

GONDWANA UNIVERSITY
GADCHIROLI

SYLLABUS

For

M. Sc.

BOTANY

SEMESTER I & II

Under
Choice Based Credit System

(CBCS)

(With effect from : 2016-17)

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

Semester I

Core	Theory / Practical	Teaching Scheme			Credit	Examination Scheme					
		Hrs/ week				Duration in hrs.	Max. Marks		Total	Minimum Marks	
		Theory	Practical	Total			External	Internal		Theory	Practical
PSCBOTT01	Paper - I	4	-	4	4	3	80	20	100	40	
PSCBOTT02	Paper - II	4	-	4	4	3	80	20	100	40	
PSCBOTT03	Paper -III	4	-	4	4	3	80	20	100	40	
PSCBOTT04	Paper - IV	4	-	4	4	3	80	20	100	40	
Pract. – I PSCBOTP01	Practical - I	-	8	8	4	6	80	20	100	40	40
Pract. – II PSCBOTP02	Practical - II	-	8	8	4	6	80	20	100	40	40
Seminar - I	Seminar - I	2	-	2	1			25	25	10	
TOTAL		18	16	34	25		480	145	625	170	80

Semester II

Core	Theory / Practical	Teaching Scheme			Credit	Examination Scheme					
		Hrs/ week				Duration in hrs.	Max. Marks		Total	Minimum Marks	
		Theory	Practical	Total			External	Internal		Theory	Practical
PSCBOTT05	Paper - V	4	-	4	4	3	80	20	100	40	
PSCBOTT06	Paper - VI	4	-	4	4	3	80	20	100	40	
PSCBOTT07	Paper -VII	4	-	4	4	3	80	20	100	40	
PSCBOTT08	Paper -VIII	4	-	4	4	3	80	20	100	40	
Pract. – III PSCBOTP03	Practical - III	-	8	8	4	6	80	20	100	40	40
Pract.- IV PSCBOTP04	Practical - IV	-	8	8	4	6	80	20	100	40	40
Seminar - II	Seminar - II	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	

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. _____

SEMESTER I

PRACTICAL I Course code : PSCBOTP01

Credit - 04

Time : 6 Hours

Full marks : 80

Q. 1 To identify the given Cyanobacterial material A .	06
Q.2 To identify two algal forms B, C , from the given mixture.	06
Q.3 To identify the given fungal culture D	06
Q. 4 To identify the given pathogen in the given material E .	06
Q. 5 To prepare a Temporary micropreparation of the given Bryophytic F material and identify it.	12
Q 6. To prepare a Temporary micropreparation of the given Pteridophytic G material and identify it.	12
Q. 7 Comment on the given spot H (Cyanobacteria/Bacteria), I (Algae), J (Fungi), K (Plant Pathology) L (Bryophyte) , M (Pteridophyte).	12
Q.8 Viva-voce	10
Q. 9 Practical Record and tour report	10

SEMESTER I

PRACTICAL II Course code : PSCBOTP02

Credit - 04

Time : 6 Hours

Full marks : 80

Q. 1 To prepare a double stained micropreparation of the given gymnospermic material A and identify it.	12
Q.2 Comment on the given fossil specimen B	12
Q.3 One experiment from Cytology C	12
Q. 4 One experiment from Genetics D	12
Q. 5 Comment on the given spot E (Gymnosperm) F (Paleobotany), G (Cytology), H (Genetics)	12
Q.6 Viva-voce	10
Q. 7 Practical Record and tour report	10

SEMESTER II

PRACTICAL III Course code : PSCBOTP03

Credit - 04

Time : 6 Hours

Full marks : 80

Q. 1 To perform the given physiological experiment A and report The findings	15
Q.2 To quantify the given metabolite in the given sample B	10
Q.3 To study the cytohistological zonation in SAM of given material C	10
Q. 4 To perform the given exercise based on plant development D	10
Q. 5 Write a note on given stage of micro- or megasporogenesis E	06
Q. 6 Spotting: F (Physiology), G (Plant development), H (Reproduction)	09
Q. 7 Viva-voce	10
Q. 8 Practical Record	10

SEMESTER II

PRACTICAL IV Course code : PSCBOTP04

Credit - 04

Time : 6 Hours

Full marks : 80

Q. 1 One experiment from paper VII A	14
Q.2 One experiment from paper VII B	10
Q.3 One experiment from paper VIII C	14
Q. 4 One experiment from paper VIII D	10
Q. 5 Spotting: E (Paper VII), F (Paper VII), G (Paper VIII), H (Paper VIII)	12
Q. 6 Viva-voce	10
Q. 7 Practical Record and field diary	10

M. Sc. Botany Syllabus

Semester I

Course code- PSCBOTT01

Credit - 04

PAPER –I: Microbiology, Algae and Fungi

UNIT – I

General Microbiology :

History – Contributions made by Leeuwenhoek, Pasteur, Robert Hook, Jenner, Waksman, Iwanowsky. Koch” s Postulate.

Bacteria – Structure, morphology, reproduction.

Viruses – General account; Morphology and ultrastructure of TMV, Bacteriophage;

Introduction to viroids, prions and interferon.

Archaeobacteria and eubacteria: General account; ultrastructure, nutrition and reproduction, biology and economic importance; **Cyanobacteria:** *Microcystis, Lyngbya, Nostoc, Scytonema, Gloeotrichia and Stigonema.*

UNIT - II

Phycology:

Criteria for classification of algae: Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Pheophyta and Rhodophyta; pigments, reserved food, flagella

Algae in diversified habitats (terrestrial, freshwater, marine), thallus organization; cell ultrastructure; reproduction (vegetative, asexual, sexual); algal blooms, algal biofertilizers; algae as a food, feed and uses in industry.

UNIT –III

General account: Classification of Fungi (recent trends and criteria used in classification); Physiology of Fungi (with reference to biotrophs, hemibiotrophs, symbionts); Fungal Cytology : Heterothallism, heterokaryosis, parasexual cycle.

Comparative study, classification and evolutionary trends in the following:

Myxomycota: Protist characters and general account with special reference to *Physarium* and *Plasmodiophora*

Eumycota: i. Oomycetes : *Saprolegnia, Synchytrium, Phytophthora, Peronospora*, ii.

