

**UNIVERSITY OF RAJASTHAN
JAIPUR**

SYLLABUS

M.Sc. Botany

Semester Scheme

IInd Semester Exam June 2017

[Signature]
Registrar
(Academic)
University of Rajasthan
JAIPUR

SECOND- SEMESTER June 2017

S. No.	SUBJECT CODE	Course Title	Course Category	Credit	Contact hours per week			EoSE duration (Hrs.)	
					L	T	P	Theory	P
1.	BOT 801	Pteridophytes, Gymnosperms and Paleobotany	CCC	4	4	0	0	3	0
	BOT 802	Genetics and Plant Breeding	CCC	4	4	0	0	3	0
	BOT 803	Plant Physiology and Biochemistry	CCC	4	4	0	0	3	0
	BOT 811	Practical- General (Based on BOT 801, BOT 802 & BOT 803)	CCC	6	0	0	9	0	6
	BOT A01	Advanced Plant Pathology	ECC	4	4	0	0	3	0
	BOT B01	Seed Pathology	ECC	4	4	0	0	3	0
	BOT C01	Morphogenesis & Experimental Biology	ECC	4	4	0	0	3	0
	BOT D 01	Advanced Plant Biosystematics	ECC	4	4	0	0	3	0
	BOT A11	Prac-A01	ECC	2	0	0	2	0	4
	BOT B11	Prac-B01	ECC	2	0	0	2	0	4
	BOT C11	Prac-C01	ECC	2	0	0	2	0	4
	BOT D11	Prac-D01	ECC	2	0	0	2	0	4

* Elective lab can be opted only if the respective Elective theory has been opted by the student

Registrar
(Academic)
University of Rajasthan
JAIPUR

BOT 801: Pteridophytes, Gymnosperms and Paleobotany

Pteridophytes: Distribution, classification by International Committee of Botanical Nomenclature (ICBN), Economic importance of Pteridophytes.

General account of fossil Pteridophytes, Psilopsida, Lycopsida, Sphenopsida and Pteropsida classes.

Morphology, anatomy, reproduction, classification, life history of: *Tmesipteris*, *Lycopodium*, *Gleichenia*, *Isoetes*, *Ophioglossum* and *Azolla*.

Origin and evolution of stele, heterospory and seed habit. **20 hrs**

Gymnosperms: Distribution, morphology, anatomy, reproduction; classification, life history and evolution. Cycadales (*Zamia*), Ginkgoales (*Ginkgo*), Coniferales (*Pinus*, *Taxus*, *Araucaria* and *Biota*), Welwitschiales (*Welwitschia*), Gnetales (*Gnetum*).

20 hrs

Paleobotany: History of paleobotany, formation and types of fossils, techniques of study of fossils, Geological time scale. Brief account of Pteridospermales (*Lygenopteris*, *Medullosa*, *Caytonia* and *Glossopteris*). Brief account of Cycadeoidales (Cycadeoidea), Cordaitales (Cordaites).

Paleobotany and the evolution of vascular plants.

Applied aspects of paleobotany, use in coal and petroleum exploration. **20 hrs**

Suggested Laboratory Exercises:

Morphological and anatomical study of representative members of Pteridophytes and Gymnosperms in their natural habitat found in your locality with special reference to, *Lycopodium*, *Isoetes*, *Gleichenia*, *Ophioglossum* and *Azolla* in Pteridophytes.

Zamia, *Ginkgo*, *Pinus*, *Taxus*, *Araucaria*, *Biota* and *Gnetum* in Gymnosperms.

Collection and study of fossils.

Suggested Readings:

1. Parihar, N.S. 1996. Biology & Morphology of Pteridophytes. Central Book Depot, Allahabad.
2. Sporne, K.K. 1991. The Morphology of Pteridophytes. B.I. Publishing Pvt. Ltd., Bombay.
3. Stewart, W.N. and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press, UK.
4. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms. New Age International Pvt. Ltd., New Delhi.
5. Singh, H. 1978, Embryology of Gymnosperms, Encyclopaedia of Plant Anatomy X. Gebruder Borntraeger, Berlin, Germany.
6. Smith, G.M. 1955. Cryptogamic Botany Vol II Tata McGraw Hill Book Co, NY.
7. Pandey, B.P. 1993. College Botany. Vol. II. S. Chand and Company Ltd., New Delhi.

