of horticultural plants.
3. Horticultural potential in Telangana State: Demand and Supply.

Unit-IV: HORTICULTURE- II

1. Plant growth regulators in Nursery, Types, Role Methods of application and preparation, Nutrients, fertilizers, biofertilizers, soil fertility management and organic farming selection.
2. Vegetative Propagation methods: Cutting, budding, tubers, rhizomes, corms, grafting and layering.
3. Maintenance of Plants: Green house, Mist chamber and Hardening of Nursery Plants. Fruit orchards.

SEMESTER-II

Paper-I (BOT-201): CYTOLOGY, GENETICS AND CYTOGENETICS

Unit-I – CYTOLOGY

1) Chromosomes-Physico-Chemical nature of Chromosomes of Prokaryotes and Eukaryotes

2) Theories and Models of Chromosome Morphology and Structure; Types of Chromosomes-

Lampbrush and Polytene

3) Chromosome Banding: Q, C, G & R Banding

4) Cytological Techniques: Flow Cytometry, FISH & GISH

Unit-II – GENETICS

1) Mendelian Laws of Inheritance -An Overview, Linkage & Crossing-Over, Chromosomal

Mapping (Two-Point and Three-Point Mapping)

2) Multiple Allelism, Intergenic Interactions and failure of dominance

(i) Codominance, (ii) Incomplete dominance, (iii) Lethal genes

3) Genetic Transformation, Conjugation and Transduction in Bacteria

4) Population Genetics – Hardy Weinberg Law

Unit-III – CYTOGENETICS-I

1) Mutagens- Physical and Chemical Mutagens, Molecular Basis of Gene Mutations

2) Transposable Elements- AC-DS System in Maize

3) DNA Damage and Repair Mechanisms – Direct Repair, Excision Repair, Mismatch Repair

and SOS Repair, C-Value paradox

4) Mutagenicity Tests-Ames Test

Unit-IV – CYTOGENETICS-II

1) Structural Alterations in Chromosomes – Deletions, Duplications, Inversion and

Translocation (Robertsonian Translocations)

2) Numerical Changes in Chromosomes – Aneuploids and Euploids; Cytogenetics of

Aneuploids, Autopolyploids and Allopolyploids

3) Genome study in Rice

4) Chloroplast and Mitochondrial Genomes

Suggested Readings:

25) Lewin. B. 2000. Genes VII. Oxford University Press, New York.
26) Gupta. P.K. 1995. Cytogenetics. Rastogi & Co., Meerut.
27) Glick. B.R. & Thompson. J.E. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boc Raton, Florida.
28) Sybenga. J. 1973. General Cytogenetics. American Elsevier Pub. Co., New York.
29) Swanson, Merz & Young. 1967. Cytogenetics. Prentice Hall India.
30) Lewis. K.R. & John. B. 1963. Chromosome Marker. J & A Churchill Co., London.
31) Alberts. B., Breyer. D., Hopkin. K., Johnson. A.D., Lewis. J., Raff M., Roberts. K. & Watter. P. 2014. Essential Cell Biology. 4th Edition. Garland Publishers, New York.
32) Karp. G. 2013. Cell and Molecular Biology – Concepts and Experiments. 7th Edition. Wiley Global Education, USA.
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35) Wilson. J., & Hunt. T. 2007. Molecular Biology of the Cell. 5th Edition. The Problems Book. 2nd Edition. Garland Publisher, New York.
36) Celis. J.E. (Ed.). 2006. Cell Biology: A Laboratory Hand Book. 3rd Edition. Elsevier, USA.
37) Lodish. H., Berk. A., Kaiser. C.A., Kreiger. M., Scott. P.M., Bretcher. A., Ploegh. H., & Matsudaira. P. 2004. Molecular Cell Biology. 5th Edition. W.H. Freeman and Co., New York.
38) Kleinsmith. L.J. & Kish. V.M. 1995. Principles of Cell and Molecular Biology. 2nd Edition. Harper Collins College Publishes., New York, USA.
39) Powar. C.B. Cell Biology.
40) Singh. R.J. 2014. Plant Cytogenetics. 2nd Edition. CRC Press, India.
41) William. K., Cummings. S., Spencer. M.R., & Charlotte. A. 2013. Essentials of Genetics. Pearson Books, Delhi.
42) Hartwell L. 2011. Genetics: From Genes to Genomes, Study Guide and Solution Manual. 4th Edition. Nero.
43) Bass. H. & Birchler. J. 2011. Plant Cytogenetics: Genome Structure and Chrmosome Function. Springer, New York.
44) Russel. P.J. 2009. Genetics – A Molecular Approach. 3rd Edition. Pearson Benjamin Cummings, San Francisco, USA.
45) Roy. D. 2009. Cytogenetics. Alfa Science International Ltd., UK.
46) Gupta. P.K. 1995. Cytogenetics. Rastogi & Co., Meerut.
47) Sybenga. J. 1992. Cytogenetics in Plant Breeding. Springer London Ltd.
48) Swanon. M. & Young. 1982. Cytogenetics. Prentice Hall, India

