

**GONDWANA UNIVERSITY
GADCHIROLI**

SYLLABUS
For
M. Sc.
BOTANY
SEMESTER III & IV

Under
Choice Based Credit System
(CBCS)

(With effect from: 2017-18)

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Botany.

Semester III

Core	Theory/ Practical	Teaching Scheme			Credit	Examination Scheme					
		Hrs/week				Duration in hrs.	Max. Marks		Total	Min. Marks	
		Theory	Practical	Total			External	Internal		Theory/ Seminar	Practical
PSCBOTT09	Paper - IX	4	-	4	4	3	80	20	100	40	
PSCBOTT10	Paper - X	4	-	4	4	3	80	20	100	40	
PSDBOTT11	Paper - XI	4	-	4	4	3	80	20	100	40	
PSSBOTT12	Paper - XII	4	-	4	4	3	80	20	100	40	
Pract-V PSCBOTP05	Practical - V	-	8	8	4	6	80	20	100		40
Pract-VI PSDBOTP06	Practical - VI	-	8	8	4	6	80	20	100		40
Seminar - III	Seminar - III	2	-	2	1			25	25	10	
TOTAL		18	16	34	25		480	145	625	170	80

Semester IV

Core	Theory/ Practical	Teaching Scheme			Credit	Examination Scheme					
		Hrs/week				Duration in hrs.	Max. Marks		Total	Min. Marks	
		Theory	Practical	Total			External	Internal		Theory/ Seminar	Practical
PSCBOTT13	Paper - XIII	4	-	4	4	3	80	20	100	40	
PSCBOTT14	Paper - XIV	4	-	4	4	3	80	20	100	40	
PSDBOTT15	Paper - XV	4	-	4	4	3	80	20	100	40	
PSSBOTT16	Paper - XVI	4	-	4	4	3	80	20	100	40	
Pract-VII PSCDBOTP07	Practical - VII	-	8	8	4	6	80	20	100		40
Pract-VIII PSPBOTP08	Practical - VIII	-	8	8	4	6	80	20	100		40
Seminar - IV	Seminar - IV	2	-	2	1			25	25	10	
TOTAL		18	16	34	25		480	145	625	170	80

Project Work/Dissertation Scheme / Guidelines for the Students, Supervisors and Examiners

Every student is required to carry out a project work in semester IV. The project can be of following types. A) Experimental Project Work; OR B) Field Based Project Work; OR C) Review writing based Project Work.

Experimental Project Work and Field Based Project Work:

Student can carry out Experimental / Field Based Project Work on a related research topic of the subject /course. It must be an original work and must indicate some degree of experimental work / Field work. On the basis of this work, student must submit the Project Report (typed and properly bound) in two copies at least one month prior to commencement of the final Practical / lab Examination of Semester IV. The project report shall comprise of Introduction, Material and Methods, Results, Discussion, Summary, Conclusion and, References along with the declaration by the candidate that the work is original and not submitted to any University or Organization for award of the degree and certificate by the supervisor and forwarded through Head / Course-coordinator / Director of the Department / Centre or the Principal of the College.

Review writing based Project Work.

Student can carry out review writing Based Project Work on a related topic of the subject / course. It must be a review of topic based on research publications. Student shall refer peer reviewed original research publications and based on findings, write a summary of the same. The pattern of review writing shall be based on reputed reviews published in a standard, peer reviewed journals. On the basis of this work, student must submit the Project Report (typed and properly bound) in two copies at least one month prior to commencement of the final Practical / lab Examination of Semester IV. The project report shall comprise of Abstract, Introduction, detailed review, Discussion, Summary, Conclusion and, References along with the declaration by the candidate that the work is original and not submitted to any University or Organization for award of the degree and certificate by the supervisor and forwarded through Head / Course-coordinator / Director of the Department / Centre or the Principal of the College.

*The supervisors for the Project Work shall be from the following.
A person shall be an approved faculty member in the relevant subject.
OR

Scientists of National Laboratories / Regional Research Laboratories/ Experts from R&D in Industry who are approved by competent authority in such facilities by the Union Government / the State Government / Gondwana University / Other Universities recognized by UGC.

The Project Work will carry total 100 marks and will be evaluated by both external and internal examiner in the respective Department / Center / Affiliated College.

The examiners will evaluate the Project Work/Dissertation taking into account the coverage of subject matter, arrangement and presentation, references, etc.

For written Project work	40	Marks – Evaluated jointly by External & Internal examiner
Oral Presentation	20	Marks – Evaluated jointly by External & Internal examiner
For Viva-Voce	20	Marks – Evaluated by External examiner
Internal Assessment	20	Marks – Evaluated by Internal examiner

Total	100	
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Seminar

Guidelines for Students, Supervisors and Examiners

In each semester, the student will have to deliver a seminar on any topic relevant to the syllabus / subject encompassing the recent trends and development in that field / subject. The topic of the seminar will be decided at the beginning of each semester in consultation with the supervising teachers. The student has to deliver the seminar which will be followed by discussion. The seminar will be open to all the teachers of the department, invitees, and students.

The students should submit the seminar report typed and properly bound in two copies to the head of the department. The said shall be evaluated by the concerned supervisor / head of the department. The marks of the seminar shall be forwarded to the university within due period through head of the Department. The record of the seminar should be preserved till the declaration of the final result.

Internal Assessment:

1. The internal assessment marks shall be awarded by the concerned teacher.
2. The internal assessment marks shall be sent to the University after the Assessment in the prescribed format.
3. For the purpose of internal assessment the University Department / College shall conduct any three assignments described below. Best two scores of a student in these tests shall be considered to obtain the internal assessment score of that student.
4. If the student does not appear for the Practical Exam he shall be declared failed in Practical Examination irrespective of marks obtained in Internal Practical Assessment. However the Internal Practical Assessment marks will be carried forward for his next supplementary Practical Exam.
5. General guidelines for Internal Assessment are:
 - a) The internal assessment marks assigned to each theory paper as mentioned in Appendix 1 shall be awarded on the basis of assignments like class test, attendance, home assignments, study tour, industrial visits, visit to educational institutions and research organizations, field work, group discussions or any other innovative practice / activity.
 - b) There shall be three assignments (as described above) per course.
 - c) There shall be no separate / extra allotment of work load to the teacher concerned. He/ She shall conduct the Internal assessment activity during the regular teaching days / periods as a part of regular teaching activity.
 - d) The concerned teacher / department / college shall have to keep the record of all the above activities until six months after the declaration of the results of that semester.
 - e) At the beginning of each semester, every teacher / department / college shall inform his / her students unambiguously the method he / she proposes to adopt and the scheme of marking for internal assessment. (Prescribed in syllabus of respective Subjects).
 - f) Teacher shall announce the schedule of activity for internal assessment in advance in consultation with HOD / Principal.

Practical Examination

1. Each practical carries 100 marks. The scheme of marking shall be as per given in the syllabi of respective subjects.
2. Practical performance shall be jointly evaluated by the External and Internal Examiner. In case of discrepancy, the External Examiner's decision shall be final.
3. Duration of practical examination will be as per given in the syllabi of respective subjects.
4. The Practical Record of every student shall carry a certificate as shown below, duly signed by the teacher-in-charge and the Head of the Department. If the student fails to submit his / her certified Practical Record duly signed by the Teacher-In-Charge and the Head of the Department, he / she shall not be allowed to appear for the Practical Examination and no Marks shall be allotted to the student.

5. The certificate template shall be as follows:

CERTIFICATE

Name of the college / institution _____

Name of the Department: _____

This is to certify that this Practical Record contains the bonafide record of the Practical work of Shri / Shrimati / Kumari _____ of M. Sc. _____

Semester _____ during the academic year _____. The candidate has satisfactorily completed the experiments prescribed by Gondwana University Gadchiroli for the subject _____

Dated ___/___/_____

Signature of the teacher who taught the examinee

Head of the Department

1. _____

2. _____

Practical Schedule: Semester III PRACTICAL V

Course code: PSCBOTP05

Credit - 04

Time : 6 Hours

Full marks : **80**

Q. 1 To perform the given Ecological exercise - [A]	15
Q. 2 Soil analysis/Ecological adaptation - [B]	10
Q. 3 One experiment from paper X - [C]	15
Q. 4 One experiment from paper X - [D]	10
Q. 5 Spotting: [E] (Paper IX), [F] (Paper IX), [G] (Paper X), [H] (Paper X)	20
Q. 6 Viva-voce	05
Q. 7 Practical Record	05

Semester III PRACTICAL VI

Course code: PSDBOTP06

Credit - 04

Time : 6 Hours

Full marks : **80**

Q. 1 Experiment from Major Exercise	15
Q. 2 Experiment from Minor Exercise	10
Q. 3 Experiment from Major Exercise	15
Q. 4 Experiment from Minor Exercise	10
Q. 5 Spotting: E (Major Exercise), F (Minor Exercise), G (Major Exercise), H (Minor Exercise)	20
Q. 6 Viva-voce	05

M. Sc. Botany Syllabus
Semester III
Course code- PSCBOTT09
PAPER –IX: Plant Ecology

UNIT - I:

Vegetation organization: Concepts of community and continuum, analysis of communities (analytical and synthetic characters): interspecific associations, concept of ecological niche.