- 8 Arnold, Chester, A. 2000. An Introduction to Paleobotany. Agrobios, (India).
 9 Rashid.A.2001.An introduction to Pteridophyta(II edition). Vikas publishing house, Pvt. Ltd., New Delhi.
 10 Sunderrajan,S (2007), Introduction to Pteridophyta, New Age International Publishers, New Delhi.

BOT 802 : Genetics and Plant Breeding

Gene structure and expression: Concept and structure of gene, cis-trans test, operon concept, fine structure and analysis of eukaryotes gene. Genome organization in eukaryotes, intron and its significance, gene family. 6

Inheritance and allelism: Mendelian and non Mendelian inheritance, Co-dominance, incomplete dominance. Gene interactions: Complementary genes, Supplementary genes, Epistasis, Duplicate genes, Polygenic inheritance, Pleiotropy, Multiple alleles and human blood group. Extra nuclear inheritance: Inheritance of mitochondrial and chloroplast genes, cytoplasmic male sterility, Sex determination mechanism, sex linked inheritance, sex limited characters, sex reversal, phenocopy and genomic imprinting. 10

Genetic recombination: Homologous and non homologous recombination, independent assortment, crossing over; Molecular mechanism of recombination, Holiday junction, site specific recombination, FLP/FRT and Cre/lox recombination, role of RecA and RecBCD enzymes 6

Mutations and mutagenesis: Types of mutation: Spontaneous and induced mutations, lethal, conditional, biochemical, loss and gain of function, base substitution, frame shift mutation, germinal verses somatic mutation, physical and chemical mutagens and their effect, Ames test. Mutagenesis: Inspectional mutagenesis by transposons, site directed mutagenesis, in-vitro mutagenesis and deletion technique. 9

Chromosome mapping: Linkage maps, tetrad analysis, mapping with genetic markers, QTL mapping, construction of molecular maps, restriction mapping, correlation of genetic and physical maps; mapping by using somatic cell hybrids. 6

Structural and numerical alteration in chromosome: Origin, meiosis and breeding behavior of duplication, deficiency, inversion and translocation heterozygote. Origin, occurrence, production and meiosis of haploids, aneuploids and euploids. Induction and characterization of monosomics and trisomics; Origin, production and meiosis of autopolyploids and allopolyploids; Evolution of major crop plants. 9

Molecular cytogenetics: Nuclear DNA content, C value paradox, cot curve and its significance, multigene families and their evolution, in situ hybridization – concept and technique, computer assisted chromosome analysis, chromosome microdissection and microcloning, flow cytometry 8

and confocal microscopy in karyotype analysis. An idea about Proteomics, Genomics and Epigenomics.

Genetic system and breeding method: Selection and breeding strategies for self pollinated, cross pollinated and clonally propagated crop plants, breeding for crop quality, biotic and abiotic stresses, gene pyramiding for multitrail incorporation. Genetic control and manipulation of breeding systems including male sterility and apomixes.

6

Practical

1. Problems related to linkage, crossing over and gene interaction
2. Problems related to gene mapping
3. Linear differentiation in Chromosome through banding technique
4. Isolation of chlorophyll mutants following irradiation and treatment with chemical mutagen
5. Quantitative estimation of DNA by diphenylamine method
6. Karyotype analysis
7. Induction of polyploidy
8. To study the application of colchicines treatment.
9. Selfing and crossing technique
10. Demonstration of flow cytometry and confocal microscopy
11. Presentation of chart and models related to syllabus
12. Any other exercise based on theory syllabus