SEMESTER-II

Paper-II (BOT-202): ECOLOGY, EVOLUTION AND PHYTOGEOGRAPHY

Unit-I – ECOSYSTEM ORGANISATION

1) Structure and Function – Primary Production (Methods of Measurement, Global pattern controlling factors); Energy Dynamics (Trophic Organization, Energy flow, Ecological Efficiencies)
2) Global Biogeochemical Cycles of Carbon, Nitrogen, Phosphorus and Sulphur
3) Ecological succession: Mechanisms of Ecological Succession- Sub-Climax and Climax theories, Stability of ecosystem; Homeostasis and Self-regulation, Margalef's model of Ecological succession
4) Strategy of Ecosystem development, Migration, Ecesis, Aggregation and Colonization

Unit-II – POLLUTION ECOLOGY

1) Kinds, Sources, Quality Parameters; Effects of Pollution on Plants and Ecosystems
2) Ozone Depletion, Acid rains, UV radiation and their Effects; Green House effect
3) Global Climate Change; National Carbon Pool and Carbon Sequestration
4) Eutrophication and Biomagnifications; Bioremediation and Activated sludge

Unit-III – EVOLUTION

1) Origin of life, Theories of organic evolution- Lamarckism, Darwinism, Concept of Variation, Adaptation, Fitness and Natural Selection
2) Mechanisms of Speciation, Genetic Polymorphism and Selection
3) Molecular Evolution: Molecular Divergency-Protein & Nucleotide Sequence Analysis, Molecular Clocks
4) Origin and Evolution of Cultivated Plants – Wheat and Rice

Unit-IV – PHYTOGEOGRAPHY

1) Introduction, Principles, Theory of Tolerance; Theory of Continental Drift and Plate Tectonics
2) Endemism – Endemic Plants of India
3) Biogeography – Major Terrestrial Biomes – Theories of Island Biogeography
4) Phytogeographical Zones of India.

Suggested Readings:

26) Alan Beebay & Anne-Maria Brennan. 2008. First Ecology. 3rd Ed. Oxford University Press.
27) Ambasht. R.S. & Ambasht. N.K. A Textbook of Plant Ecology. CBS Publishers & Distributers, New Delhi.
28) Begon Michael, Colin Townsend & John. L. Harper. 2005. Ecology, From Individuals to Ecosystems. 4th Ed. Black Well Publishing, Oxford.
29) Cain, S.A. 1944. Foundations of Plant Geography. Harper & Bros, NY. 4. Good, R.D. 1974. The Geography of flowering Plants. 3rd edition, Long Mans, London.
30) Dash. M.C. 2009. Fundamentals of Ecology. Tata McGraw Hill Pub., New Delhi.
31) Eddy Van Der Maarel & Janet Franklin. 2012. Vegetation Ecology. 2nd Ed. Wiley-Blackwell.
32) Ernst-Detlef Schulze, Erwin Beck, Klaus Muller-Hohenstein. 2010. Plant Ecology. Springer, Berlin.
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34) Girard, James. 2014. Principles of Environmental Chemistry. 3rd Ed. Jones & Bartlett.
35) Magurran. A.E. 1988. Ecological Diversity and its Measurement. Croom Helm, UK.
36) Manuel. C. Molles Jr. 2013. Ecology – Concepts and Applications. 6th Ed. McGraw Hill.
37) Moore P.D. & Chapman. S.B. 1986. Methods in Plant Ecology. Blackwell Scientific, Oxford, UK.
38) Odum. E.P. & Gary W. Barrett. 2005. Ecology. Thomson Brooks / Cole, Singapore.
39) Odum. E.P. 1971. Fundamentals of Ecology. W.B.Saunders, Philadelphia.
40) Paul Davies , 2003 Origin of life, Penguin Publishers, UK
41) Richard T. Wight & Boorse. D.F. 2013. Environmental Science: Towards a Sustainable Future. 12th Ed. Benjamin-Cummings.

42) Ricklefs. R.E. & Gary L. Miller. 2000. Ecology. 4th Ed. W.H.Freeman & Co., New York.
43) Sharma. P.D. 2015. Ecology and Environment. Rastogi Publications, Meerut.
44) Smith. R.L. 1996. Ecology and Field Biology. Harper Collins, New York.
45) Stiling. P. 2002. Ecology, Theory and Applications. Prentice-Hall of India, New Delhi.
46) Symposium on Origin and Phytogeography of Angiosperms 1974. BSIP Publication
47) Teresa Andesirk, Gerald Audesirk and Bruce, E. Byers. 2003. Biology-Life on Earth. 6th edition. Prentice Hall University of Massachusetts, Amherst.
48) Tom Hennigan & Jean Lightner. 2013. The Ecology Book. Master Books.
49) Valentine, D.H. 1972. Taxonomy, Phytogeography and Evolution. Academic Press, London. New York.
50) Webber, P and Punnett, N. 1999. Physical geography and people Stanley. Thomas (Pub) Ltd. England.

SEMESTER-II

Paper-III (BOT-203): PLANT DEVELOPMENTAND REPRODUCTIVE BIOLOGY

Unit-I – MERISTEMS, TISSUE SYSTEM AND ANATOMY:

1) Meristems, Classification and Types; Organization of Shoot Apical Meristem
2) Simple and Complex tissues: Ultrastructure of Xylem and Phloem
3) Epidermal, Ground and Vascular Tissue Systems – Cambium, Laticifers, Periderm and Lenticels
4) Stem-Anatomy of Node, Primary Structure and Secondary Growth, Annual Rings, Heart wood and Sap wood, Hard and Soft wood, Reaction wood, Anomalous Secondary Growth

Unit-II – PLANT GROWTH AND DEVELOPMENT:

1) Introduction to Plant Growth and Development.
2) Seed Germination and Seedling growth: Metabolic activities during Seed Germination and Seedling Development, Hormonal control of Seedling Growth
3) Vascular Tissue Differentiation: Wood development in relation to Environmental Factors
4) Symmetry and Polarity – General Account

Unit-III – EMBRYOLOGY-I

1) Male Gametophyte: Anther wall, Microsporogenesis and Pollen development: Pollen Morphology (incl. SEM and TEM), NPC system
2) Pollen Storage, Viability, Pollen in Air; Pollen Allergy
3) Female Gametophyte: Ovule development, Types of Ovules, Megasporogenesis, Development and Ultra-structure of Female Gametophyte
4) Pollination: Biotic and Abiotic systems