Vegetation development: Temporal changes (cyclic and non-cyclic); mechanism of ecological succession (relay floristic and initial floristic composition; facilitation, tolerance and inhibition models); changes in ecosystem properties during succession, Autecology.

UNIT - II:

Ecosystem organization: Structure and functions; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (trophic organization, energy flow pathways, ecological efficiencies); litter fall and decomposition (mechanism, substrate quality and climatic factors); global biogeochemical cycles of C, N, P, and S; mineral cycles (pathways, processes, budgets) in terrestrial and aquatic ecosystems.

UNIT - III:

Air, Water and Soil pollution: Kinds; sources; quality parameters; effects on plant and ecosystems.

Climate change: Greenhouse gases (CO₂, CH₄, N₂O, CFCs; sources, trends and role); ozone layer and ozone hole; consequences of climate change (Global warming, sea level rise, UV radiation).

UNIT - IV:

Ecosystem stability: Concept (resistance and resilience); Ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems; ecology of plant invasion; environmental impact assessment; ecosystem restoration.

Ecological management: Concepts; sustainable development; sustainability indicators.

Practicals:

1. A trip to the grass land/ forest/ water body to get acquainted with their plant species.
2. Distribution pattern of different plant species determined by Quadrat/ Transat/ Point centered Quadrat methods.
3. Qualitative parameters of distribution of plant species, Frequency, Density, Basal cover, dominance, Abundance and IVI.
4. Analysis of soils of two different areas i.e. Cropland and forest/ grassland for certain nutrients, CO₃, NO₃, Base deficiency.
5. Analysis of water quality for physical properties like colour, BOD, COD, O₂, CO₂ contents etc.
6. Study of adaptations in plants of Hydrophytic, Xerophytic and Halophytic zones.

Suggested Readings:

1. Ambasht R.S. 1968. Freshwater ecosystem- Manual of Ecology 123-137 (See Misra KC et al 1968)
2. Ambasht R.S. 1966 Conservation Ecology, Abs Proc School on Plant Ecol (Full paper in press Oxford and IBH Calcutta).
3. Ambasht R.S. 1995 A text book of plant ecology Student and co. Varanasi-5
4. Anderson JM Ecology for environmental sciences: biosphere ecosystems and man
5. Billings WB 1964 Plants and the ecosystem Macmillan & co, London.
6. Clements FE 1916 Plant succession, An analysis of the development of vegetation. Carnegie Institute of Washington.
7. Cragg JB 1968 The theory and practice of conservation, IUCN Publ, New Series No. 12, 25-35.
8. Dash MC 1993 Fundamentals of Ecology WB Saunders and co. Philadelphia USA.
9. Deangelis DL Energy flow, nutrient cycling and ecosystem resilience. Ecology 56, 238-43.
10. Dwivedi Rama Shankar 1968. The decomposer system manual of ecology See Misra KC et al 1970)
11. Frankel OH, Soule ME, 1981, Conservation and Evolution, Cambridge Univ Press.
12. Grace J 1983, Plant atmosphere relationships. Champman & Hall.
13. Greig Smith P 1983, Quantitative plant ecology, Univ California Press, California.
14. Hutchings MJ (ed) 1988, Plant population biology, Blackwell.
15. Hutchinson GE 1978, An introduction to population ecology. Yale Univ. Press.
16. Kochhar PL 1986 Plant Ecology Ratan prakashan, Mandi, Agra.
17. Krebs GJ 1972 Ecology Harper and Row Publ, New York.
18. Kumar HD 1994 Modern concepts of ecology. Vikas publishing house pvt ltd, New Delhi.
19. May RM (ed) 1981 Theoretical Ecology, Blackwell.
20. Odum EP 1963 Ecology Holt Reinhart and Winston Inc.
21. Odum EP 1983 Basic Ecology, Saunders Publ Philadelphia.
22. Reynolds CS 1984 The ecology of phytoplankton, Cambridge Univ Press
23. Silvertown JW 1982 Introduction to plant population ecology, Longman.
24. Southwick CH 1983 (ed) Global Ecology Sinauer.
25. Whittaker RH 1975 Communities and Ecosystems (2nd ed) MacMillan, New York.

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Semester III

Course code- PSCBOTT10

PAPER –X: Cell and Molecular Biology- II

UNIT - I:

Ribosomes: Structure and function

Transcription & Translation: Transcription in prokaryotic and eukaryotic cells, plant promoters, transcription factors, types of RNA and their function, splicing, mRNA transport, rRNA biosynthesis; translation in prokaryotic and eukaryotic cells, structural levels of proteins, post-translational modification; structure and role of tRNA.

UNIT - II:

Gene structure and expression: Fine structure of gene, Cis-trans test; fine structure analysis in eukaryotes; introns and their significance, RNA splicing; regulation of gene expression in pro- and eukaryotes.

Protein sorting: Machinery involved, vesicles, coat proteins; protein targeting to plastids, mitochondria, peroxisomes, nucleus, vacuoles; modification during transport.

UNIT - III:

Genome organization in prokaryotes and eukaryotic organelles: Phage genome, genetic recombination in phage and mapping phage genes; mapping of bacterial genes through transformation, conjugation and transduction; genetics of mitochondria and chloroplast.

Genetic recombination and genetic mapping: Recombination, independent assortment and crossing over; molecular mechanism of recombination, role of RecA and RecBCD enzymes; site-specific recombination; chromosome mapping, linkage group, genetic markers, construction of molecular maps, correlation of genetic and physical maps; Somatic cell genetics - an alternative approach to gene mapping.

UNIT - IV:

Cell cycle and apoptosis: Control mechanisms, role of cyclins and cyclin dependent kinases; retinoblastoma and E2F proteins; cytokinesis and cell plate formation; programmed cell death in plants; regulation in plant growth and development.

Signal transduction: Overview, receptors and G- proteins, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascades, diversity in protein kinases and phosphatases.

Techniques in cell biology: Electrophoresis, immunotechniques, FISH, GISH, confocal microscopy

Practicals:

1. Isolation of nuclei and identification of histones by SDS-PAGE.
2. Isolation of chloroplast and demonstration of two subunits of RUBISCO by SDS PAGE
3. Restriction digestion of plant DNA, its separation by agarose gel electrophoresis, visualization by ethidium bromide staining.
4. To study in vitro transcription.
5. To study in vitro translation.
6. To study conjugation in bacterial cells.
7. To detect the presence of specific antigen by ELISA
8. Isolation of RNA and quantification by spectrophotometric method.

References: Online journals available on UGC V-SAT programme

Suggested readings:

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1999. *Molecular Biology of Cell*, Garland Publishing, Inc., New York.
2. Buchanan, B.B., Gruissem, W. and Jones, R. L. 2000 *Biochemistry and Molecular Biology of Plants*. American Soc. Of Plant Physiologists, Maryland, USA.
3. De Robertis, E.D.P. and De Robertis, E.M.F. *Cell and Molecular Biology* 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.
4. Karp, G. 1999 *Cells and Molecular Biology; Concepts and Experiments*. John Wiley & Sons, Inc., USA.
5. Khush, G.s. 1973 *Cytogenetics of Aneuploids*, Academic Press, New York, London
6. Kleinsmith, L.J. and Kish, V.M. 1995 *Principles of Cell and Molecular Biology* (2nd Edi.) Harper Collins Coll. Publisher, New York, USA.
7. Lewin, B. 2000 *Gene VII* Oxford Univ. press, New York.
8. Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 *Molecular Cell Biology* Edi. W.H. Freeman and Co., New York, USA.
9. Malacinski, G. M. and Freifelder, D. 1998 *Essentials of Molecular Biology* (3rd Edi.) Jones and Bartiet Pub. Inc., London.
10. Russel, P. J. 1998 *Genetics* (5th Edi.) The Benjamin/ Cummings Publishing Com. Inc., USA
11. Sunstad, D. P. and Simmons, M. J. 2000 *Principles of Genetics* (2nd Edi.) John Wiley & Sons Inc., USA.
12. Tamarin, R. H. 2001 *Principles of Genetics* 7th Edi. The McGraw–Hill Companies.
13. Wolf, S.L. 1993. *Molecular and Cellular Biology*, Wadsworth Publishing Co., California, USA.
14. Gerhard, Krauss, Wieley, VCH Third revised edition, *Biochenmistry of Signal Transduction and Regulation*.

M. Sc. Botany Syllabus
Semester III
Course code- PSDBOTT11 (DSE-I)
PAPER –XI: Reproductive Biology of Angiosperm-I

UNIT - I:

General: Need for reproductive system as experimental material, Interdisciplinary approaches: genetic and molecular perspective,

Anther: Structure, anther wall;: endothecium, middle layer, tapetum-Structure, types-structure-function relationship, role of tapetum, microsporogenesis- sporogenous cells cytoplasmic reorganization during sporogenesis (Ultrastructural changes), molecular biology of meiosis, DNA and RNA synthesis, Protein synthesis, meiosis specific genes. Pollen tetrad development, pollen wall proteins, adaptive significance of pollen wall.