Suggested reading

- Benjamin Lewin (2000). Genes VII. Oxford university press.
- Gardner E J, Simmons M J, Snustad D P (1991). Principles of Genetics (III Edn). John Wiley and Sons Inc.
- Snustad D P, Simmons M J (2000). Principles of Genetics (III Edn). John Wiley and Sons.
- Strickberger (2005). Genetics (III Edn). Prentice Hall of India Pvt. Ltd.
- William S Klug, Michael R Cummings (1994). Concepts of Genetics. Prentice Hall.
- Robert J Brooker (2009). Genetics: Analysis and principles (III Edn). McGraw Hill.
- Daniel L Hartl, Elizabeth W Jones (2009). Genetics: Analysis of genes and genomes (VII Edn). Jones and Bartlett publishers.
- D Peter Snustad, Michael J Simmons (2010). Principles of genetics (V Edn). John Wiley and Sons.
- Acquah G (2007). Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd. USA.
- Hartl DL and Jones EW (2007). Genetics – Analysis of Genes and Genomes, 7th edition, Jones and Bartlett publishers.
- Hartwell LH, Hood L, Goldberg ML, Reynolds AE, Silver LM, Veres RC (2006). Genetics – From Genes to Genomes, 3rd edition, McGraw Hill.

Dr. Registrar
(Academic)
University of Rajasthan
JAIPUR
5

- Lewin B (2008). Genes IX, Jones and Barlett Publishers.
- Singh RJ (2002). Plant Cytogenetics, 2nd edition, CRC Press.
- Strickberger MW (2008). Genetics, 3rd Edition, Pearson (Prentice Hall).
- Weising K, Nybom H, Wolff K and Kahl G (2005) DNA Fingerprinting in Plants

BOT 803: Plant Physiology and Biochemistry

Water relations to plants: Properties of water, properties of Solutions, Chemical potential, water potential, Soil- Plant- Atmosphere continuum, Transpiration, Stomatal regulation of transpiration, Antitranspirants. Translocation of water and solute, mechanism of water transport Cohesion- Tension theory, Pressure flow model.

Membrane transport: Passive non-mediated transport, Nernst equation, passive mediated transport, ATP- drive active transport, ion channels.

Mineral nutrition: macro and micro nutrients and their role in plants.

15Hrs

Biomolecules: General structure, classification, properties, distribution and functions of primary metabolites(carbohydrates, proteins, amino acids, lipids) and secondary metabolites (flavonoids, alkaloids, steroids).

Enzymes- Discovery and nomenclature, characteristics of enzymes. Concept of holzymes, apozymes, coenzyme, ribozyme, abzyme and artificial enzyme. Regulation of enzyme activity, mechanism of action. Michaelis-Menten equation,

15Hrs

Carbohydrate metabolism: Synthesis of carbohydrates: Photosynthetic pigments, absorption and transformation of radiant energy, (Light harvest complex LHC) photo-oxidation, Red drop effect, Emerson enhancement effect, Photosynthetic quantum yield, Photorespiration, CAM, impact of changing environment effect , Photosynthetic, Industrial Photosynthesis, Allocation, translocation and partitioning of photoassimilate.

Degradation of Carbohydrate: Glycolysis, Krebs cycle, Electron Transport System(ETS) and its evolution, Pentose phosphate pathway, Hexose monophosphate shunt, glyoxylate pathway, Glycogenesis, gluconeogenesis, Respiratory inhibitors, High energy compounds, their synthesis and utilization.

15Hrs

N₂ metabolism – N₂ fixation symbiotic and asymbiotic, Nodule development Amino Acid Metabolism.

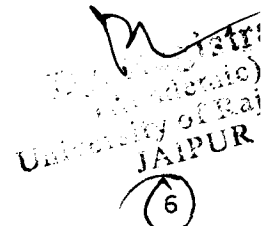
Fat metabolism: Synthesis of long chain fatty acids, lipid biosynthesis, & oxidation.