Unit-IV – EMBRYOLOGY-II

1) Fertilization, Endosperm development: Nutrition of embryo; Embryogeny, Apomixis and Experimental Embryology
2) Anther and Embryo culture
3) Pollen-Pistil Interaction – Seed and Fruit development
4) Applications of Palynology

Suggested Readings:

11) Carlquist, S. 1961. Comparative plant Anatomy, Holt, Rinehart & Winston, New York.
12) Faegri, K.A. & Vander Pijl, L. 1971. The Principles of Pollination ecology, Pergamon Press, Oxford, London.
13) Fahn, A. 1990. Plant Anatomy.
14) Iwanami *et.al.*, 1988. Pollen: Illustrations and Scanning Electromicrographs, Spinger-Verlag, Berlin.
15) Johri, B.M. 1984. Embryology of Angiosperms, Springer-Verlag, Berlin.
16) Mauseth, J.D. 1988. Plant Anatomy. The Benjamin Cumminds Publication Co., Inc, Reading.Reading.
17) Raghavan, V. 1976. Experimental embryogenesis in Vascular Plants, Academic Press, London.
18) Shivanna, K.R. & Johri B.M. 1989. The Angiosperm Pollen: Structure and Function, Wiley Eastern Ltd., New Delhi.
19) Shukla, A.K., Vijayaraghavan, M.R. & Chaudhary, B. 1998. Biology of Pollen, APH Publication Company, New Delhi.
20) Wardlaw, C.W. 1968, Morphogenesis in Plants, Methuen & Co., London.

SEMESTER-II

PAPER - IV (BOT-204): MEDICINAL BOTANY AND HORTICULTURE

Unit- I: PLANTS AND MEDICINE – I

4. Introduction, History, Scope and Importance of Indigenous Systems of Medicine.
5. Traditional medicine (AYUSH) Ayurveda, Siddha, Unnai and Homeopathy and Ethnomedicine.
6. Different types of Crude Drugs – Based on Origin and Applications, CIMAP.

Unit - II: PLANTS AND MEDICINE – II

4. Wild and potential Drug-Yielding plants and their therapeutic values with special reference to Sarpagandha, Ashwagandha, Ginger and Vasica.
5. Endangered medicinal plants and their conservation, NBRI, patent laws.
6. Principles of Pharmacognosy - Phytomedicine and applications.

Unit-III: HORTICULTURE- I

4. Introduction, scope for economic development of outdoor, indoor and roof gardens.
5. Applications: Bonsai, floriculture, floral arrangements and bouquet preparation. commercial production of horticultural plants.
6. Horticultural potential in Telangana State: Demand and Supply.

Unit-IV: HORTICULTURE- II

4. Plant growth regulators in Nursery, Types, Role Methods of application and preparation, Nutrients, fertilizers, biofertilizers, soil fertility management and organic farming selection.
5. Vegetative Propagation methods: Cutting, budding, tubers, rhizomes, corms, grafting and layering.
6. Maintenance of Plants: Green house, Mist chamber and Hardening of Nursery Plants. Fruit orchards.

Suggested Readings:

1) Ashuthosh Kar 2013, Pharmacognosy and Phytochemistry IInd Ed. New Age International Publishers, New Delhi
2) Biren Shah and Seth AK 2014, Text book of Pharmacognosy & Phytochemistry, Elsevier Health Sciences, India
3) Jarald EE 2010, text book of Pharmacognosy and Phytochemistry a, CBS Publishers and Distributors, New Delhi
4) Khadabadi KH, Bavisker BA & Deere SL, 2014, Pharmacognosy & Phytochemistry a comprehensive approach, Pharmamed Press
5) Kumar GS and Jayveera KN, 2013, A text book of Pharmacognosy and Phytochemistry 1st ed. S .Chand Publishing, Delhi
6) Ruby KM, Rajani Chouhan and Jaya Dwivedi 2014,Phytochemisytry and pharmacology of some Indian medicinal plants ,LAP Lambert, Academic Publishing
7) Horticulture-Principles and Practices" by George Acquaah
8) Introduction to Horticulture" by Kumar N
9) Introductory Horticulture" by Christopher E P
10) Basic Horticulture" by Jitendra Singh
11) Basics of Horticulture" by K V Peter