Zygomycetes : *Mucor, Rhizopus, Syncephalastrum, Cunninghamella*

UNIT – IV

Comparative study, classification and evolutionary trends in the following: iii.

Ascomycetes: *Saccharomyces, Phyllactinia, Chaetomium, Xylaria*, iv. Basidiomycetes:

Melampsora, Puccinia, Ravenelia, Ustilago, Polyporus, v. Deuteromycetes:

Helminthosporium, Fusarium, Colletotrichum, Phoma

Plant Pathology : Symptomology, histopathology, etiology and identification of diseases with reference to following fungal, bacterial and viral diseases (Paddy blast, wheat rust, bunt of wheat, smut of jowar, black arm of cotton, red rot of sugarcane, citrus canker, gummosis, leaf curl of papaya, potato blight.)

Laboratory Exercises:

Classification and type study of the following classes

Cyanobacteria: *Microcystis, Lyngbya, Nostoc,*

Scytonema, Gloeotrichia and Stigonema.

Prochlorophyta : *Prochloron*

Chlorophyta: *Pandorina, Eudorina, Stigeoclonium, Ulva, , Chlorella, Scenedesmus,*

Caulerpa, Valonia, Acetabularia.

Phaeophyta : *Spacelaria, Padina, , Turbinaria.*

Rhodophyta : *Nemalion, Gelidium, Gracilaria, Corallina, Polysiphonia.*

Euglenophyta : *Euglena, Phacus.*

Bacillariophyta : *Cyclotella, Synedra, Cymbella, Navicula, Gomphonema.*

Morphological Studies of Fungi (any 15 of the following)

Stemonities, Perenospora, Phytophthora, Albugo, Mucor, Rhizopus, Yeast, Aspergillus,

Penicillium, Chaetomium, Taphrina, Peziza, Erisyphe, Phyllactenia, Uncinula, ,

Melamosora, Uromyces, Drechslera, Ravenallia, Ustilago, Polyporus, Morchella, Cyathus, ,

Alternaria, Helminthosporium, Curvularia, Colletotrichum, Phoma, Plasmodiophora,

Cercospora, Fusarium, Claviceps.

Symptomology of some diseased plants (any 7 of the following).

White rust of Crucifers, Downy mildew, powdery mildew, Rusts, Smuts, Ergot, Groundnut

leaf spot (Tikka disease), False smut of paddy, red rot of Sugarcane, Wilt disease, Citrus

canker, Angular leaf spot of cotton, Potato blight, Leaf mosaic of bhindi/ papaya, Leaf curl

of tomato/Potato/Papaya, Little leaf of brinjal.

Identification of Fungal cultures (Any 5)

Rhizopus, Mucor, Aspergillus, Penicillium, Drechslera, Curvularia. Phoma, Colletotrichum,

Alternaria, Helminthosporium.

Field study: For collection and studying fungal flora

Suggested Readings:

1. Kumar HD (1988) Introductory Phycology. Affiliated East-West Press Ltd. New Delhi
2. Morris I (1986) Introduction to the Algae. Cambridge University Press, UK
3. Round FE 1986 The Biology of Algae. Cambridge University Press, UK
4. Mandahar CL 1978 Introduction to Plant Viruses. Chand & Co. Ltd., New Delhi
5. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.
6. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.
7. Alexopoulos, C.J. (1962). Introductory Mycology John Wiley Eastern Pvt.Ltd.
8. Alexopoulos, C.J. and Mims C.W. (1979). Introductory Mycology 3rd Edition, John Wiley and Sons, Inc. Wiley, New York.
9. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc.Wiley, New York
10. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.
11. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.
12. Bilgrami, K.S. and H.C.Dube (1985) A text Book of Modern Plant Pathology, Vikas Publication House, New Delhi.
13. Barnett, J.H. (1968) Fundamentals of Mycology. The English Language Book Society and Edward Arnold Publication, Limited.
14. Dube, R.C. and D.K.Maheshwari (1999) A.Text Book of microbiology, S. Chand & Co. Ltd.
15. Dube, R.C. and D.K.Maheshwari (2000) Practical Microbiology - S.Chand & Co. Ltd.
16. Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.
17. Jha, D.K. (1993) A Text Book of Seed Pathology, Vikas Publication House.
18. Mehrotra, R.S. (1989) Plant Pathology, Tata McGraw Hill.
19. Mehrotra, R.S. and K.R.Aneja (1998) An Introduction to Mycology, New Age Intermediate Press.
20. Pelzer, M.J. , Jr.Cahn, E.C.S. and N.R.Krieg (1993) Microbiology, Tata McGraw Hill.
21. Preece and Dickeson. Ecology of leaf surface microorganism Academic Press, New York.
22. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall of India.
23. Raychoudhari, S.P. and Nariani, T.K. (1977) Virus and Mycoplasma Diseases of Plant in India, Oxford and IBH Publication Co.
24. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.
25. Snowdon, A.L. (1991) A colour Atlas of Post harvest diseases & disorders of fruits & vegetables Vol.I & II Wolfe Scientific, London.
26. On line Journals available on UGC -VSAT

M. Sc. Botany Syllabus

Semester I

Course code : PSCBOTT02

Credit - 04

PAPER –II: Bryophytes & Pteridophytes

UNIT - I

General characters, distribution, classification, ecology of Bryophytes, Bryophytes as ecological indicators, morphogenesis in bryophytes, fossil history of bryophytes, cytology of bryophytes, regeneration in bryophytes, modern trends in taxonomy.

UNIT - II

General account in-

Hepaticopsida: Sphaerocarpaceae, Takakiales

Anthocerotopsida: Anthocerotales,

Bryopsida: Sphagnales, Polytrichales..

UNIT - III

General characters, distribution, classification, evolution of stele, heterospory and seed habit, apospory and apogamy; Important contributions of Indian Pteridologists, General account of Ryniopsida, Psilopsida, Lycopsidea [protolpidodendrales, Lycopodiales, Selaginales, Isoetales.

UNIT - IV

General account of Sphenopsida [Hyeniales, Equisetales], Filicopsida [Ophioglossales, Filicales, Salviniales, Marsileales], Tracheophyta [Progymnospermosida].

BRYOPHYTES:

Laboratory Exercises:-

Study of morphological and reproductive characters of representative members mentioned in the syllabus using cleared whole mount preparations, dissections and sections. Preparation of permanent slides is necessary. Study of bryophytes in their natural habitats.

Botanical excursion outside the state is compulsory to study the bryophytes in their natural conditions.

PTERIDOPHYTES:

Laboratory Exercises:-

Pteridophytes-

Study of fossil forms (specimens and permanent micropreparations).

Study of living forms: Morphological, anatomical and reproductive characters of the forms mentioned in the syllabus. Anatomical characters to be studied either by taking free hand sections (t.s./ l.s.) and by observing the permanent micropreparations. Preparations of permanent slides are essential.

Suggested Readings

1. Andrews H.N. Jr. (1961) *Studies in Paleobotany* (Jonh Wiley & Sons, New York)
2. Arnold C.A. (1947) *An introduction to Paleobotany* (McGraw Hill, New York) 13
3. Banks H.P. (1968) *The early history of Land plants. In evolution and environment*, ed. E.T. Drake. New Haven: Yale Univ. Press, pp, 73-107.
4. Banks H.P. (1970) *Evolution and plants of past.* (Belmont, California, Wadsworth).
5. Banks, H. P. (1975). *Reclassification of Psilophyta*, *Taxon*. 24, 401-13.
6. Berrie, G. K. (1963). *Cytology and Phylogeny of liverwoets.* *Evolution* 17, 347-357.
7. Bierhorst D.W (1971) *Morphology of vascular plants*, New York (Mac Millan)
8. Campbell, D. H. (1961). *The evolution of the Land Plants* (central Book Depot, Allahabad)
9. Cavers, F. (1910). *The interrelationship of Bryophyta I-IV.* *New Phytologist*. 9
10. Cavers, F. (1911). *The interrelationship of Bryophyta VII-IX.* *New Phytologist*. 10.
11. Chrysler M.A. (1910) *The fertile spike in Ophioglossaceae.* *Ann. Bot.* 24:1-18.
12. Delevoryas T. (1962) *Morphology and Evolution of fossil plants* (Holt, Rinehart and Winston, New York).
13. Eames A.J (1936) *Morphology of vascular plants, lower groups* (McGraw Hill, New York).
14. Foster A.S.and E.M Gifford Jr. (1959) *Comparative morphology of vascular plants* Freeman, San Fransisco.
15. Grolle, R. (1963). *Takakia in Himalayas*, *Ost. Bot. Zeitscher*, 110:444-447.
16. Gupta K.M. (1962) *Marsilea*, *Botanical monograph no. 2* (CSIR, New Delhi).
17. Ingold, C. T. (1939). *Spores discharge in land plants* (Oxford London)
18. Kashyap S.R. (1929). *Liverworts of the western Himalayas and The Punjab Plain1*(*Chronica Botanica*)
19. Kashyap S.R. (1933). *Liverworts of the western Himalayas and The Punjab Plain2*(*Chronica Botanica*)
20. Lacey, W. A. (1969). *Fossil Bryophytes.* *Biological Reviews*, 44,189-205.
21. Mehra , P.N. and O. N. Handoo (1953). *Morphology of Anthoceros erectus and A. himalayensis and the phylogeny of the anthocerotales.* *Bot. Gaz.*114:371-382.
22. Parihar N. S. (1976). *An introduction to Embriyophyta, Bryophyta* (Centaral Book House,

Allahabad)

23. Parihar N.S. (1977) The biology and morphology of the Pteridophytes (Central Book Depot, Allahabad).
24. Pichi- Sermolli REG (1959) Pteridophyta in vistas in botany, WB Turrill, ed. (Pergamon Press, London) pp 421-493.
25. Proskauer J. (1951). Study in Anthocerotales, III, The Bryologist 53,165-172.
26. Puri Prem (1985) Bryophytes- A broad perspective.
27. Ramanujam CGK (1992) Origin and evolution of lycopods Paleobotanist 41, 51-57.
28. Rashid A. (1982) (4th edn) An introduction to pteridophyta (Vikas Publ House Pvt Ltd.)
29. Schuster R. (1966). The Hepaticae and Anthocerotae of North America. East of the Hundredth meridian, Newyork (Colombia University Press).
30. Scott D.H. (1908) Studies in fossil botany. London, Black Part 2.
31. Scott D.H. (1920-1923) Studies in fossil botany. (A & C Black London.)
32. Sharma O.P (1996) Textbook of pteridophyta (Mac Millan India Ltd, New Delhi)
33. Smith A. J. E. (1986). Bryophyte phylogeny fact or Fiction? Journal of Bryology, 14,83-
34. Smith G. M. (1955). Cryptogamic Botany-vol. 2 Bryophyta and Pteridophyta (McGraw Hill Book compony, Newyork)
35. Smith W. N. and G. W. Rothwell (1993). Paleobotany and the evolution of plants (Cambridge Univ. press)
36. Sporne K.R. (1962) The morphology of pteridophyta (Hutchinson Univ. Library, London)
37. Steil W.N. (1939) Apogamy, Apospory and Parthenogenesis in the pteridophyta, Bot. rev, 5, 433-453.
38. Steward W.N. (1983) Paleobotany and the evolution of plants. 1st ed. New York, (Cambridge Univ. press)
39. Surange K.R and S. Chandra (1972) Fructification of Glossipteridae from India, Paleobotanist 21, 1-17.
40. Taylor T.N. (1988) the origin of land plants- Some answers more questions, Taxon, 37, 805-33.
41. Udar ram (1970) An introduction to bryophyte (Shashidhar malviya Prakashan, Lucknow)
42. Udar Ram, Srivastava S.C. and Kumar Dinesh (1970) Genus *Buxbaumia* in India, Curr. Sci. (India) 39, 14-15.
43. Walton J. (1925) Carboniferous Bryophyta I. Hepaticae. Annals of Botany, 39, 563-72.
44. Walton J. (1928) Carboniferous Bryophyta II. Hepaticae & Musci. Annals of Botany, 42, 707-16.
45. Walton J. (1940) An introduction to the study of fossil plants. A& C Black, London.
46. Watson E.V. (1967) The structure and life of Bryophytes, 2nd ed, London, Hutchinson.
47. Wilson C.W. (1942) The telome theory and the origin of the stamen. Am. J Bot., 29, 759-764.
48. Zimmermann W. (1952) Main results of the "Telome theory". The Paleobotanist, Birbal Sahni Memorial Volume, 456-70.

M. Sc. Botany Syllabus

Semester I

Course code ; PSCBOTT03

Credit - 04

PAPER –III: Gymnosperms and Paleobotany

UNIT - I – Paleobotany

Introduction : Plant fossils – Preservation, preparation, age determination, geological time scale; Fossil record – systematic, reconstruction and nomenclature; Applied aspects of paleobotany.

UNIT - II – Gymnosperms

General account, distribution (living, Fossil), origin, systems of classification, economic importance.

Comparative morphology and evolutionary tendencies of

1. Pteridospermales – Lyginopteridaceae (*Calymotheca hoeninghausii*, *Heterangium*, *Spherostoma*) Medullosaceae (*Medullosa*, *Trignocarpus*)
2. Cycadales – Cycadaceae; Fossil history (*Baenia*, *Nilssonia*, *Androstrobus*)
3. Cycadeoidales – Williamsoniaceae, Cycadoeoidaceae

UNIT - III

4. Cordaitales (General account and relationships)
5. Caytoniales (General account and relationships)
6. Glossopteridales (General account and relationships)
7. Pentoxylales (General account and relationships)
8. Gnetales (General account and relationships)

UNIT - IV

9. Ginkgoales – *Ginkgo*, *Baiera*, *Trichopitys*
10. Coniferales – (Morphology, reproductive organs, gametophytes, embryo)
11. Taxales – *Taxus*

Laboratory Exercises:-

Comparative Study of vegetative and reproductive parts of – *Cycas*, *Zamia*, *Cedrus*, *Abies*, *Pinus*, *Cupressus*, *Cryptomeria*, *Taxodium*, *Podocarpus*, *Agathis*, *Thuja*, *Gnetum*, *Ephedra*, *Juniperus*, *Cephalotaxus*, *Taxus*

Permanent micropreparations to be submitted by the students.

Ginkgo: Morphology to be studied from Museum specimens & anatomy from permanent slides only.

Study of important fossil gymnosperms from material and permanent slides.

Visit to palaeobotanical Institutes, localities and collection of specimens.

Field visits to ecologically different localities to study living gymnosperms.

Suggested Readings:

1. Stewart, W.N. and Rothwell G.W. (1993), *Palaeobotany and the Evolution of Plants*, Cambridge University Press.
2. Foster A.S. & Gifford F.M. (1967): *Comparative morphology of vascular plants*, Freeman Publishers, San Fransisco.
3. Eames, A.J.(1974): *Morphology of Vascular Plants- lower groups*, Tata Mc-Graw Hill publishing Co., New Delhi.
4. Arnold, C.A. (1947): *Introduction to Palaeobotany*, Mc-Graw Hill Book Co. Inc., New York and London.
5. Kubitzki K. (1990), *The families and genera of vascular plants Pteridophytes and Gymnosperms*, Springer Verlag, New York
6. Agashe, S.N. (1995), *Palaeobotany*, Oxford & IBH, New Delhi.
7. Biswas, C & Johri, B.N. (2004), *The Gymnosperms*, Narosa Publishing House, New Delhi.
8. Coulter J.M. & Chamberlain C.J.(1978): *Morphology of Gymnosperms*, Central Book Depot, Allahabad.
9. Kakkar, R.K.and Kakkar, B.R. (1995), *The Gymnosperms (Fossils & Living)*, Central Publishing House, Allahabad.
10. Sharma O.P. (2002) *Gymnosperms*, Pragati Prakashan, Meerut.
11. Siddiqui, K.A. (2002) *Elements of Palaeobotany*, Kitab Mahal, Allahabad.
12. Bhatnagar, S.P. and Moitra A. (1996), *Gymnosperms*, New Age International Pvt. Ltd., New Delhi.
13. Singh, H. (1978), *Embryology of Gymnosperms*, Encyclopedia of Plant Anatomy X, Gebryder, Bortragear, Berlin.
14. Pant, D.D. (2003): *Cycas and allied Cycadophytes*, BSIP, Publications.
15. Bierhorst D.W. (1971): *Morphology of vascular plants* McMillan, New York.
16. Thomas, B.A. & Spicer R.A. (1987): *The Evolution and Palaeobiology of land plants*. Discordies Press, Fortland, USA.
17. Spicer, R.A. & Thomas, B.A. (1986) *Systematic and taxonomic approaches in Palaeobotany*. Systematic Association Special Volume.
18. Chamberlain C.J. (1986); *Gymnosperms, structure and Evolution*, CBS publishers and distributors, New Delhi. On line Journals available on UGC -VSAT

M.Sc. Botany Syllabus

Semester I

Course code : PSCBOTT04

Credit - 04

Paper- IV Cytology and Genetics

UNIT - I

Mendel's laws of inheritance; chromosome theory of inheritance; deviations from Mendel's findings; Penetrance and expressivity; Modifiers, suppressors and pleiotropic genes; multiple alleles and isoalleles (example Corn, *Drosophila* and *Nicotiana*); multigene families (globin and immunoglobulin genes); sex determination and dosage compensation in plants, *Drosophila*, *C. elegans*.

UNIT – II

Chromatin organization: Chromosome structure and packaging of DNA; molecular organization of centromere and telomere, rRNA genes, euchromatin and heterochromatin; Karyotype analysis and evolution, banding patterns; specialized types of chromosomes: polytene, lampbrush, B-chromosome, sex chromosome; molecular basis of chromosome pairing, C- value paradox, Cot curve and its significance.

UNIT – III

Structural and numerical changes in chromosomes; origin, breeding behavior of duplications, deficiency, inversion and translocation heterozygotes; effect of aneuploidy on plants; transmission of trisomics and monosomics and their use in chromosome mapping; complex translocation heterozygotes, translocation tester sets; Robertsonian translocation.

UNIT – IV

Mutations: Spontaneous and induced; physical and chemical mutagens; molecular basis; transposable genetic elements; site directed mutagenesis; role of mutations in crop improvement; induction of polyploidy

Epigenetics: Introduction; paramutations in maize; Callipygh sheep; role of histones; DNA methylation; Epigenetics and Lamarckism; Epigenome and epigenomics.

Laboratory Exercises:-

1. To study the effect of mutagen treatment on germination, seedling height and cell division.
2. To study the spontaneous and induced chromosomal aberrations in pollen mother cells.
3. To study the effect of mutagen treatment on pollen fertility.
4. To study the karyotype of given organism.
5. To study the chiasma frequency in the given material.
6. To study linear differentiation of chromosomes by chromosome banding.
7. To perform the site directed mutagenesis in the given system.

Suggested Reading

Gupta P K 2007 Genetics: Classical to Modern. Rastogi Publications, Meerut.

18

Hexter W and Yost Jr. H T 1977 The Science of Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.

Hartl D L and Jones E W 1998 Genetics: Principles and Analysis (4th ed.). Jones and Barflett Publishers, USA.

Khush G S 1973 Cytogenetics of Aneuploids. Academic press, New York.

Snustad D P and Simmons M J 2000 Principles of Genetics (2nd ed.) John Wiley and Son Inc., USA.

M. Sc. Botany Syllabus

Semester II

Course code : PSCBOTT05

Credit - 04

Paper- V Plant Physiology and Biochemistry

UNIT – I

1) The Scope of plant physiology

2) Photosynthesis: Evolution of photosynthetic apparatus, pigments, Light, light harvesting complex, Mechanism of electron transport, Photo protective mechanism, CO₂ fixation, C₃, C₄ and CAM pathway, Photorespiration, photosynthesis Physiological and ecological consideration (photosynthetic responses to light by the intact leaf, photosynthetic responses to carbon dioxide and temperature) coupled reaction and ATP Synthesis, the chemiosmotic-coupling hypothesis, ATP Synthesis in chloroplast and in mitochondria

UNIT –II

Respiration:- introduction, the respiratory substrate, fermentation, anaerobic and aerobic respiration, mechanism of respiration ,Glycolysis, Citric acid cycle, oxidative pentose phosphate pathway, Plant mitochondrial electron transport, alternative pathway of electron transport chain, cyanide resistant chain, metabolic pool, respiratory ratio, measurement of R.Q., Regulation of respiration ,respiratory enzymes, the non oxidat ive enzymes, the oxidative enzymes, factor affecting the rate of respiration

UNIT –III

1) Carbohydrates Metabolism

General classification and properties of carbohydrates, synthesis of starch and Sucrose, catabolism (degradation) of starch and sucrose

2) Lipids Metabolism

General classification and properties of lipids, fatty acid biosynthesis, synthesis of membrane

lipids, synthesis of structural lipids, synthesis and catabolism of storage lipids.

3) **Metabolism of amino acids**

General classification and properties of amino acids, amino acid biosynthesis in plants, assimilation of inorganic nitrogen into n-transport amino acids, GS/GOGAT Cycle

4) **Nitrogen metabolism**

Nitrogen cycles, Biological Nitrogen fixation by free-living and symbiotic bacteria, nif genes

5) **Sulfur and Phosphate assimilation by the plants**

UNIT -IV

Enzymes: - nomenclature and classification of Enzymes, Isoenzymes, Allosteric Enzymes, Multienzymes, Ribozymes, Lysozymes, Ribozymes & Abozymes and Coenzymes enzyme kinetics, mode and mechanism of Enzyme action (Regulation of Enzyme activity), Activators & Inhibitors, properties of Enzymes, factors affecting Enzyme activity pH, Buffer, reaction kinetics, colligative properties

Solute transport and photo-assimilate translocation:- Mechanism of water transport through xylem; Pathway of translocation patterns of Translocation through phloem;

Source and sink, Materials Translocated in the Phloem i.e. Sucrose, Amino acids, Hormones and some inorganic ions, Rate of Movement, Phloem loading: from chloroplast to sieve elements, Phloem Unloading: sink-to-source Transition, mechanism of translocation in the phloem

Laboratory Exercises:-

To study the effect of time and enzyme concentration on the rate of reaction of enzyme (e.g. phosphatase, nitrate reductase).

To study the effect of substrate concentration on activity of enzyme and determination of its K_m value.

Demonstration of the substrate inducibility of the enzyme nitrate reductase.

Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.

To determine the total carbohydrate content in the given sample

Estimation of Pectic Substances-gravimetric method

To prove Berr-Lambert's law using a suitable solution.

Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophyll and carotenoids.

To determine the chlorophyll a/ chlorophyll b ratio in C₃ and C₄ plants.

Isolation of intact chloroplasts and estimation of chloroplast proteins by spot protein assay.

Preparation of standard curve of protein (BSA) and estimation of protein content in extracts of plant material by Lowry's or Bradford's method.

Preparation of Leaf Protein Concentrates from green vegetables.

Determination of reducing sugars by Nelson – Somogyi Method

Suggested Readings (for laboratory exercises):

- 1 **Bajracharya, D. 1999.** Experiments in Plant Physiology: A Laboratory Manual. Narosa Publishing House, New Delhi.
- 2 **Cooper, T.G. 1977.** Tools in Biochemistry. John Wiley, New York, USA.21
- 3 **Copeland, R.A. 1996.** Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis. VCH Publishers, New York.
- 4 **Dennison C. 1999.** A guide to Protein Isolation. Kluwer Academic Publishers, Dordrecht, The Netherland.
- 5 **Devi, P. 2000.** Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics. Agrobios, Jodhpur, India.
- 6 **Dryer, R. L. and Lata, G. F. 1989.** Experimental Biochemistry. Oxford University Press, New York.
- 7 **Hames, B.D.(Ed.).1998.** Gel Electrophoresis of Proteins: A Practical Approach, 8th edition. PAS, Oxford University Press, Oxford, UK.
- 8 **Harborne, T.C. 1981.** Phytochemical Methods: A Guide to Modern Techniques of Plants Analysis. Chapman& Hall, London.
- 9 **Moore, T.C. 1974.** Research Experiences in Plant Physiology: A Laboratory Manual. Springer-Verlag, Berlin.
- 10 **Ninfa, A. J. and Ballou, D. P. 1998.** Fundamental Laboratory Approaches for Biochemistry and Biotechnology. Fitzgerald Science Press, Inc., Maryland, USA.
- 11 **Plummer, D.F. 1988.** An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
- 12 **Scott, R.P.W. 1995.** Techniques and Practice of Chromatography. Marcel Dekker, Inc., New York.
- 13 **Wilson, K. and Goulding, K.H.(Eds), 1986.** A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London,UK.
- 14 **Wilson, K. and Walker, J. 1994.** Practical Biochemistry: Principles and Techniques, 4th edition. Cambridge University Press, Cambridge, UK.
- 15 **Sadasivam and Manikum: Biochemical Methos , New Age International (p) Limited Publishers 4835/24, Ansari Road, Daryaganj, New Delhi- 110002**

SUGGESTED READINGS (FOR THEORY):

- 1 **Buchanan, B. B., Gruissem, W. and Jones, R.L. 1989.** Biochemistry and Molecular Biology of plants. American Society of Plant Physiologists, Maryland, USA.
- 2 **Dennis, D.T., Turpin, D. H., Lefebvre, D.D. and Layzell, D.B. (eds).1997.** Plant Metabolism (2nd Ed.) Longman, Essex, England.
- 3 **Gaiston, A.W.1989.** Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.

- 4 **Hooykass P.J.J., Hall, M. A. and Libbenga, K.R.(eds).1999.** Biochemistry and Molecular Biology of plant Horm. Elsevier, Amsterdam, The Netherlands.
- 5 **Hopkins, W.G. 1995.** Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
- 6 **Lodish, H., Berk, A., Zipursky S.L., Matsudaira, P., Baltimore, D and Darnell, J. 2000.** Molecular Cell Biology (4th ed). W. H. Freeman and Company. New York ,USA.
- 7 **Moore, T.C. 1989.** Biochemistry and Physiology of Plant Hormones (2nd ed). Springer-Verlag, New York, USA.
- 8 **Nobel, P.S.1999.** Physicochemical and Environmental Plant Physiology (2nd ed). Academic Press, Diego, USA.
- 9 **Salisbury, F.B. and Ross, C.W.1992:** Plant Physiology (4th ed). Wadsworth Publishing Co., California, USA.
- 10 **Singhal G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee.1999:** Cocepts in Photobiol Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
- 11 **Taiz, L. and Zeiger, E. 1998:** Plant Physiology. Sinaucr Associates, Inc., Publishers, Massachus, USA.
- 12 **Thomas,B. and Vince-Prue,D.1997:** Photoperiodism in Plants (2nd ed). Academic Press, San Diego, USA.
- 13 **Westhoff, P.1998:** Molecular Plant Development: From gene to plant. Oxford University Press, Oxford, UK.
- 14 **Dey, P. M. And Harborne, J. B. 2000:** Plant Biochemistry ,Harcourt Asia PTE Ltd. A Harcourt Publishers International Company, 583 Orchard Road 09-01 Forum Singapore-238884
- 15 **Ranjan, purohit, Prasad 2003:** Plant Hormones Action and Application, Agrobios(India), agro house, behind Nasrani cinema Chopasani Road, Jodhpur -34

M. Sc. Botany Syllabus

Semester –II

Course code : PSCBOTT06

Credit - 04

Paper- VI: Plant Development and Reproduction

UNIT - I

Plant growth

Kinetics and pattern of growth

Shoot Development – Organization of shoot apical meristem (SAM); cytological and molecular analysis of SAM; control of cell division and cell communication; control of tissue differentiation.

Phytohormones: Classification, chemical nature and their role in plant development.

UNIT - II

Leaf growth and differentiation – Determination; phyllotaxy; control of leaf form; differentiation of epidermis (with special reference to stomata & trichomes) and mesophyll.

Root Development – Organization of root apical meristem (RAM); vascular tissue differentiation; lateral root hairs; root microbe interactions.

Flower Development – Physiology of flowering, florigen concept and photoperiodism, Genetics of floral organ differentiation; homeotic mutants in *Arabidopsis* and *Antirrhinum*.
Pollination mechanisms and vectors

UNIT - III

Male Gametophyte – Structure of anther, microsporogenesis, tapetum; pollen development and gene expression; male sterility; sperm dimorphism; pollen germination; pollen tube growth and guidance.

Female Gametophyte – Ovule types; megasporogenesis; organization of embryo sac; structure of embryo sac cells.

Pollen – pistil interaction and fertilization; Structure of the pistil; pollen – stigma interactions, double fertilization; *in vitro* fertilization.

UNIT - IV

Seed Development and fruit growth – Endosperm development; embryogenesis; ultrastructure and nuclear cytology; storage proteins of endosperm and embryo; polyembryony; apomixes; embryo.

Germination of seed: Biochemical and hormonal control.

Latent life – Dormancy : Importance and types of dormancy; seed dormancy; overcoming seed dormancy; bud dormancy.

Senescence and Programmed Cell Death (PCD) – Basic concepts; types of cell death, PCD in life cycle of plants; metabolic changes associated with senescence and its regulations; influence of hormones and environmental factors on senescence.

Laboratory Exercises/ Field Exercises (Any 12):

1. Tissue systems, meristem, vascular and cork cambium
2. Internal structure of root, stem and leaf (dicot and monocot), advanced secondary growth in dicot stem and root.
3. Anomalies in primary and secondary structure of stem
4. Study of living shoot apices by dissections using aquatic plants such as *Ceratophyllum* and *Hydrilla*.
5. Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double-stained permanent slides of a suitable plant such as *Coleus*, *Kalanchoe*, *Tobacco*. Examination of shoot apices in a monocotyledon in both T.S. and L.S. to show the origin and arrangement of leaf primordia.
6. Study of alternate and distichous, alternate and superposed, opposite and superposed; opposite and decussate leaf arrangement.
7. Examination of rosette plants (*Launaea*, *Mollugo*, *Raphanus*, *Hyoscyamus* etc) and induction of bolting under natural conditions as well as by GA treatment.
8. Microscopic examination of vertical sections of leaves such as *Cleome*, *Nerium*, Maize and Wheat to understand the internal structure of leaf tissues and trichomes, glands etc. Also study the C3 and C4 leaf anatomy of plant.
9. Study of epidermal peels of leaves such as *Coccinia*, *Gaillardia*, *Tradescantia*, *Thunbergia*, etc. to study the development and final structure of stomata and prepare stomatal index. Demonstration of the effect of ABA on stomatal closure.
10. Study of whole roots in monocots and dicots. Examination of L.S. of root. from permanent preparation to understand the organization of root apical meristem and its derivatives. (use maize, aerial roots of banyan, *Pistia*, *Jussieua* etc.). Origin of lateral roots. Study of leguminous roots with different types of nodules.
11. Study of microsporogenesis and gametogenesis in sections of anthers.
12. Examination of modes of anther dehiscence and collection of pollen grains for microscopic examination (Maize, Grasses, *Crotolaria*, *Tradescantia*, *Brassica*, *Petunia*, *Solanum melongena*, etc.)
13. Tests for pollen viability using stains and *in vitro* germination. Pollen germination using hanging drop and sitting drop cultures, suspension culture and surface culture.
14. Estimating percentage and average pollen tube length *in vitro*.
15. Role of transcription and translation inhibitors on pollen germination and pollen tube growth.
16. Pollen-pistil interaction, self-incompatibility, *in vitro* pollination.
17. Study of ovules in cleared preparations; study of monosporic, bisporic and tetrasporic types of embryo sac development through examination of permanent stained serial sections.
18. Field study of several types of flower with different pollination mechanisms (wind pollination, thrips pollination, bee/butterfly pollination, bird pollination).
19. Emasculation, bagging and hand pollination to study pollen germination, seed set and fruit development using self compatible and obligate outcrossing systems. Study of cleistogamous flowers and their adaptations.
20. Study of nuclear and cellular endosperm through dissections and staining.
21. Isolation of zygotic globular, heart-shaped, torpedo stage and mature embryos from suitable seeds and polyembryony in citrus, jamun (*Syzygium cumini*) etc. by dissections.

22. Study of seed dormancy and methods to break dormancy.

Suggested Readings:

- 1) Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
- 2) Fageri, K. and Van der Pol, L. 1979. The Principles of Pollination Ecology. Pergamon Press, Oxford.
- 3) Fahn, A. 1982. Plant Anatomy, (3rd edition). Pergamon Press, Oxford.
- 4) Fosket, D.E. 1994. Plant Growth and Development. A molecular Approach. Academic Press, San Diego.
- 5) Howell, S.H. 1998, Molecular Genetics of Plant Development. Cambridge University Press, Cambridge.
- 6) Leins, P., Tucker, S.C. and Endress, P.K. 1988. Aspects of Floral Development. J. Cramer, Germany.
- 7) Lyndon, R.F., 1990. Plant Development. The Cellular Basis. Unwin Hyman, London.
- 8) Murphy, T.M. and Thompson, W.F. 1988. Molecular Plant Development. Prentice Hall, New Jersey.
- 9) Proctor, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
- 10) Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
- 11) Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer-Verlag, New York.
- 12) Raven, P.H., Evert, R.F. and Eichhorn, S.E. 1992. Biology of Plants (5th Edition). Worth, New York.
- 13) Steeves, T.A. and Sussex, I.M. 1989. Patterns in Plant Development (2nd edition). Cambridge University Press, Cambridge.
- 14) Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London.
- 15) Waisel, Y., Eshel, A. and Kafkaki, U. (eds) 1996. Plant Roots: The Hidden Hall (2nd edition.) Marcel Dekker, New York.
- 16) Shivanna, K.R. and Sawhney, V.K. (eds) 1997. Pollen Biotechnology for Crop Production and Improvement, Cambridge University Press, Cambridge.
- 17) Shivana, K.R. and Rangaswamy, N.S. 1992. Pollen Biology: A Laboratory Manual. Springer-Verlag, Berlin.
- 18) Shivana, K.R. and Johri, B.M. 1985. The Angiosperm Pollen: Structure and Function. Wiley Eastern Ltd., New York.
- 19) The Plant Cell. Special issue on Reproductive Biology of Plants, Vol. 5(10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA.
- 20) On line Journals available on UGC -VSAT

M. Sc. Botany Syllabus

Semester II

Course code : PSCBOTT07

Credit - 04

Paper- VII Cell and Molecular BiologyBiology- I

UNIT - I

Cell wall: Structure; function; biogenesis and growth; cell differentiation

Plasma membrane: Membrane architecture (fluid mosaic model); sites for ATPases; membrane transport - ion carriers, channels, pumps and aquaporins; receptors.

Plasmodesmata: Structure, role in movement of molecules and macromolecules; comparison with gap junction.

UNIT – II

Cellular organelles: Ultra-structure and function of golgi complex, lysosomes, peroxisomes, endoplasmic reticulum, mitochondria, chloroplast and plant vacuoles.

Cell shape and motility: The cytoskeleton; organization and role of microtubules and microfilaments; motor movements, implications in flagellar & other movements, cell division.

UNIT – III

Nucleus: Ultrastructure, nuclear pores, nucleolus, DNA structure A, B and Z forms, replication in prokaryotic and eukaryotic cells, DNA replication proteins, damage and repair.

UNIT – IV

Molecular biology of stress responses: Definition and classification of stress; Plant defence mechanism (passive and active); HR and SAR; modulation of plant metabolism in response to biotic stress: early and late response; production of ROS, induction of enzymes, induction of genes involved in phenylpropanoid metabolism; PR proteins and R- genes

Suggested Readings:

Atherly, A.G., Griton, J.R. and Mc Donald, J. F. 1999. The Science of Genetics.

Saunders College Pub. Fort Worth, USA

Buchanan, B.B., Gruissem, W. and Jones, R. L. 2000 Biochemistry and Molecular Biology of Plants. American Soc. Of Plant Physiologists, Maryland, USA.

Bush, H. Rothblum, L. 1982. Vol. X. The Cell Nucleus RDNA part A. Academic Press.

Dc, D. N. 2000 Plant cell vacuoles: An introduction. CSIRO Publication, Collingwood, Australia.

De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.

Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.

Kleinsmith, L.J. and Kish, V.M. 1995 Principles of Cell and Molecular Biology (2nd Edi.) Harper Collins Coll. Publisher, New York, USA.

Krishnamurthy, K.V. 2000 Methods in Cell wall Cyto-chemistry. CRC Press, Boca Raton, Florida

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

Russel, P. J. 1998 Genetics (5th Edi.) The Benjamin/ Cummings Publishing Com. Inc., USA

Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Practicals

Orcein staining of the salivary gland chromosomes of *Chironomus* and *Drosophila*.

Cell fractionation & isolation of Chloroplast and mitochondria.

Isolation of plant DNA and its quantification by spectrophotometric method.

To perform flagellary staining.

Isolation of DNA and preparation of Cot-curve.

Demonstration of vital structure and functions of cell

To study the induction of defence genes by elicitors.

Suggested Readings (for laboratory exercises):

Fukui, K. and Nakayama, S. 1996. Plant Chromosomes: Laboratory Methods. CRS Press, Boca Raton, Florida.

Glick, B. R. and Thompson, J.E. 1993. Methods in Plant Molecular Biology and

Biotechnology. CRC Press, Boca Raton, Florida USA.

Goswami, H. K. 1986. Practical cytology – Applied Genetics and Biostatistics
Himalaya Pub. House, Bombay.

Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology: Structure and Function.
Jones and Barlett Publishers, Boston, Massachusetts.

Hall, J.L. and Moore, A.L. 1983. Isolation of Membranes and Organelles from Plant
Cells Academic Press, London, U.K.

Harris, N. and Oparka, K.J. 1994. Plant Cell Biology: A Practical Approach. IRL
Press, at Oxford University Press, Oxford, U.K.

Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes: Analysis, Manipulation and
Engineering. Har Academic Publishers, Australia.

Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press,
Oxford. Techniques, 2nd edition. PAS, IRL Press at Oxford University Press, Oxford.

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

Review Journals:

Annual Review of Plant Physiology and Molecular Biology

Biochemistry and Cell Biology

Cell

Cell Biology International -

Cell Death and Differentiation -

Cell Motility and the Cytoskeleton -

Cellular Physiology and Biochemistry

Current Advances in Plant Sciences

Cytokine -

European Journal of Cell Biology -

Journal of Cell Science

Nature Reviews: Molecular and Cell Biology

Protoplasma- An International Journal of Cell Biology -

Trends in Cell Biology

Trends in Plant Sciences

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Semester II

Course code : PSCBOTT08

Credit - 04

Paper- VIII Angiosperms- I

UNIT - I

Angiosperm Morphology, structural units and floral symmetry, dicot and monocot flower; structure, diversity origin and evolution of stamen, carpels; placentation types and evolution. Floral adaptation to different pollinators

UNIT - II

Angiosperm Taxonomy: Scope, aims, principles of taxonomy, historical development of plant taxonomy, relative merits and demerits of major systems of classifications. Taxonomic structure: taxonomic hierarchy, concept of taxa, concept of species, concept of genus and family; Taxonomic character: HETEROBATHMY, ANALYTIC Vs. synthetic character, qualitative Vs quantitative characters.

UNIT - III

Taxonomic evidence: Morphology, anatomy, embryology, palynology, cytology, phytochemistry, genome analysis.

Taxonomic tools: herbarium, floras, monographs, botanical gardens, biochemical and molecular techniques, computers and GIS.

UNIT - IV

Biosystematics: The population concept phenotypic plasticity, biosystematic categories, methods of biosystematics studies. Numerical taxonomy: principles, aims and objectives, cladistics in taxonomy, polarity of characters, homology, homoplasy, monophyly, polyphyly. Plant nomenclature: Salient features of ICBN

Laboratory Exercises:-

1. To study the floral symmetry in various taxa.
2. To study and work out the differences in dicot and monocot flower.
3. To study the variation in stamens and carpels.
4. To study placentation types in various taxa.
5. To study the floral adaptations for pollination.
6. To study anatomical features of various taxa.
7. To study embryological features of various taxa.
8. To study palynological features of various taxa.
9. To study cytological features of various taxa.
10. To prepare a cladogram on the basis of various morphological features of the species belonging to a genus.

Suggested Readings

- Devis, P.H. and Heywood, V. H. 1973. Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.
- Grant, V. 1971. Plant Speciation, Columbia University press, London.
- Grant W. F. 1984. Plant Biosystematics. Academic press, London.
- Harrison, H.J. 1971. New concept in flowering plant Taxonomy. Hickman educational books Ltd. London.
- Hislop-Harrison, J. 1967. Plant Taxonomy. English Language Book Sco. And Edward Arnold Pub. Ltd, UK.
- Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.
- Jones, A. D. and Wiggins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co. New York.
- Jones, S. B., Jr. and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw- Hill Book Co., New York.
- Nordstrom, B., El Gazaly, G. and Kassas, M. 2000. Plant systematic for 21st century. Portland press. Ltd, London.
- Radford, A. E. 1986. Fundamentals of plant systematic. Harper and Row publication, USA.
- Solbrig, O.T. 1970. Principles and methods of plant Systematics. The Macmillan Co. Publication Co. Inc., USA.
- Woodland, D. W. 1991. Contemporary Plant Systematics, Pentice Hall, New Jersey.
- Takhtajan, A. L. 1997. Diversity and classification of Flowering Plants. Columbia University Press, New York.
- Stebbins, G. L. 1974. Flowering Plants-evolution Above species Level. Edward Arnold Ltd, London.
- Jones, A. D. and Wiggins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co.
- Jones, S. B., Jr. and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw Hill Book Co., Newer RH 1975 Communities and Ecosystems (2nd ed) MacMillan, New York.