Plant growth regulators: Chemical nature, bioassay, physiological effects and mode of action of Auxins, Gibberelins, cytokinines, abscisic acid and ethylene, Salicylic Acid Strigolactones, Jasmonic Acid

15 Hrs

Practical exercises:-

1 Effect of temperature and different solvents on membrane permeability of beet root.



- 2 Study of stomatal regulation.
- 3 Estimation of lipids
- 4 Separation of chlorophyll by paper chromatography.
- 5 Separation of amino acids by paper chromatography.
- 6 Separation of chlorophyll by liquid-liquid chromatography.
- 7 Test of phenols, steroids alkaloids and terpenoids.
- 8 Isolation of VAM fungi.
- 9 Determination of amylase activity.
- 10 Separation of aliphatic wax components by thin layer chromatography (TLC)
- 11 Isolation of root nodule bacteria from roots of legume plant.
- 12 Quantification of protein in given plant sample.
- 13 Demonstration of Physiological effects of growth regulator.
- 14 Quantification of carbohydrates in given sample.
- 15 Demonstration of plasmolysis in Rheo discolor leaf peel.
- 16 The effect of temperature on enzyme activity.
- 17 The effect of pH on enzyme action.
- 18 To determine total soluble carbohydrates in given plant material.
- 19 To determine proline in given plant material.

Suggested readings

1. Taiz L and Zeiger E. (2006) Plant Physiology, 4th Edition, Sinauer Associates Inc. Publishers, Massachusetts, USA.
2. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology. Asia Ltd. Singapore.
3. Devlin, R.M. and Witham, F.H. 1986. Plant Physiology, 4th Ed. CBS Pub. Delhi.
4. Verma, S K. A Textbook of Plant Physiology, Biochemistry & Biotechnology. S. Chand & Co. 768 pages
5. Hopkins WG & Huner NPA. 2004. Introduction to Plant Physiology. John Wiley & Sons
6. Voet, D and Voet J.G. 1995. Plant Biochemistry, John Wiley, New York.
7. Lehninger, A.L. 1982. Principles of biochemistry, CBS Publication

Dr. Rajiv Kumar
(Assistant Professor)
University of Rajasthan
JAIPUR ⑦

Elective Paper

BOT (A01) : Advanced Plant Pathology

- **Disease Development:** Biotic and Abiotic factors in pathogenesis Penetration and Modes of infection. 7 H
- **Management of Plant disease:** Physical ,Chemical and Biological Biopesticides, Plant Disease Clinics, Plant Disease epidemiology and plant disease forecasting 8H
- **Disease Control :**Immunizing the host, Disease control by transgenic, Pollen Management and Integrated Pest Management 7H
- **Breeding for disease resistance-**Types of resistance (basal resistance, systemic resistance , acquired resistance) Production of disease resistant plants 8H
- **Molecular Plant Pathology:** Molecular diagnosis, Identification of genes and specific molecules in disease development, Genetics of host pathogen interaction. Molecular mechanism of resistance and Biotechnological approaches for disease 10H

Symptomolgy, Identification and Control of Following Plant Diseases: 20H

Fungal diseases:

Wheat - Flag smut, Karnal bunt.

Rust of Linseed

Viral diseases:

Cadang –Cadang disease of Coconut

Leaf Curl of Tomato

Nematode disease:

Root Knot of Brinjal,

Ear Cockle of Wheat

Non-Parasitic Diseases

Black Heart of Potato

Mango necrosis

Suggested Practical :-

- Isolation of antibiotic resistant colonies by antibiotic disc method / gradient plate method.
- Hanging drop method.
- Grams stain for different bacteria
- Negative staining technique of bacteria
- Determination of growth curve of bacteria
- Identification of fungal cultures
- Isolation of microorganism from soil
- Study of following disease

[Signature]
Registrar
(Academic)
University of Rajasthan
JAIPUR

- **Fungal diseases:**
- Wheat - Flag smut, Karnal bunt.
- Rust of Linseed
- **Viral diseases:**
- ,Cadang –Cadang disease of Coconut
- Leaf Curl of Tomato
- **Nematode disease:**
- Root Knot of Brinjal,
- Ear Cockle of Wheat
- **Non-Parasitic Diseases**
- Black Heart of Potato
- Mango necrosis

Recommended Books:

1. Agrios, G.N. 2005. Plant Pathology, 5th edition. Academic Press, New York, USA.
2. Alexopoulos, C.J., C.W. Mims and M. Blackwell. 1996. Introductory Mycology. 4th edition, John Wiley and Sons, Inc., New York, USA
3. Khan, J.A. and J. Dijkstra. 2002. Plant Virus as Molecular Pathogens. The Haworth Press Inc. USA.
4. Mehrotra, R.S. and A. Agarwal. 2003. Plant Pathology. 2nd Edition. TATA McGraw Hill. Pub. Company Ltd. New Delhi.
5. Singh, R.S. 1982. Plant Pathogens: The Fungi. Oxford and IBH Publishing Company, New Delhi, India
6. Singh, R.S. 1989. Plant Pathogens: The Prokaryotes. Oxford and IBH Publ. Company, New Delhi, India.
7. Trignano, R.N., M.T. Windham and A.S. Windham. 2008. Plant Pathology: Concepts and Laboratory Exercises. 2nd edition. CRC Press.
8. Vidhyasekram, P. 2004. Concise Encyclopedia of Plant Pathology. Food product Press and Haworth Press Inc. Binghamton, Ne

BOT (B01) : SEED PATHOLOGY

Introduction and importance of Seed Pathology in modern agriculture. History of Seed Pathology. Various methods for testing seed borne fungi, bacteria and viruses (Dry seed examination, seed washing test, incubation methods, cultural, biochemical, serological, nucleic acid based methods).

10 H

Mechanism of seed infection and its types, environment influencing seed infection, infected/contaminated part of seed, morphology and anatomy of seeds in relation to invasion, location of inoculum of the pathogen in seed- seed coat and pericarp, endosperm and perisperm and embryo.

10 H

(Signature)
 Dy. Registrar
 (Academic)
 University of Rajasthan

Seed-borne diseases of some important crops with particular reference to the state of Rajasthan and India. Typical case of infection by: fungi (wheat- smuts and bunts, Sesame-charcoal rot; bacteria (Brassicac- black rot, cluster bean- bacterial blight); viruses (tomato mosaic virus, pea seed borne mosaic virus,) and nematodes (wheat- ear cockle, rice- white tip).

10 H

Seed-borne inoculum, inoculum density and assessment of seed borne inoculum in relation to plant infection, epiphytotics due to seed borne inoculum, disease forecast based on infected seed samples, tolerance limits of seed borne pathogens.

10 H

Transmission of seed borne disease: Systemic and non- systemic seed transmission, types of disease transmission, mode of establishment and course of disease from seed to seedling and plant, factors affecting seed transmission.

10 H

Management of seed-borne disease, principles of control, seed treatments (physical, chemical and biological), mechanism of action of seed treatments, major seed treatments for important seed borne pathogens and their methods of application.

10 H

List of suggested Practical exercises:

1. Dry seed examination of seed lots.
2. Isolation and identification of seed-borne mycoflora by standard blotter method.
3. Preparation of culture media (PDA and NA).
4. Plating seeds on PDA/NA for identification of seed borne fungi and bacteria.
5. Other methods of plating e.g. deep freezing; 2,4D- blotter method.
6. Water agar test tube seedling symptom test.
7. Study of any seed borne nematode disease.
8. Detection of bacterial and viral pathogens in seeds.
9. LOPAT tests for detection of seed- borne bacteria.
10. Nucleic acid based detection of seed borne pathogens.
11. Histopathology of infected seed samples.
12. Physical control of seed-borne pathogens.
13. Antibiotic/fungicidal assay against seed-borne pathogens
14. Biological control of seed borne pathogens.
15. Field visits: Crop fields, FCI, NSC, Seed testing Labs., quarantine station (e.g. NBPGR) etc.