12) Basics of Horticulture" by Arumugam Vadivel
13) Basic Plant Pathology Methods" by James B Sinclair and Onkar Dev Dhingra
14) Horticulture: A Basic Awareness" by Robert F Baudendistel
15) Hydroponic Basics" by George F Van Patten
16) Basics of Horticulture" by Sharon Pastor Simson and Martha C Straus

SEMESTER-II

PRACTICAL SYLLABUS

Paper-I: CYTOLOGY, GENETICS AND CYTOGENETICS (and) ECOLOGY, EVOLUTION AND PHYTOGEOGRAPHY

----X----

I) PROBLEMS ON CYTOGENETICS:

1) Problems on Inversions
2) Problems on Translocations
3) Problems on Polyploids
4) Problems on Hardy Weinberg law (Population Genetics)

II) CYTOLOGY:

1) Effect of chemical mutagens on dividing cells (Mitosis)
2) Meiotic stages in Onion / Maize flower buds
3) Mitotic Index (MI)
4) Induction of Tetraploidy by using Colchicine

III) Spotters:

1) Chromosomal aberrations
   (a) Chromosomal bridges; (b) Laggards and fragments; (c) Chromosomal breakages; (d) Precocious moments of chromosomes; (e) Unequal separation of chromosomes.
2) Cp-DNA
3) Mt-DNA
4) Karyotype
5) AC-DS system
6) Chromosome models
7) Ames's Test
8) Conjugation
9) Polyploids
10) Molecular Evolution
11) Gene- chips
12) Protein modeling
13) Computer
14) Protein chips
15) DNA data bank

PROBLEMS IN CYTOGENETICS:

Problem-1: Consider an organism with four pairs of chromosomes in standard order, the ends of which we shall label 1-2, 3-4, 5-6, 7-8. Strain-A crossed to the standard strain gives a ring of four plus two bivalents during meiotic prophase. Strain-B crossed to the standard strain also gives a ring of four plus two bivalents. In each of the four situations which follow, explain how a cross of strain A x strain B could produce (a) four bivalent. (b) ring of four two bivalents, (c) two ring of four, (d) ring of six plus one bivalent.

Problem-2: An inversion heterozygote possesses one chromosome in the normal order a b c d e f g h and one in the invented order a b f e d c g h
A four stand double crossover occurs in the f-e and d-c. Diagram and label the first anaphase

Problem-3: Eight regions of a dipteran chromosome are easily recognized cytologically and

labeled a through h. Four different races within this species have the chromosomal orders as
listed. (1) a h b d c f e g, (2) a e d c f b h g, (3) a h b d g e f c, (4) a e f c d b h g
Assuming that each race evolved by a single inversion from another race, show how the four races could have originated.

Problem-4: The European raspberry (*Rubus idaeus*) has 14 chromosomes. The dewberry (*Rubus caesius*) is a tetraploid with 28 chromosomes. Hybrids between these two species are
sterile F1 individuals. Some unreduced gametes of the F1 are functional in backcrosses.
Determine the chromosome number and level of ploidy for each of the following: (a) F1, (b)
F1 backcrossed to *R. idaeus*, (c) F1 backcrossed to *R. Caesius*, (d) chromosome doubling of
F1 (*R. maximus*).

Problem-5: The diploid number of the garden pea is 2n=14. (a) How many different trisomics
coiled be formed, (b) How many different double trisomics could be for formed.

Problem-6: The diploid number of an organism is 12. How many chromosomes would be expected in (a) a monosomic (b) a trisomic (c) a tetrasomic (d) a double trisomic (e) a nullisomic (f) a monoploid (g) a triploid and (h) an autotetraploid.