UNIT - II:

Male gametophyte development: formation of vegetative and generative cells, differential behavior of sperms, gene expression during pollen development.

Pollen: Physiological and biochemical aspects, pollen storage, viability causes for loss of viability. pollen abortion and male sterility, structural, developmental and functional aspects of male sterility environmental factors, role of mitochondrial genome in male sterility, gametocides.

UNIT - III:

Pistill: Carpel determination, ovule and its structural details.

Megasporogenesis: Meiosis, functional megaspores, organization of female gametophyte structure of the embryo sac, egg, synergid-ultrastructure, role central cell, antipodal cell, haustoria, cytoskeleton of the embryo sac, enzymatic isolation of embryo sac, types of embryo sac, nutrition of embryo sac.

UNIT - IV:

Pollination-pollination mechanism, biotic and abiotic pollination, floral attractants and rewards,

Pollen-pistil interaction; The stigma-Types and structure, stigmatic exudates, style-transmitting tissue, canal cell, post pollination events (stigma receptivity, pollen adhesion, pollen hydration, pollen germination and pollen tube growth, biochemistry of pollen germination, RNA and protein metabolism during pollen tube, calcium gradient in the pollen tube (Chemotropism) pollen allelopathy.

Incompatibility: General concept, self incompatibility (Intraspecific type) heteromorphic, homomorphic types, mechanism of self compatibility, importance of self compatibility, methods of overcoming self incompatibility, Parasexual hybridization.

Practicals :**Major exercises:**

1. Short term exercises on pollen production, viability and their percentage of germination. Rate of growth of germ tube to be studied in a given period.
2. Cytology of pollen inhibition in self and interspecific incompatibility, application of some techniques to overcome incompatibility.
3. Techniques, Familiarity with phase contrast, polarizing, fluorescence and electron microscopy, whole mounts, dissection and macerations, permanent double stained microtome sections, photo microscopy.
4. Interpretation of electron micrographs (SEM, TEM) of pollen.
5. Preparation of permanent slides using micro-technique: Embedding and block making.
6. Preparation of permanent slides using micro-technique: Section cutting and processing for staining.
7. Study of pollen morphology (polarity, symmetry, shape, size, aperture) using acetolysis method.

Minor exercises:

8. Study from the permanent preparations.
 - a. Development and structures of anther pollen.
 - b. Structure and types of ovule.
 - c. Megasporogenesis,
 - d. Embryo sac and its types.
 - e. Development of endosperm, types.
 - f. Structure and development of embryo- types
 - g. Pericarp and seed coat structure from sections and macerations.
 - h. Sketching of ovular structure, embryo sac, anther wall, embryo with the help of camera lucida.
9. Preparation of dissected whole mounts of endothecium, tapetum, endosperm and embryo, squash preparations of tapetum, microspore mother cells, dyads, tetrads pollinia and massulae.
10. Study of mitosis and meiosis and identification of various stages.
11. Experiments on intra- ovarian pollination.

Suggested Readings:

1. Asker S. 1979, Progress in apomixis research. *Hereditas* 91, 231-240.
2. Barnier, G. 1986, The flowering process as an example of plastic development. *Soc. Expt.. Biol.* 40: 257-286.
3. Barth, F.G. 1991, insects and flowers, Princeton Univ. Press. Princeton.
4. Battaglia, E. 1963. Apomixis In recent advances in the embryology of angiosperms (ed P. Maheshwari), pp- 264, Intt. Soc. Plant Morphologists, Univ. Delhi.
5. Bhandari N. N. 1984, The microsporangium in embryology of angiosperms (ed B.M. Johri) Springer- Verlag, Berlin, pp. 53-121.
6. Bhandari N.N., M. Bhargava and P. Chitralkha 1986, Cellularization of free nuclear endosperm of *Papaver somniferum* L. *Phytomorphology*, 36, 357-366.
7. Bhojwani S.S. and M.K. Rajdan 1983, Plant tissue culture, Theory and Practice Elsevier, Amsterdam.
8. Boesewinkel F.D. and Boman F. 1984, The seed structure in embryology of angiosperms (ed B.M.Johri), Springer- Verlag, Berlin, pp. 567-610.
9. Bouman F. 1984 The ovule in embryology of angiosperms (ed B.M.Johri), Springer- Verlag, Berlin, pp. 123-157.
10. Cartson P.S., Smith N.H., Dearing R.D. (1972) Parasexual interspecific plant hybridization. *Proc. Nat. Acad. Sci. USA*, 69, 2292-2294.
11. Cartson P.S. (1973) The use of protoplasts of genetic research. *Proc. Nat. Acad. Sci. USA*, 70, 598-602.
12. Chitralkha P. and N.N. Bhandari 1991, Post fertilization development of antipodal cells in *Ranunculus scferatus*. *Phytomorphology* 41, 200-212.
13. Ciampolini F.M., Nepi and E. Pacini 1993, tapetum development in *Cucurbita pepo* (Cucurbitaceae) *Pt. Syst. Evol. (Suppl)* 7-13-22.
14. Cocking E.C. 1960, A method for the isolation of plant protoplasts and vacuoles. *Nature (London)* 187-927-929.
15. Cocking E.C. 1970, Virus uptake, cell wall regeneration and virus multiplication in isolated plant protoplasts. *Int. Rev. Cytol* 28-89-124

M. Sc. Botany Syllabus

Semester III

Course code- **PSDBOTT11 (DSE-I)**

PAPER –XI: Molecular Biology and Plant Biotechnology-I

UNIT- I:

DNA replication: DNA replication in prokaryotic organism – Initiation, elongation, and termination, DNA replication in eukaryotes – origin, replication form, replication proteins, Comparative account of DNA replication in prokaryotes and eukaryotes, DNA replication proteins

DNA damage and repair: Types of DNA damage, factors for DNA damage,

Repair system: Single base change, direct repair, mismatch repair, SOS response.

UNIT- II:

Isolation of gene and nucleotide sequence: DNA manipulation enzymes; General methods of gene isolation.

Molecular probing: Recombinant DNA libraries (gDNA and cDNA, oligonucleotide probes); nucleic acid hybridization (southern, northern, dot-blot and slot-blot); antibodies as probe for proteins (immunoblotting or western blotting, immunoprecipitation, southwestern screening).

UNIT- III:

Splicing of foreign DNA into cloning vector: Vectors for prokaryotes; ligation.

Introduction of foreign DNA into host cell: Transformation; transfection; transgenesis

Isolation of genes or protein products from clones: Expression vectors- Characteristics; vectors producing fusion proteins

Polymerase chain reaction: Types of PCR's and their applications in molecular biology

UNIT- IV:

Sequence alignment and phylogenetic trees: Dot plots, sequence similarity, pairwise and multiple alignment, significance of alignment, phylogeny and phylogenetic trees and evolution.

Genomics: Definition; genome analysis (genetic polymorphisms, genetic mutations); microarray technology and applications (gene expression and diseases).

Proteomics: Protein stability and folding; application of hydrophobicity; DALI (Distance-matrix alignment); Protein structure- evolution, classification, prediction and modeling, prediction of function. DNA microarrays, mass spectrometry, network and graphs, protein complexes and aggregates, protein interaction networks, regulatory networks.

Practicals:**Major Exercises -**

1. Detection of DNA damage by mutagens.
2. Bacterial transformation and selection of transformed cells.
3. To detect molecular polymorphism of different species.
4. To demonstrate the presence of particular polypeptide by Western blotting.
5. To design PCR primers for isolation of given gene and to clone it in the given vector.
6. Amplification and sequencing of nr DNA by PCR

Minor Exercises-

7. To find the sequences of a given protein in SWISS-Prot, Uni-Prot.
8. To work out the sequence from given autoradiogram and to identify it from Gene Bank by BLAST method.
9. To generate Pairwise and multiple sequence alignment of a given organisms.
10. To generate phylogenetic tree using given sequences.
11. To predict a protein from given sequence by using online tools from NCBI.

Suggested Readings:

1. Alberts, Bruce; Johnson Alexander; Lewis, Julian; Raff, Martin; Roberts, Keith; Walter,
2. Peter, C. 2002 Molecular Biology of the Cell, Garland Science, New York and London.
3. Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
4. Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics
5. Bergman, N.H 2007 Comparative Genomics Humana Press Inc., Part of Springer Science+ Business Media
6. Brown, T. A. 1999. Genomes, John Wiley & Sons(Asia) Pvt. Ltd., Singapore
7. De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.
8. Glover, D.M. and. Hames, D.B 1995 DNA Cloning : A practical approach, R.L. Press, Oxford.
9. Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques. Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.
10. Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in Functional Genomics. Birkhauser Verlag,

Basel, Switzerland.

11. Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.
12. Lehninger' Principles of biochemistry-Nelson, Cox, 4th Edn., W.H.Freeman and Co.,2005.
13. Lewin, B. 2000 Gene VII Oxford Univ. press, New York.
14. Lewin, B. 2010 Gene X Oxford Univ. press, New York.
15. Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 Molecular Cell Biology Edi. W.H. Freeman and Co., New York, USA
16. Mount W. 2004 Bioinformatics and sequence genome analysis 2nd Edi. CBS Pub. New Delhi
17. Old and Primrose , 1994, Principles of gene manipulation. Blackwell Scientific Publ.
18. Raymond Schuler and Zielinski, E. 2005, Methods in plants Molecular biology - Acad. Press.
19. Russel, P. J. 1998 Genetics (5th Edi.) The Benjamin/ Cummings Publishing Com. Inc., USA
20. Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.
21. Shaw, C.H. 2006, Plant Molecular Biology: A practical approach. Panima Pub. Corp.
22. Stryer, Berg, Biochemistry- 6th Edition, W. H. Freeman and Co.,2007.
23. Voet, D.; Voet, J.; Biochemistry – 3rd Edn. John Wiley and sonsInc., 2004.
24. Wilson Keith and Walker John 2005 Principles and techniques of biochemistry and molecular biology, 6th Ed. Cambridge University Press, New York.

25. Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA
Suggested Readings(for laboratory exrcises)

1. Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
2. Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics.
3. McEntyre, J.; Ostell, J., editors Bethesda (MD) The NCBI Handbook: National Library of
4. Medicine (US), NCBI; 2002-2005
5. Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.
6. Tools & updated literature available at www.ncbi.com

References: Online journals available on UGC V-SAT programme.

M. Sc. Botany Syllabus
Semester III
Course code- PSDBOTT11 (DSE-I)
PAPER –XI: Paleobotany-I

UNIT – I:

Introduction to the science of Petrology- The earth zones, chemical composition of earth crust. The classification of rocks i.e. Endogenetic and Exogenetic (igneous, metamorphic and sedimentary) and their brief account. Glaciations, volcanic eruption and earthquake.

UNIT–II

Geological column and time scale. Physiography of India. Fossilisation, modes of preservation, preparation and age determination and techniques. Systematics, reconstruction and nomenclature. Life in Precambrian, greening of earth –speculation.

UNIT–III:

Study of Rhyniopsida (primitive vascular plants) Cooksonia, Steganotheca, Uskiella, Renalia, Horniophyton, Aglophyton, Zosterophylopsida (ancestors of microphyllous plants) Zosterophyllum, Sawadonia, Asteroxylon. Prelycopods and Lycopsidea-Hebaceous Lycopods of Devonian – Baragwanthia, Protolpidodendron and Miadesmia, Arborescent Lycopods of Carboniferous-study of Lepidodendrales members.

UNIT –IV:

Sphenopsida-Its origin and evolutionary consideration .Study of Hyeniales and Sphenophyllales. Horsetails and their relatives-Calamitales members. Filicopsida-Study of primitive ferns and their relatives- Cladoxylales, Stauropteridales, Zygopteridales. Filicales-classification and study of its members, Coenopteridales-Ankyropteris. Marratiales - Psaronius.

Suggested Laboratory and Field Exercises

Major Exercises:

1. Different techniques to study fossils. (Ground sectioning, peel technique) Study different types of fossils.
2. Study of plant fossils as per syllabus based on specimens and slides.
3. Arborescent Lycopods of Carboniferous-study of Lepidodendrales members.
4. Study of Sphenophyllales, Calamitales members.
5. Study of primitive ferns and their relatives Cladoxylales, Stauropteridales, Zygopteridales. Filicales- Coenopteridales-Ankyropteris, Marratiales - Psaronius

Minor Exercises:

6. Study of Rhyniopsida (primitive vascular plants).
7. Stratigraphy Maps of the India and World.
8. Geological Maps of India.
9. Geological column and time scale.

10. Study of different rocks.
11. Preparation of practical record.

Suggested Readings

1. Agashe S.N. (1995) - Palaeobotany, Plants of the past, their evolution, palaeoenvironment and application in exploration of fossil fuels. Oxford & IBH publishing company - New Delhi.
2. Andrews H.N. (1961) - Studies in Palaeobotany, Wiley and Sons - New York.
3. Arnold, C.A. (1947) - An Introduction to Palaeobotany, McGraw-Hills., New York.
4. Beck, C. B. and Wight, D. C. (1988) - Progymnosperm, In origin and evolution of Gymnosperms, Columbia Uni. Press - New York.
5. Beck, C.B. (1976) - Current status of the Progymnospermosida, Review of Palaeobotany and Palynology.
6. Darrah, W.C. (1960) - Principles of Paleobotany.
7. Erdtman, G. (1957) - Pollen and Spore morphology and plant taxonomy. (An introduction to palynology) Hafner Publishing Comp - New York.
8. Chandra, S. and Surange, K.R. (1979) - Revision of the Indian species of Glossopteris, Monograph, Birbal Sahni Institute of Palaeobotany.
9. Hoffmeister, W.S. (1960) - Palynology has an important role in oil exploration. World oil - 150:1001-140.
10. Meyen, S.V. (1987) - Fundamentals of Palaeobotany Chapman and Hill, London, New York.
11. Parihar, N.S. (1995) - Essentials of Palaeobotany, Central Book - Allahabad.
12. Sahni, B. (1964) - Revisions of Indian fossils plants, -III (Monocotyledons) - BSIP - Lucknow.
13. Stewart, W.N. & Rothwell, G.V. (1993) - Palaeobotany and Evolution of Plants, Cambridge Univ., Press - Cambridge.
14. Venkatchala, B.S. & Maheshwari, H.K. (1991) - Palaeobotanical Researches in India. Jour. Ind. Bot. Society - 70; 1-12.
15. Wadia, D.N. (1953) - Geology of India, Mac, Millan - Co. London.
16. Prasad, K.N. (1999) - An introduction to palaeobotany, APH Pub.
17. Cleal, J. Christopher. & B.A. Thomas (2009) Introduction to Plant Fossils, Cambridge Univ., Press - Cambridge.
18. Willis, K. J. & McElwain, J. C. (2014). The Evolution Of Plants (second edition) OXFORD University Press.
19. Stewart, W.N. and Rothwell G.W. (1993), Palaeobotany and the Evolution of Plants, Cambridge University Press.
20. Arnold, C.A. (1947): Introduction to Palaeobotany, Mc-Graw Hill Book Co. Inc., New York and London.
21. Agashe, S.N. (1995), Palaeobotany, Oxford & IBH, New Delhi.
22. Siddiqui, K.A. (2002) Elements of Palaeobotany, Kitab Mahal, Allahabad.
23. Thomas, B.A. & Spicer R.A. (1987): The Evolution and Palaeobiology of land plants. Discordies Press, Fortland, USA.
24. Spicer, R.A. & Thomas, B.A. (1986) Systematic and taxonomic approaches in Palaeobotany. Systematic Association Special Volume.

M. S c. Botany Syllabus
Semester III
Course code- PSSBOTT12 (SEC-I)
PAPER –XII: Biofertilizers-I

UNIT I

Historical account of Biofertilizer, types of Biofertilizer, Microbial inoculant from bacteria, algae, fungi and other groups ,their isolation ,identification . Mass inoculation of microbial inoculants, effect of inoculant on crop yield. Marketing and work done on biofertilizer in India

UNIT II

Bacterial inoculants :- Rhizobial culture packing and quality control , method of inoculation , effect of Rhizobial inoculant on crop yield . Azotobacter inoculants on , Azospirillum inoculants and mass cultivation ; Phosphate solubilizing microorganism , Phosphate biofertilizer

UNIT III

Algal inoculants:- Algalization, biological nitrogen fixation , nonsymbiotic and symbiotic microorganism, Diazotrops; genetics and ecology of Diazotrops, special features of nitrogen fixation in Cyano bacteria, Frankia-induced nodulation. Factors affecting growth, Azolla as bio fertilizers, Azolla association of Anabaena, mass cultivation of Azolla, practical application in rice field.

Unit IV

Fungal inoculants:- Mycorrhiza fungi as bio fertilizers; Methods of Inoculation, Mechanism of symbiosis, Growth and yield – Colonization of VAM-Isolation and production of VAM. Benefits from mycorrhizas to plants as biofertilizer.

Practicals:

Based on theory syllabus.

Suggested reading:-

1. The complete technology book on biofertilizers and organic farming –NIIR, New Delhi.
2. Somani L.L, P.Shilpkar and D.Shilpkar (2011) Biofertilizers commercial production technology and quality control. Agrotech publisher Academy Udaipur.
3. The complete technology book on Vermiculture and Vermicompost NIIR- New Delhi.

M. Sc. Botany Syllabus
Semester III
Course code- PSSBOTT12 (SEC-I)
PAPER –XII: Nursery and Gardening -I

Unit-I:

Garden Planning- Formal and informal gardens, originality in planning, view from the house, variety and surprise, overcrowding (density of planting), colour scheme, spacing, fragrance, spacing for vegetables and fruits, water supply and garden accessories, choice of plants, arches and pergolas, wall aspect, hill features, situation, landscaping and garden features.

Unit-II:

Garden Operation- Procurement of material. Preparation of soil. Drainage. Digging and trenching. Soil enrichment. Organic manures. Inorganic manures.

Unit-III:

Garden Style- Informal garden, Romantic Garden, Wildlife garden, Container garden, Roof garden, Planned garden, Small garden, Japanese garden, Exotic garden, Kitchen garden, Vegetable garden, Herb garden, Fruit garden.

Unit-IV:

Lawns and hedges, Flowers, herbaceous border and annuals, Roses, Chrysanthemums and Carnations, Bulbous plants, Climbers, Trees and shrubs, Orchids, Ferns and Palms, Cacti and other succulents.

Practicals:

Based on theory syllabus.

Suggested Readings:

1. Trivedi, P. P. (1987) Home Gardening. ICAR New Delhi.
2. Deena Beverley and Barty Phillips (2002) Encyclopedia of Gardening, Parragon Book, UK.

M. Sc. Botany Syllabus

Semester III

Course code- PSSBOTT12 (SEC-I)

PAPER –XII: PLANT DIVERSITY AND HUMAN WELFARE-I

Unit-I:

Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agrobiodiversity and cultivated plant taxa, wild taxa.

Unit-II:

Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.

Unit-III:

Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss

Unit-IV:

Management of Plant Biodiversity: Organizations associated with biodiversity management- Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication.

Practicals:

Based on theory syllabus.

Suggested Readings

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity – Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi

M. Sc. Botany Syllabus
Semester III
Course code- PSSBOTT12 (SEC-I)
PAPER –XII: FLORICULTURE-I

Unit-I:

Introduction: History of gardening; Importance and scope of floriculture and landscape gardening.

Unit-II:

Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

Unit-III:

Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai.

Unit-IV:

Diseases and Pests of Ornamental Plants.

Practicals:

Based on theory syllabus.

Suggested Readings

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

M. Sc. Botany Syllabus
Semester III
Course code- PSSBOTT12 (SEC-I)
PAPER –XII: BASIC BOTANY-I

UNIT I

Diversity of cryptogams:- classification, general description, economic importance of cryptogams with examples- viruses, micoplasma, bacteria, fungi, lichens, bryophytes and plant pathology.

UNIT II

Diversity of phenorogamas:- classification, general description, economic importance with examples of pteridophytes, gymnosperms, monocotyledonous and dicotyledonous.

UNIT III

Morphology of angiosperms:- description of monocotyledonous and dicotyledonous plants in technical terminology for the identification of plants in your region, habit and habitate, types of roots, leaves inflorescence, flowers, fruits, seeds identification of some important local plants from families of angiosperms.

UNIT IV

Anatomy of angiosperms:- Histological accounts of cell and tissue, tissue system in monocotyledonous and dicotyledonous plants. Anatomy of root, stem, leaf, primary structure and normal secondary growth in stem and root, Anomalous secondary growth in stem and root, Healing of wounds and fall of leaves.

Practicals:

Based on theory syllabus.

Suggested Readings:-

- 1) S.Sundara Rajan College Botany Vol I to IV Himalaya publishing house.
- 2) Saxena And Sarsbhai A textbook of botany Vol. I to III Kitabghar Gwalior.
- 3) Gangulee And Kar College botany Vol.I and II.
- 4) K.S.Bilgrami, L.M.Shrivastava, J.L.Shremali Fundamentals of botany Vol. I and II Vikas Publishing House PVT.LTD. Sahibabad UP.
- 5) A.C.Dutta Botany for degree students.
- 6) S.N.Pande And P.S.Trivedi Text book of botany Vol I and II. Vani educationa

Semester IV PRACTICAL VII

Course code: PSCDBOTP07

Credit - 04

Time: 6 Hours

Full marks: **80**

Q. 1 One Major exercise from paper XIII – [A]	10
Q. 2 One Minor exercise from paper XIII- [B]	05
Q. 3 One Major exercise from paper XIV – [C]	10
Q. 4 One Minor exercise from paper XIV- [D]	05
Q.3 One Major exercise from paper XV [E]	15
Q. 4 One Minor exercise from paper XV [F]	10
Q. 5 Spotting: [G] (Plant Biotechnology), [H] (Angiosperms) [I] (Core Elective-I)	15
Q. 7 Viva-voce	05
Q. 8 Practical Record and tour report	05

Semester IV PRACTICAL VIII

Course code: PSPBOTP08

Credit - 04

PROJECT

Full marks: **80**

M. Sc. Botany Syllabus
Semester IV
Course code- PSCBOTT13
PAPER –XIII: Plant Biotechnology

UNIT- I:

Recombinant DNA technology: Gene cloning and principles and technique; vectors- types and their properties; construction of DNA libraries; splicing of insert into the vector; screening of DNA libraries and introduction of the recombinant DNA into the host cells.

Genetic engineering of plants: Aims, strategies for development of transgenics (with suitable examples); Agrobacterium- the natural genetic engineer; T-DNA and transposon mediated gene tagging.

UNIT- II:

Microbial genetic manipulation: Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes and nitrogen fixers, fermentation technology.

Genomics and proteomics: Molecular markers for introgression of useful traits; high throughput sequencing; functional genomics; Protein profiling and its significance.

DNA synthesis; DNA sequencing; polymerase chain reaction; DNA fingerprinting

UNIT- III:

Plant tissue culture: Basic concepts; Principles and scope; tissue culture media; callus induction and cell suspension; aspects of morphogenesis; haploid and triploid production; production of somatic embryos; applications of plant tissue culture; protoplast isolation and culture; production of cybrids

Transgenic production: Methods to introduce gene in plants; selection of transformed plants/explants; salient achievements in crop biotechnology.

UNIT- IV:

Bioinformatics: Introduction, History, Definition and applications of bioinformatics.

Database: Types and classification of databases – Primary Databases (Nucleic acid sequence, protein sequence, protein structure), Secondary databases (Genomic, cDNA, Organellar, gene expression), special databases (Human, *Escherichia coli*, *Saccharomyces cerevesaie* and *Arabidopsis thaliana*), Literature database (PubMed, OMIM), Information Retrieval system (Entrez). Other databases: GeneBank, KEGG, Taxonomy databases

Data analysis, prediction and submission tools and their uses: ORF finder, Blasts, FASTA, RASMOL, Prediction of pro- and eukaryotic genes and promoters (Genscan); protein structure (SWISS-Prot, pfam, PDB, PIR); **sequin**, webin, AutoDep tools.

Practicals:

Major Exercise:

1. Growth characteristics of *E.coli* using plating and turbidimetric methods.
2. Isolation of plasmid from *E.coli* and its quantification.
3. Restriction digestion of the plasmid and estimation of the size of various DNA fragments.
4. Cloning of a DNA fragment in a plasmid vector, transformation of the given bacterial population and selection of recombinants.
5. Co-cultivation of the plant material (e.g. leaf discs) with *Agrobacterium* and study GUS activity histochemically.
6. To isolate protoplast and determine its viability.

Minor Exercise:

7. Preparation of media for plant tissue culture.
8. To surface sterilize the given seeds/explant for tissue cultural manipulation.
9. To fuse the protoplast for production somatic hybrid.
10. Demonstration of DNA sequencing by Sanger's dideoxy method.
11. To search literature of different organisms and genes from NCBI.
12. Use of various tools to retrieve information available from NCBI
13. To retrieve gene and protein sequences of various organisms from NCBI.
14. To locate gene(s) on chromosomes for a given disease/disorder.

Suggested Readings (for laboratory exercises)

1. Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics, John-Wiley and Sons Publications, New York.
2. Baxevanis, A. D. and Ouellete, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
3. Gelvin, S. B. and Schilperoort, R. A (eds) 1994. Plant Molecular Biology Manual, 2nd edition. Kluwer Academic Publishers, Dordrecht, The Netherlands,
4. Glover, D. M. and Hames, B. D.(Eds) 1995. DNA Cloning 1: A Practical Approach: Core Techniques, 2nd edition PAS, IRL Press at Oxford University Press, Oxford.
5. Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques. Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.

6. Maniatis et al. Molecular cloning Vol. I, II and III. Cold-Spring Harbor Lab Press.
7. Shaw, C. H. (Ed.) 1988, Plant Molecular Biology : A Practical Approach. IRI Press, Oxford.

References: Online journals available on UGC V-SAT programme.

Suggested Readings:

1. Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics, John-Wiley and Sons Publications, New York.
2. Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
3. Brown, T. A. 1999. Genomes, John Wiley & Sons(Asia) Pvt. Ltd., Singapore.
4. Callow, J. A., Ford-Lloyd, B. V. and Newbury, H. J. 1997. Biotechnology and Plant Genetic Resources: Conservation and Use, CAB International, Oxon UK.
5. Chrispeels, M. J. and Sadava, D. E. 1994, Plants, Genes and Agriculture. Jones & Barlett Publishers, Boston, USA.
6. Glazer, A. N. and Nikaido, H. 1995. Microbial Biotechnology. W. H. Freeman & Company, New York, USA.
7. Gustafson, R. J. 2000. Genomes. Kluwer Academic Plenum Publishers, New York, USA.
8. Henry, R. J. 1997. Practical Applications of Plant Molecular Biology. Chapman & Hall, London, UK.
9. Jain, S. M., Sopory, S. K. and Veilleux, R.E. 1996. *In vitro* Haploid Production in Higher Plants, Vols. 1-5, Fundamental Aspects and Methods. Kluwer Academic Publishers, Dordrecht, The Netherlands.
10. Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.
11. Kartha, K. K. 1985. Cryopreservation of Plant Cells and Organs. CRC Press, Boca Raton, Florida USA.
12. Kingsman, S. M. Genetic Engineering : An Introduction to Gene Analysis and Exploitation in Eukaryotes, Blackwell Scientific Publications, Oxford, 1998.
13. Mount W. 2004 Bioinformatics and sequence genome analysis 2nd Edi. CBS Pub. New Delhi.
14. Old, R. W. and Primrose, S. B. 1989. Principles of Genome Analysis. Blackwell Scientific Publications. Oxford, UK.
15. Primrose, S. B.1995. Principles of Genome Analysis. Blackwell Scientific Ltd., Oxford, UK.
16. Raghavan, V. 1997. Molecular Biology of Flowering Plants. Cambridge University Press, New York, USA.
17. Watson, J. , Tooze and Kurtz Recombinant DNA: A short course

M. Sc. Botany Syllabus
Semester IV
Course code- PSCBOTT14
PAPER –XIV: Angiosperms - II

UNIT- I:

General account, distinguished characters, floral variation and evolution, affinities of :- Magnoliidae, Hamamelidae, Dilleniidae, Rosidae, Asteridae, circumscription as per Cronquist, 1968

UNIT- II:

General account, distinguished characters, floral variation and evolution, affinities of :- Alismatidae, Commelinidae, Aracidae, Liliaceae; Interesting features and systematic position of Cucurbitaceae, Cactaceae, Asteraceae, Amentiferae, Lemnaceae, Palmae, Orchidaceae.

UNIT- III:

Probable ancestors of angiosperms, primitive living angiosperms, speciation and extinction, IUCN categories of threat, distribution and global pattern of biodiversity.

UNIT- IV:

Biological diversity concept and levels, role of biodiversity in ecosystem functions and stability, Endemism, hotspots and hottest hotspots, invasions and introductions, local plant diversities and its socioeconomic importance.

Practicals:

Major Exercises:

1. Description of a specimen from representative, locally available families.
2. Description of a species based on various specimens to study intra specific variation: collective exercise.
3. Field trips within and around the campus; compilation of field notes and preparation herbarium sheets of such plants, wild or cultivated as are abundant.
4. Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.

Minor Exercises:

5. Description of various species of a genus, location of key characters and preparation keys at generic level.
6. Location of key characters and use of keys at family level.
7. Training in using floras herbaria for identification of specimens described in the class.
8. Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparation of dendrograms.

Suggested Readings:

1. Devis, P.H. and Heywood, V. H. 1973. Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.
2. Grant, V. 1971. Plant Speciation, Columbia University press, London.
3. Grant W. F. 1984. Plant Biosystematics. Academic press, London.
4. Harisson, H.J. 1971. New concept in flowering plant Taxonomy. Hickman educational books Ltd. London.
5. Hislop-Harisson, J. 1967. Plant Taxonomy. English Language Book Sco. And Edward Arnold Pub. Ltd, UK.
6. Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.
7. Jones, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co. New York.
8. Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw- Hill Book Co., New York.
9. Nordentam, B., El Gazaly, G. and kassas, M. 2000. Plant systematic for 2ft century. Portlant press. Ltd, London.
10. Radford, A. E. 1986. Fundamentals of plant systematic. Harper and Raw publication, USA.
11. Solbrig, O.T. 1970. Principles and methods of plant Sytematics. The Macmillan Co. Publication Co. Inc., USA.
12. Woodland, D. W. 1991. Contemporary Plant Syatematics, Pentice Hall, New Jersery.
13. Takhtajan, A. L. 1997. Diversity and classification of Flowering Plants. Columbia University Press, New York.
14. Stebbins, G. L. 1974. Flowering Plants-evolution Above species Level. Edvard Arnold Ltd, London.
15. Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co.
16. Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw Hill Book Co., New Delhi.

M. Sc. Botany Syllabus

Semester IV

Course code- PSDBOTT15 (DSE-II)

PAPER –XV: Reproductive Biology of Angiosperms II

UNIT- I:

Fertilization: Cellular nature of sperm, the sperm cytoskeleton, the male germ unit, isolation and characterization of sperm, growth of the pollen tube through the style, passage of sperm into the embryo sac, fusion of nuclei, double fertilization, triple fusion, unusual features. In-vitro approaches to the study of fertilization-Intra-ovarian pollination, test tube fertilization, in-vitro fertilization, placental pollination, Gynogenesis.

Endosperm: types of endosperms, ruminant endosperm, cytological status. endosperm haustoria, chemical composition of endosperm, food reserve in endosperm, role of endosperm in embryo development, endosperm mutants.

UNIT- II:

Embryogenesis: Zygote and its ultra-structure, milieu of the developing embryo, symmetry and polarity, rest period in zygote embryonic formulae, embryonic law. **Suspensor-**Ultra structure of suspensor cells, cytology of suspensor cell, physiology and biochemistry of suspensor; Nutrition of embryo- nutrient supply of the zygote, embryo-endosperm relation.

Polyembryony: Definition, causes, classification, induction of polyembryony, practical importance of polyembryony.

UNIT- III:

Apomixis: Definition, causes, classification, - Diplospory, Apospory, pseudogamy, autogamous development of endosperm, causes of apomixis, significance.

Parthenocarpy: Definition, causes, practical importance

Mellitopalynology : Pollen analysis of honey, Role of apiary in crop production.

Biotechnology: Concept and scope of biotechnology; Cell structure, cellular totipotency

- a) **Anther and pollen culture,**
- b) **Ovule and nucellus culture**
- c) **Endosperm culture and its practical applications**
- d) **Embryo culture:** Techniques, nutritional aspects of embryo culture morphological and physiological considerations, culture of mature embryo and proembryo.
- e) **Somatic embryogenesis:** historical background, embryogenesis from callus, direct embryogenesis- recurrent embryogenesis; cytology of somatic embryogenesis, nutritional factors, hormonal factors.

UNIT- IV:

- a) **Protoplast culture and somatic hybridization-** isolation of protoplast, culture methods, fusion of protoplast, selection of fusion products, consequences of fusion, production of Cybrids and hybrids.
- b) **Biotransformation and production of useful compounds** through cell culture, factor affecting yield, biotransformation, bioreactors, perspective.

Practicals :

Major Exercises:

- 1) Organogenesis using appropriate explants.
- 2) Responses of calli to stress condition viz. temp, (low, high), moisture, salinity.
- 3) Induction of androgenesis through anther culture.
- 4) Isolation of protoplasts, fusion and its culture.
- 5) Induction of somatic embryogenesis
- 6) Physiology of embryo development, using electrophoretic and histochemical methods embryo culture.

Minor Exercises:

- 7) Viability of seed through germination, biochemical and excised embryo methods.
- 8) Preparation of plant tissue culture medium (MS).
- 9) Demonstration of sterilization methods employed in Plant Tissue Culture techniques.
- 10) Induction of secondary metabolite synthesis in suspension culture.
- 11) Endosperm culture.
- 12) Ovule and Nucellus culture.
- 13) Viability test for isolated protoplasts.

Suggested Readings:

1. Asker S. 1979, Progress in apomixis research. *Hereditas* 91, 231-240.
2. Barnier, G. 1986, The flowering process as an example of plastic development. *Soc. Expt.. Biol.* 40: 257-286.
3. Barth, F.G. 1991, insects and flowers, Princeton Univ. Press. Princeton.
4. Battaglia, E. 1963. Apomixis In recent advances in the embryology of angiosperms (ed P. Maheshwari), pp- 264, *Intt. Soc. Plant Morphologists, Univ. Delhi.*
5. Bhandari N. N. 1984, The microsporangium in embryology of angiosperms (ed B.M. Johri) Springer- Verlag, Berlin, pp. 53-121.
6. Bhandari N.N., M. Bhargava and P. Chitrlekha 1986, Cellularization of free nuclear endosperm of *Pappaver somniferum* L. *Phytomorphology*, 36, 357-366.
7. Bhojwani S.S. and M.K. Rajdan 1983, Plant tissue culture, Theory and Practice Elsevier, Amsterdam.
8. Boesewinkel F.D. and Boman F. 1984, The seed structure in embryology of angiosperms (ed B.M.Johri), Springer- Verlag, Berlin, pp. 567-610.
9. Bouman F. 1984 The ovule in embryology of angiosperms (ed B.M.Johri), Springer- Verlag, Berlin, pp. 123-157.
10. Cartson P.S., Smith N.H., Dearing R.D. (1972) Parasexual interspecific plant hybridization. *Proc. Nat. Acad. Sci. USA*, 69, 2292-2294.
11. Cartson P.S. (1973) The use of protoplasts of genetic research. *Proc. Nat. Acad. Sci. USA*, 70, 598-602.
12. Chitrlekha P. and N.N. Bhandari 1991, Post fertilization development of antipodal cells in

- Ranunculus scferatus*. Phytomorphology 41, 200-212.
13. Ciampolini F.M., Nepi and E. Pacini 1993, tapetum development in *Cucurbita pepo* (Cucurbitaceae) Pt. Syst. Evol. (Suppl) 7-13-22.
 14. Cocking E.C. 1960, A method for the isolation of plant protoplasts and vacuoles. Nature (London) 187-927-929.
 15. Cocking E.C. 1970, Virus uptake, cell wall regeneration and virus multiplication in isolated plant protoplasts. Int. Rev. Cytol 28-89-124.

M. Sc. Botany Syllabus

Semester IV

Course code- PSDBOTT15 (DSE-II)

PAPER –XV: Molecular Biology and Plant Biotechnology-II

UNIT- I:

Transgenics : Cloning vectors for higher plants; Methods for gene transfer, *Agrobacterium tumefaciens* mediated- Basis of tumor formation, features of Ti and Ri plasmids, mechanisms of DNA transfer, role of virulence genes, use of Ti and Ri genetic markers, use of reporter genes and introns; Direct DNA transfer; particle bombardment; electroporation; microinjection; macroinjection; liposomes; electrophoretic; pollen tube method; pollen transformation; PEG method; transformation of monocots; transgene stability and gene silencing; chloroplast transformation.

UNIT- II:

Applications of transformation: Herbicide resistance; insect resistance; Bt genes, disease resistance; Nutritional quality; biopesticides and biofertilizers; hazards and safety regulations for transgenic plants.

Metabolic engineering through transgenic plants: Production of secondary metabolites; industrial enzymes; biodegradable plastics (PHB and any other); edible vaccines; antibody production and other important drugs.

UNIT- III:

Plant tissue culture: History, Culture types: Callus culture, organ culture, suspension culture for production of secondary metabolites, protoplast culture, fusion and somatic hybrids, Somatic embryogenesis, anther and pollen culture, haploid plants, somaclonal variations, organogenesis (direct and indirect).

Gene expression: Gene expression in Mitochondria, chloroplast, yeast

Regulation of gene expression: Regulation of gene expression in translation and post-translation level

UNIT- IV:

Nitrogen fixing genes: Organization, function and regulation of nitrogen fixing genes in *Klebsiella*, *hup* genes.

DNA fingerprinting and marker assisted breeding: RFLP maps; linkage analysis; RAPD markers; STS; SSR (microsatellites); ISSR; SCAR (sequence characterized amplified regions); SSCP (single strand conformational polymorphism); AFLP; QTL: map based cloning; molecular marker assisted selection

Cleaner Biotechnology: Pollution control through genetically modified organisms.

Practicals:

Major Exercises:

1. *Agrobacterium tumefaciens* mediating gene transfer in a suitable plant.
2. Induction of secondary metabolite synthesis in suspension culture.
3. Use of RAPD/RFLP/SSCP etc. markers to detect molecular polymorphism of different species.
4. Isolation and protein profiling in different plant species by SDS-PAGE.
5. Raising of suspension culture and plotting of growth curve.
6. Bacterial transformation and selection of transformed cells.
7. Study of expression of inducible genes at biochemical level.

Minor Exercises:

8. Elisa testing of Bt gene in cotton.
9. Isolation of secondary metabolites by gel filtration.
10. Purification of plant metabolite/ protein by column chromatography.
11. DNA ligation and analysis of ligated DNA on agarose gel (cloning and analysis using GUS gene).
12. Organogenesis and somatic embryogenesis using appropriate explants and preparation of artificial seeds.
13. Demonstration of anther culture.

Suggested Readings (for laboratory exercises)

1. Gelvin, S. B. and Schilperoort, R. A (eds) 1994. Plant Molecular Biology Manual, 2nd edition. Kluwer Academic Publishers, Dordrecht, The Netherlands.
2. Glick, B. R. and Thompson, J. E. 1993, Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boca Raton, Florida.
3. Glover, D. M. and Hames, B. D.(Eds) 1995. DNA Cloning 1: A Practical Approach: Core Techniques, 2nd edition PAS, IRL Press at Oxford University Press, Oxford.
4. Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques. Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.
5. Hall, R. D. (Ed.), 1999. Plant Cell Culture Protocols. Humana Press. Inc. New Jersey, USA.
6. Maniatis et al. Molecular cloning Vol. I, II and III. Cold-Spring Harbor Lab Press.
7. Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.
8. Shaw, C. H. (Ed.) 1988, Plant Molecular Biology : A Practical Approach. IRL Press, Oxford.
9. Smith, R. H. 2000. Plant Tissue Culture : Tecniques and Experiments. Academic Press, New York.

Suggested Readings:

1. Alberts, Bruce; Johnson Alexander; Lewis, Julian; Raff, Martin; Roberts, Keith; Walter, Peter, C. 2002 Molecular Biology of the Cell, Garland Science, New York and London.
2. Bhojwani SS and Rajdhan MK 1996 Plant tissue culture: Theory and Practice. Elsevier Sci. Publ., New York.
3. Peter c2002 Molecular Biology of the Cell, New York and London: Garland Science.
4. Callow, J. A., Ford-Lloyed, B. V. and Newbury, H. J. 1997. Biotechnology and Plant Genetic Resources: Conservation and Use, CAB International, Oxon UK.
5. Charlwood, B. Y. and Rhodes, M.V. 1999 Secondary products from plant tissue culture, Clarendon Press. Oxford.
6. Chrispeels, M. J. and Sadava, D. E. 1994, Plants, Genes and Agriculture. Jones & Barlett Publishers, Boston, USA.
7. Collins HA and Edwards S 1998 Plant cell culture. BIOS Sci. Publ., Oxford UK.
8. Dicosmo F and Misawa, M. 1996 Plant Cell culture: Secondary metabolism towards industrial application, CRC press, Boca Raton, NewYork.
9. Glazer, A. N. and Nikaido, H. 1995. Microbial Biotechnology. W. H. Freeman & Company, New York, USA.
10. Gustafson, R. J. 2000. Genomes. Kluwer Academic Plenum Publishers, New York, USA.
11. Henry, R. J. 1997. Practical Applications of Plant Molecular Biology. Chapman & Hall, London, UK.
12. Jain SM, Sopory SK and Veilleux RE 1996 In vitro haploid production in higher plants. Vols. 1-5. Kluwer Acad. Publ., The Netherlands.
13. Kurz, W.G.W 1989 Primary and Secondary metabolism of plant and Cell cultures, Springer Verlag, Berlin.
14. Old, R. W. and Primrose, S. B. 1989. Principles of Genome Analysis. Blackwell Scientific Publications. Oxford, UK.
15. Primrose, S. B. 1995. Principles of Genome Analysis. Blackwell Scientific Ltd., Oxford, UK.
16. Raghavan, V. 1997. Molecular Biology of Flowering Plants. Cambridge University Press, New York, USA.
17. Shantharam, S. and Montgomery, J. F. 1999. Biotechnology, Biosafety, and Biodiversity. Oxford & IBH Publication Co., Pvt., Ltd., New Delhi.

References: Online journals available on UGC V-SAT programme.

M. Sc. Botany Syllabus
Semester IV
Course code- PSDBOTT15 (DSE-II)
PAPER –XV: Paleobotany-II

UNIT- I:

Gymnospermopsida-- Study of Aneurophytales and Archaeopteridales. Gymnosperm and early evolution (Archeosperma, Elkinsia, and Morentia) of seed habit stages in evolution. Study of Pteridosprmales-Lyginopteridaceae, Medullosaceae, Cycadeoidales-Cycadeoidaceae, Williamsonsaceae, Wielandiellaceae. and Fossil Cycads (Nilssonina, Baenia, Androstrobus).

UNIT- II:

Gymnosper- Caytoniales, Glossopteridales, Penntoxylales. fossil Cordaitales, Voltziales and phylogenetic consideration of all the orders.

UNIT- III:

Study of Deccan Intertrappean flora of India. Formation of Deccan traps and Intertraps, age and its floristic composition in relation to Pteridophytes, Gymnosperms and Angiosperms. Paleocene and Paleogeography of Deccan Intertraps.

UNIT- IV:

Paleopalynology-Important features of spores and pollen morphology, their role in stratigraphy and in exploration of coal and oil. Paleopalynological studies, microfossils and its application. Paleocology and paleogeography.

Indian Gonwana-Its stratigraphy and classification (Two fold and three fold). Index fossil.

Suggested Laboratory and Field Exercises

Major Exercises:

1. Study of Deccan Intertrappean flora of India. Pteridophytes, Gymnosperms and Angiosperms-flowers and fruits.
2. Gymnosperm- Caytoniales, Glossopteridales, Penntoxylales. fossil Cordaitales.
3. Lyginopteridaceae, Medullosaceae, Cycadeoidales-Cycadeoidaceae, Williamsonsaceae, Wielandiellaceae and Fossil Cycads (Nilssonina, Baenia, Androstrobus).
4. Important features of spores and pollen morphology and technique to study them (Maceration)

Minor Exercises:

5. Study different types of fossils.
6. Study of plant fossils as per syllabus based on specimens and slides.
7. Study of wood anatomy of fossils.
8. Exploration and excursion to different fossiliferous localities.

9. Preparation of practical record/submission of collection and tour report of excursion.

Suggested Readings

1. Agashe S. N. (1995)-Palaeobotany, Plants of the past ,their evolution, palaeoenvironment and application in exploration of fossil fuels. Oxford & IBH publishing company-New Delhi.
2. Andrews H.N.(1961)-Studies in Palaeobotany, Willey and Sons –New York.
3. Arnold,C.A.(1947)-An Introduction to Palaeobotany ,MC-GrawHills.,New York.
4. Beck, C. B. and Wight, D. C.(1988)-Progymnosperm, In origin and evolution of Gymnosperms,Columbia Uni. Press-New York.
5. Beck, C.B.(1976)-Current status of the Progymnospermosida, Review of Palaeobotany and Palynology.
6. Darrah, W.C.(1960)-Principles of Paleobotany.
7. Erdtman,G(1957)-Pollen and Spore morphology and plant taxonomy.(An introduction to palynology) Hafner Publishing Comp-New York.
8. Chandra,S.andSurange, K.R.(1979)-Revision of the Indian species of Glossopteris, Monograph,BirbalSahni Institute of Palaeobotany.
9. Hoffmeister,W.S.(1960)-Palynology has an important role in oil exploration.World oil-150:1001-140.
10. Meyen, S.V.(1987) – Fundamentals of Palaeobotany Chapman and Hill,London,New York.
11. Parihar ,N.S.(1995) –Essentials of Palaeobotany,Central Book –Allahabad.
12. Sahni, B.(1964)- Revisions of Indian fossils plants, -III(Monocotyledons) –BSIP-Lucknow.
13. Stewart, W.N.&Rothwell,G.V. (1993)-Palaeobotany and Evolution of Plants,Cambridge Univ., Press-Cambridge.
14. Venkatchala, B.S&Maheshwari,H.K.(1991)-Palaeobotanical Researches in India.Jour.Ind.Bot.Society-70;1-12.
15. Wadia, D.N (1953)-Geology of India,Mac,Millan-Co.London.
16. Prasad, K.N. (1999). - An introduction to palaeobotany, APH Pub.
17. Cleal, J. Christopher. &B.A.Thomas (2009) Introduction to Plant Fossils, Cambridge Univ., Press-Cambridge.
18. Willis, K. J. & McElwain, J. C. (2014). The Evolution Of Plants (second edition) OXFORD University Press.
19. Stewart, W.N. and Rothwell G.W. (1993), Palaeobotany and the Evolution of Plants, Cambridge University Press.
20. Arnold, C.A. (1947): Introduction to Palaeobotany, Mc-Graw Hill Book Co. Inc., New York and London.
21. Agashe, S.N. (1995), Palaeobotany, Oxford & IBH, New Delhi.
22. Siddiqui, K.A. (2002) Elements of Palaeobotany, Kitab Mahal, Allahabad.
23. Thomas, B.A. & Spicer R.A. (1987): The Evolution and Palaeobiology of land plants. Discordies Press, Fortland, USA.
24. Spicer, R.A. & Thomas, B.A. (1986) Systematic and taxonomic approaches in Palaeobotany. Systematic Association Special Volume.

M. Sc. Botany Syllabus
Semester IV
Course code- PSSBOTT16 (SEC-II)
PAPER –XVI: BIOFERTILIZERS-II

UNIT I

Application and evaluation techniques of crop response to biofertilizers, simplified Anaerobic digester for biofertilizers; modified Anaerobic fermenter biofertilizer, Operation condition for anaerobic digestion of biofertilizer.

UNIT II

Soil fertility and Fertilizer:- Soil microbiology and biofertilizer; Biogas from liquid biofertiliser derived from ecologically hazardous water hyacinth; Municipal sewage, agricultural and industrial waste. Recycling of biodegradable waste.

UNIT III

Vermiculture and Vermitechnology:-Introduction; Advantages of vermicomposting, earthworm, ecological types of earthworm, Vermicomposting and their application in organic culture- compost making, Methods and field application

UNIT IV

Green manuring and Organic fertilizer:- Organic farming and organic manures, Methanogenesis- pest and disease management system in agriculture.

Practicals:

Based on theory syllabus.

Suggested reading:-

4. The complete technology book on biofertilizers and organic farming –NIIR, New Delhi.
5. Somani L.L, P.Shilpkar and D.Shilpkar (2011) Biofertilizers commercial production technology and quality control. Agrotech publisher Academy Udaipur.
6. The complete technology book on Vermiculture and Vermicompost NIIR- New Delhi.

M. Sc. Botany Syllabus
Semester IV
Course code- PSSBOTT16 (SEC-II)
PAPER –XVI: Nursery and Gardening-II

Unit-I:

Plant Protection- Difference between a pest and a disease, preventive measures, control measures, cultural control, mechanical control, chemical control, common pests, bird and animal pests, rodent pests, insect pests and diseases.

Unit –II:

Plant propagation- Sexual and vegetative methods of propagation, short and long term storage of propagules (seeds, fruits, bulbs, rhizomes etc).

Unit-III:

Bonsai and Indoor plants- Tools and containers, Procuring plants for bonsai, characteristic elements of bonsai, Shaping-pruning-wiring technique, form and style, root pruning and potting-repotting, Maintenance of growth. Indoor plants and foliage and ornamental plants.

Unit-IV:

Poly-house, Pots and potculture- Design and construction of Poly-house, maintenance and applications of poly-house. Popularity of pot culture, pot arrangements, selection of pots, filling up of pots, watering, repotting, boxes and baskets of potting.

Practicals:

Based on theory syllabus.

Suggested Readings:

3. Trivedi, P. P. (1987) Home Gardening. ICAR New Delhi.
4. Deena Beverley and Barty Phillips (2002) Encyclopedia of Gardening, Parragon Book, UK.

M. Sc. Botany Syllabus

Semester IV

Course code- PSSBOTT16 (SEC-II)

PAPER –XVI: PLANT DIVERSITY AND HUMAN WELFARE-II

Unit-I:

Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation.

Unit-II:

Social approaches to conservation, Biodiversity awareness programmes, Sustainable development.

Unit-III:

Role of plants in relation to Human Welfare:

Importance of forestry their utilization and commercial aspects
Avenue trees, Ornamental plants of India.

Unit-IV:

Role of plants in relation to Human Welfare. Alcoholic beverages through ages. Fruits and nuts:
Important fruit crops their commercial importance. Wood and its uses.

Practicals:

Based on theory syllabus.

Suggested Readings

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity – Principles and Practices.
Oxford and IBH Publications Co. Pvt. Ltd. New Delhi

M. Sc. Botany Syllabus
Semester IV
Course code- PSSBOTT16 (SEC-II)
PAPER –XVI: FLORICULTURE-II

Unit-I:

Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India.

Unit-II:

Landscaping Places of Public Importance: Landscaping highways and Educational institutions.

Unit-III:

Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life;

Unit-IV:

Cultivation of Important cut flowers such as Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Liliium, Orchids.

Practicals:

Based on theory syllabus.

Suggested Readings

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

M. Sc. Botany Syllabus
Semester IV
Course code- PSSBOTT16 (SEC-II)
PAPER –XVI: BASIC BOTANY-II

UNIT I

Plant physiology:-

- A) Water relation – Diffusion, Osmosis and Inbibition.
- B) Absorption of water and minerals by root.
- C) The loss of water from plants.
- D) The movement of water in plants.
- E) Metabolism of nitrogen, Photosynthesis, Respiration.
- F) Synthesis of protein, fat and there trans location.
- G) Plant growth, movement and reproduction.

UNIT II

Ecology and evolution:- Ecological groups of plants, ecological factors, the units of vegetation (communities), plant succession, ecological types of adaptation of plants, environmental pollution. Evolution of plant kingdom. The ideas of development of organic evolution (Darwinism and Lamarckism).

UNIT III

Economic botany:- General description of economically important plants, yielding food, fodder and forage, wood, oils, gums and resin, oil, drugs and narcotics, beverages, Spices and condiments.(any three examples from each type)

UNIT IV

Paleo botany:- Geological time scales, changes in organic life through ages, process of fossilization, types of fossils presarvations, economic importance of fossils.

Practicals:

Based on theory syllabus.

Suggested Readings:-

1. S.Sundara Rajan College Botany Vol I to IV Himalaya publishing house.
2. Saxena And Sarsbhai A textbook of botany Vol. I to III Kitabghar Gwalior.
3. Gangulee And Kar College botany Vol.I and II.
4. K.S.Bilgrami, L.M.Shrivastava, J.L.Shremali Fundamentals of botany Vol. I and II Vikas Publishing House PVT.LTD. Sahibabad UP.
5. A.C.Dutta Botany for degree students.
6. S.N.Pande And P.S.Trivedi Text book of botany Vol I and II. Vani educational book.