Suggested Readings:

1. Agarwal, P. C., Mortensen, C. N. and Mathur, S. B. (1989). Seed-borne diseases and seed health testing of rice. Technical Bull. No.3, Danish government institute of seed Pathology for Developing Countries (DGISP), Copenhagen and CAB International Mycological Institute, (CMI) UK.
2. Agarwal, V.K. 2006. Seed Health. International Book Distributing Company. Charbagh, Lucknow, India.
3. Agarwal, V.K. and Sinclair, J.B. (1987). Principles of Seed-pathology, II edition CRC Lewis Publishers, Boca Raton, New York, London.
4. Agrawal, R.L. 1980. Seed Technology. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi

5. Agrios, G.N. 2005. Plant Pathology. Academic Press, London., New York
6. Anonymous (1985, 2014). International rules for seed testing. International Seed Testing Association (ISTA). <http://www.seedtest.org/en/home.html>; http://www.seedtest.org/en/international-rules-_content---1--1083.html
7. Clifton, A. 1958. Introduction to the Bacteria. McGraw Hill Book Co., New York.
8. Khare, D. and Bhale, M.S. (2014). Seed Technology. Scientific Publishers (India), Jodhpur. Revised 2nd Ed.
9. Mandahar, C.L. 1978. Introduction to plant viruses. S. Chand & Co. Ltd., Delhi.
10. Mathur, S.B. and Cunfer, B.M. 1993. Seed-borne diseases and Seed health Testing of Wheat. Danish Government Institute of Seed Pathology for Developing Countries. Hellerup, Denmark.
11. Neergaard, P. (1977). Seed Pathology. Vol. I & II. The Mac Millan Press Ltd., London.
12. Rangaswamy, G. & Mahadevan, A. 1999. Diseases of crop plants in India (4th edition). Prentice Hill of India, Pvt. New Delhi.
13. Richardson, M. J. (1990). An annotated list of seed borne diseases 4th edn. Proc. Int Seed Test Assoc. Zurich, Switzerland.
14. Schaad, N. W. (1980). Laboratory guide for identification of plant pathogenic bacteria (edt.). Bacteriology Committee of American Phytopathological Society, St. Paul, Minnesota.
15. Schaad, N. W. (1988). Laboratory guide for identification of plant pathogenic bacteria (2nd eds.). APS Press (The American Phytopathological Society), St. Paul, Minnesota.
16. Singh, D. and Mathur, S. B. (2004). Histopathology of seed-borne infections. CRC Press, Boca Raton, London, New York, Washington DC. pp 296.
17. Singh, K.G. and Manalo, P.L. 1986. Plant Quarantine and Phytosanitary Barriers in the Asean. Asean Plant Quarantine Centre and Training Institute, Malays

BOT C01 : MORPHOGENESIS AND EXPERIMENTAL BIOLOGY

1. **Development and morphogenesis:** Shoot apex, the subcellular and biochemical structure of the meristem. The mechanism of primordium initiation, transition to flowering, growth and formation of organs. Experimental work on shoot apical meristem, meristem culture and virus free plants, histochemical studies on apical meristems. **14H**
2. **The phenomenon of morphogenesis :** - Correlation, polarity, symmetry, differentiation, regeneration. **9H**

Registrar
(Academic)
University of Rajasthan
JAIPUR

3. Morphogenetic factors : Physical, mechanical, chemical and genetic factors. Molecular basis of morphogenesis in plants with special reference to work done in *Arabidopsis*. **8H**

4. Somatic embryogenesis : Survey of somatic embryogenesis in angiosperms, direct somatic embryogenesis and embryogenesis from callus and protoplasts, cytology, physiology and genesis of somatic embryogenesis, nutritional factors, hormonal factors and embryo rescue. Endosperm and embryo culture, synthetic seeds. Cell plating technique and isolation of mutant cell lines, auxotrophic mutants. Mechanism involved in cell culture mutants. Suspension culture and growth studies. **16H**

5. Microtechniques : fixation, , dehydration, clearing, embedding in paraffin and GMA, microtomy, equipments and histological staining procedures, histochemistry. Transmission and scanning electron microscopy for internal structure and morphological development of plant organs and tissues.