Problem-7: Given a pericentric inversion heterozygote with one chromosome in normal order
(1 2 3 4 5 6 7) and the other in the inverted order (1 5 4 3 2 6 7 8), diagram the first anaphase
figure when a 4-strand double crossover occurs involving the regions between 4 and the centromere ( ) and between the centromere and 5.

Problem-8: A four-strand double crossover occurs in an inversion heterozygote. The normal
chromosome order is (0 1 2 7 6 5 4 3 8). One crossover is between 1 and 2 the other is 5 and
6. Diagram and label the first anaphase figures.

Problem-9: Diagram and label the first anaphase produced by an inversion heterozygote whose normal chromosome is (o a b c d e f g h) and with the inverted order (o a b f e d c g h),
assume that a two-strand double crossover occurs in the regions c-d and e-f.

Problem-10: Prove the Hardy-Weinberg law by finding the frequency of all possible kinds of
mating the progeny using the symbols below.

	Alleles		Genotypes		
Frequency	A	a	AA	Aa	aa
	p	q	p^2	2pq	q^2

Problem-11: The MN blood group has three phenotypes M, MN and N with the genotypes L^M, L^M, L^M, L^N and L^N, L^N, respectively. In sample of 100 individuals the following members
in the M, MN and N groups were obtained.

Phenotype (Blood group)	**M**	**MN**	**N**	**Total**
Genotype	L^M, L^M	L^M, L^N	L^N, L^N	
No. of individuals	60	30	10	100

Estimate the frequency of L^M and L^N alleles of the gene producing MN blood group in man.

V) ECOLOGY AND PHYTOGEOGRAPHY

a) Major experiments:

1) Estimation of Gross and Net Primary Productivity and Respiratory consumption in aquatic ecosystems.
2) Air Pollution Tolerance Index (APTI) in tree species.
3) Determination of Biochemical oxygen demand (BOD) in sewage water.
4) Study of plant community by determining the frequency, density and abundance of different species, based on the collected data construct frequency diagram and compare it with normal frequency diagram

b) Minor experiments:

1. Determination of accumulated soil enzymes (protease and urease) and soil fertility
2. Estimation of organic matter in agriculture soils.
3. Determination of Chemical Oxygen Demand (COD) in industrial effluents
4. Estimation of eutrophication factors; phosphates and sulphates in degraded and fertile soils.
5. TDS (Estimation of Total Dissolved Solids in a given sample of water)

VI) SPOTTERS:

1. Petrol or Coal (Non-renewable energy)
2. Alcohol (Bioenergy)
3. Hydrophytes
4. Xerophytes
5. Epiphytes
6. Continental drift
7. Phytogeographic region of Telangana

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SEMESTER-II

PRACTICAL SYLLABUS

Paper-II: PLANT DEVELOPMENT AND REPRODUCTIVE BIOLOGY (and) MEDICAL BOTANY AND HORTICULTURE.

I) MAJOR EXPERIMENTS:

a) Plant Development

1) Micrometry for standardization of Microscope.
2) Stomatal Index (SI) for abaxial and adaxial surface of leaf material.
3) *In vitro* pollen germination and tube growth in BK medium at different time periods.

b) Anatomy:

1) Plant fixation, Sectioning and staining including microtome sections.
2) Awareness on SEM.
3) Section cutting:
   a) Structure of Node
   b) 3D structure of wood (TS, RLS, TLS) in Teak and Neem.
4) Anomalous growth (primary): *Boerhaavia*, *Amaranthus*, *Casurina* or *Nyctanthes*.
5) Anomalous Secondary growth: *Aristolochia*, *Leptodenia*, *Strychnos*, *Dracaena*.
6) Vessel less angiosperm, eg. *Michaelia*.

II) MINOR EXPERIMENTS:

1) Histochemical studies of**:**
   (a) Proteins
   (b) Cellulose
   (c) Lignin
   (d) Starch
   (e) Pectins
2) Determination of pollen viability
3) Measurement of Microscopic structure by using Ocular micro meter.
4) Pollen germination by using Hanging drop technique.
5) Dissection of endosperm haustorium

III) SPOTTERS

1. Dimorphism in flowers (Pin & Thrum forms)
2. Callose deposition in Pollen tube
3. Polarity in a single cell
4. Group effects
5. Secretary Tapetum
6. Plasmodia Tapetum
7. Endothecia Thickenings
8. Hypogeal germination
9. Epigeal germination
10. Apical meristem / shoot apex.
11. Bilateral symmetry. Eg; *Opuntia*, *Laminaria*.
12. Dorsi-ventral symmetry .Eg: *Thuja*
13. Ovules slides (whole mounts)
14. Embryo (Heart and Globular)

PALYNOLOGY:

1) Slides of Pollen grains (permanent): *Acacia, Hibiscus, Ipomea, Datura* and Grass

Medical botany and Horticulture

1. **Phytochemical Methods:**
   a) Extraction method (with Soxhlet).
   b) Paper Chromatography: Amino acids and Phenolic constituents.
   c) Electrophoresis: Leaf and Seed Proteins.

2. **Organoleptic study of powder drugs:**
   Cannabis sativa, Cinnamomum zeylanicum, Carum curvi, Senna angustifolia, Curcuma longa, Eugenia caryophyllata, Strychnos Nux-vomica, Rauwlfia serpentina, Santalum album.

3. **Crude phytodrugs and their therapeutic uses:**
   a) *Rauwlfia serpentina* (Drug acting on cardio-vascular system)
   b) *Strychnos Nux-vomica* and *Cannabis sativa* (Drug acting on Central Nervous System (CNS).
   c) *Senna angustifolia* (Drug acting on gastro-intestinal tract)
   d) *Carum curvi* and *Cinnamomum zeylanicum***:** Aromatic, stimulant and carminative culinary purposes and flavoring.
   e) *Curcuma longa, Eugenia caryophyllus, Santalum album***:** Analgesic, antiseptic perfumery, condiment or spice.

1. Identification of commercially important floricultural crops.
2. Propagation technique in Gladiolus/carnation/Petunia.
3. Training and pruning of rose/Jasminum.
4. Drying and preservation of flowers.
5. Preparation of bouquets garland.
6. Identification of pests and diseases of Horticulture products in storage.
7. Study of facilities of storage units and methods of storage.

Spotters:

a)Green house , b) Mist chamber, c) Poly house, d) Micropropagation, e) Callus, f) Pick Axe, g)Kodali, h) Spade, i)Hoe- Cum-Rake, j) Shovel, k)Secateur, l)Hedge Shear.

SEMESTER-II

PRACTICAL MODEL PAPER

Paper-I: CYTOLOGY, GENETICS AND CYTOGENETICS (and) ECOLOGY AND PHYTOGEOGRAPHY

Time: **4 hours** *Max.Marks*: **100**

1) Cytological preparations / Calculate of mitotic index (A) (Cytological preparation include showing different mitotic stages)	15
2) Cytogenetics problem on Inversions / Translocations (B)	15
3) Major experiment from Ecology (C)	20
4) Slides & Specimens (6X5)	30
D E F G H I	
5) Record	14
6) Viva-Voce/ Assignment	06

SEMESTER-II

PRACTICAL MODEL PAPER

Paper-II: PLANT DEVELOPMENT, REPRODUCTIVE BIOLOGY AND PALYNOLOGY (and) MEDICAL BOTANY AND HORTICULTURE

Time: **4 hours** *Max.Marks*: **100**

1) Conduct the given experiment and interpret the results section cutting (A)	15
2) Invitro Pollen germination - (B)	15
3) Experiments from Medical botany and Horticulture (C) & (D)	20
4) Slides and Specimens (6X5) E F G H I J	30
5) Record	14
6) Viva-Voce/ Assignment	06