13H

Suggested Practical/ Field Exercises ;

1. Study of developmental stages and organization of vegetative shoot apices.
2. Study of reproductive shoot apices.
3. Localization of different metabolites through histochemical techniques.
4. Study of polarity of egg and synergids in embryo sac through permanent slides.
5. In vitro tissue and organ culture using different media.
Preparation of media, inoculation and somatic embryogenesis.
6. Endosperm, ovary and ovule culture.
7. Histological techniques
 - Fixation
 - Dehydration
 - Clearing
 - Infiltration
 - Embedding
 - Microtomy

M
Dr. Registrar
(Academic)
University of Rajasthan
JAIPUR

- Staining
8. Microtechniques
- Microtome- Manual and automated.
 - Spreading table
 - Oven
 - Ribbon box
 - Block holders etc.

9. Demonstration of SEM and TEM

10. Equipments

- Culture chamber
- Autoclave
- Laminar airflow cabinet
- Centrifuge
- Spectrophotometer
- Waterbath
- Electrophoresis kit
- Ph meter
- Electronic balance
- BOD incubator

BOT (D01) : ADVANCED PLANT BIOSYSTEMICS

Herbarium methods- Plant exploration, plant collection, pressing and drying, mounting, maintenance and importance of herbarium; Important national, international herbaria, concept of digital herbaria. **(10 Hours)**

Concept of species- speciation; Gradual and additive mechanism; species classification, concept of characters: analytic versus synthetic character, qualitative versus quantitative characters, good and bad characters. **(10 Hours)**

Concept of population – its significance, types of variation (developmental, environmental and genetical), variance analysis, isolating mechanism. **(10 Hours)**

Ecotypes- Origin and differentiation, taxonomic significance of ecotypes, vicarians. **(6 Hours)**

Experimental taxonomy and hybridization- Role of hybridization in evolution, amphidiploidy, breeding barriers, epistasis and pleiotropy. **(10 Hours)**

Biochemical systematic- Methods and principles, systematic markers, PCR analysis, chemotaxonomy, seed proteins, technique of protein electrophoresis, chemical protein analysis procedures, genome analysis and nucleic acid hybridization. **(14 Hours)**

Suggested Readings:

1. Cole, A.J. 1989. Numerical Taxonomy, Academic Press, London.
2. Davis, P.H. and Heywood, V.H. 1973, Principles of Angiosperms Taxonomy, Robert E. Kreiger Pub. Co., New York.
3. Grant, V. 1971. Plant Speciation. Columbia University Press, New York.
4. Grant W.E. 1984. Plant Biosystematics Academic Press London.
5. Harrison H.J. 1971. New Concepts in Flowering Plant Taxonomy, Rieman Educational Book Ltd. London.
6. Heslop-Harrison, J. 1967. Plant Taxonomy - English Language Book Soc. & Edward Arnold Pub. Ltd. U.K.
7. Heywood, V.H. and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press London.
8. Jones, A.D. and wilbins, a.d. 1971. Variations and Applications in Plant Species. Hiemand & Co. Educational Books Ltd. London.
9. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematic (2nd edition). Mcgraw-Hill Book co., New York.
10. Nordenstam, B., El Gazaly, G. and Kassas, M. 2000. Plant Systematic for 21st century, Portland press Ltd. London.
11. Radford, A.E. 1986. Fundamentals of Plant Systematic. Harper & Row Publications, USA.
12. Singh, H. 1978. Embryology of Gymnosperms, Encyclopaedia of Plant Anatomy X. Gebruder Bortaeager, Berlin.
13. Solbrig, O.T. and Solbrig, D.J. 1979. Population Biology and Evolution, Addison-Wesley Publishing Co. Ind USA.
14. Solbrig, O.T. 1970. Principles and Metods of Plant Biosystematics. The Macmillan Cocollier- Macmillan Ltd. London.
15. Stabbings, G.L. 1974. Flowering Plant- Evolution above Species Level. Edward Arnold Ltd. London.
16. Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2nd edition) Edward Arnold Ltd. London.
17. Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
18. Woodland, D.W. 1991. Contemporary Plant Systematic. Prentice Hall, New Jersey.

Suggested Laboratory Exercises:

[Handwritten signature]
The Registrar
(in-charge)
of Rajasthan
JAIPUR

1. Flora writing
2. Synonymy
3. Taximetrics and cladistics
4. Molecular taxonomy


Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR