

10th semester rules

Time in of working days in/sem
 68 days and above - without fee
 59 to 67 days - 1500 fee
 58 to 55 days - 2000 fee
 ↓
 Do may allow to write course papers
 not the current papers
 ↓
 Current papers allow to write it
 on next semester only.

4th and below - Report sum with
 2.500 fine for
 A submission 50%
 Attendance only can
 work the exam

Placed at the Special Meeting
 of the Academic Council
 held on 25.06.2019

APPENDIX - II

MADURAI KAMARAJ UNIVERSITY
 (University with Potential for Excellence)

M.Sc. BOTANY - COURSE STRUCTURE UNDER CBCS

(For the candidates to be admitted from academic year 2019 onwards)

Sem order	Course	Course title	Ins. Hrs/ week	Credit	Exams hrs	Marks		Total
						Int.	Ext.	
I	Paper I	Plant diversity (Lichens, Mosses and Taxonomy of Angiosperms)	3	4	3	25	75	100
	Paper II	Developmental Botany	3	4	3	25	75	100
	Paper III	Instrumentation & Biotechnology	3	4	3	25	75	100
	Paper IV	Practical I (includes theory I, II & III)	3	5	3	40	80	100
	Major elective I	Herbal Botany	3	5	3	25	75	100
II	Paper V	Plant Diversity II (Algae, Lichens, Bryophytes & Pteridophytes)	3	4	3	25	75	100
	Paper VI	Cell and Molecular Biology	3	4	3	25	75	100
	Paper VII	Environmental Botany	3	4	3	25	75	100
	Paper VIII	Practical II (includes theory V, VI & VII)	3	5	3	40	80	100
	Major elective II	Biodiversity & Conservation	3	5	3	25	75	100
III	Paper IX	General Microbiology	3	4	3	25	75	100
	Paper X	Genetics and Evolution	3	4	3	25	75	100
	Paper XI	Biochemistry	3	5	3	25	75	100
	Paper XII	Practical III (includes theory IX, X & XI)	3	5	3	40	80	100
	Non major elective	Mushroom cultivation	3	5	3	25	75	100
IV	Paper XIII	Plant Physiology	3	4	3	25	75	100
	Paper XIV	Biotechnology and Biostatistics	3	5	3	25	75	100
	Paper XV	Biotechnology	3	4	3	25	75	100
	Paper XVI	Practical IV (includes theory XII, XIII & XIV)	3	5	3	40	80	100
	Major elective Elective	Fermentation Technology or Plant tissue culture	3	5	3	25	75	100

H. Jeyaraj

PRINCIPAL
 Arulmigu Palaniandavar College
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 PALANI - 624 601

10TH SEMESTER

Total no. of working days 90/Sem.

68 days and above - without fine

59 to 67 days - 1500 fine

58 to 45 day - 3000 fine

↓
only allow to write current papers

Not the current papers.

↓
Current paper allow to write it

on next semester only.

64 and below - Repeat sem. with

2.500 fine for

in admission - 50%.

Attendance only can
write the exam.

Placed at the Special Meeting
of the Academic Council
held on 25.06.2008

APPENDIX - B

MADURAI KAMARAJ UNIVERSITY
(University with Potential for Excellence)

M.Sc BOTANY - COURSE STRUCTURE UNDER CBCS

(For the candidates to be admitted from academic year 2008 onwards)

Semester	Course	Course title	Ins. Hrs/ week	Credit	Exam Hrs	Marks		Total
						Int.	Ext.	
I	Paper I	Plant diversity I (Gymnosperms and Taxonomy of Angiosperms)	6	4	3	25	75	100
	Paper II	Developmental Botany	6	4	3	25	75	100
	Paper III	Instrumentation & Biotechniques	6	4	3	25	75	100
	Paper IV	Practical I (includes theory I, II & III)	6	5	3	40	60	100
	Major elective I	Herbal Botany	6	5	3	25	75	100
II	Paper V	Plant Diversity II (Algae, Lichens, Bryophytes & Pteridophytes)	6	4	3	25	75	100
	Paper VI	Cell and Molecular Biology	6	4	3	25	75	100
	Paper VII	Environmental Biology	6	4	3	25	75	100
	Paper VIII	Practical II (includes theory V, VI & VII)	6	5	3	40	60	100
	Major elective II-	Biodiversity & Conservation	6	5	3	25	75	100
III	Paper IX	General Microbiology	6	4	3	25	75	100
	Paper X	Genetics and Evolution	6	4	3	25	75	100
	Paper XI	Biochemistry	6	5	3	25	75	100
	Paper XII	Practical III (includes theory IX, X & XI)	6	5	3	40	60	100
Non major Elective	Mushroom cultivation	6	5	3	25	75	100	
IV	Paper XIII	Plant Physiology	6	4	3	25	75	100
	Paper XIV	Bioinformatics and Biostatistics	6	5	3	25	75	100
	Paper XV	Biotechnology	6	4	3	25	75	100
	Paper XVI	Practical IV (includes theory XIII, XIV & XV)	6	5	3	40	60	100
Major elective III/project	Fermentation Technology or Plant tissue culture	6	5	3	25	75	100	

Comment

M.Sc. CODE : EBY8

Placed at the Special Meeting
of the Academic Council
held on 25.06.2008

APPENDIX - B

MADURAI KAMARAJ UNIVERSITY

(University with Potential for Excellence)

M.Sc BOTANY - COURSE STRUCTURE UNDER CBCS -
(For the candidates to be admitted from academic year 2008 onwards)

Sem ester	Course	Course title	Ins. Hrs/ week	Credit	Exam Hrs	Marks		Total
						Int.	Ext	
EBY8C11	Paper I	Plant diversity I (Gymnosperms and Taxonomy of Angiosperms)	6	4	3	25	75	100
EBY8C12	Paper II	Developmental Botany	6	4	3	25	75	100
EBY8C13	Paper III	Instrumentation & Biotechniques	6	4	3	25	75	100
EBY8C1P	Paper IV	Practical I (includes theory I, II & III)	6	5	3	40	60	100
EBY8T11	Major elective I	Herbal Botany	6	5	3	25	75	100
EBY8C21	Paper V	Plant Diversity II (Algae, Lichens, Bryophytes & Pteridophytes)	6	4	3	25	75	100
EBY8C22	Paper VI	Cell and Molecular Biology	6	4	3	25	75	100
EBY8C23	Paper VII	Environmental Biology	6	4	3	25	75	100
EBY8C2P	Paper VIII	Practical II (includes theory V, VI & VII)	6	5	3	40	60	100
EBY8T21	Major elective II	Biodiversity & Conservation	6	5	3	25	75	100
EBY8C311	Paper IX	General Microbiology	6	4	3	25	75	100
EBY8C32	Paper X	Genetics and Evolution	6	4	3	25	75	100
EBY8C33	Paper XI	Biochemistry	6	5	3	25	75	100
EBY8C3P	Paper XII	Practical III (includes theory IX, X & XI)	6	5	3	40	60	100
EBY8C41	Non major Elective	Mushroom cultivation issues Major Economic Indian Economy EBY8N31	6	5	3	25	75	100
EBY8C42	Paper XIII	Plant Physiology	6	4	3	25	75	100
EBY8C43	Paper XIV	Bioinformatics and Biostatistics	6	5	3	25	75	100
EBY8C4P	Paper XV	Biotechnology	6	4	3	25	75	100
EBY8C4P	Paper XVI	Practical IV (includes theory XIII, XIV & XV)	6	5	3	40	60	100
EBY8T41	Major elective III/project	Fermentation Technology or Plant tissue culture EBY8T42	6	5	3	25	75	100

Comment

EBY8N31

M.Sc. BOTANY

(For the candidates to be admitted from academic year 2008 onwards)

Question paper pattern

Time : 3 Hours

Max. Marks: 75

Section A: (10 x 1 = 10 marks)

Question No. 1 to 10 (Multiple choice/one mark question)

- 1. Two questions from each unit
- 2. Four choices in each questions
- 3. No 'none of these' choice

Section B: (5 x 7 = 35 marks)

Question No. 11 to 15

Answer all questions choosing either (a) or (b)

Answer not exceeding two pages

(One question from each unit)

- | | | |
|--------|----|--------|
| 11 (a) | or | 11 (b) |
| 12 (a) | or | 12 (b) |
| 13 (a) | or | 13 (b) |
| 14 (a) | or | 14 (b) |
| 15 (a) | or | 15 (b) |

Section C: (3 x 10 = 30 marks)

Question No 16 to 20

Answers not exceeding four pages

Answer any three out of five (one question from each unit)

1. The pattern for internal valuation may be: two tests - 13 marks each; average 15 marks
2. Group discussion/seminar/Quiz - 3 marks
3. 2 assignments: 3 mark each; average 3 marks
4. 1st test may be allowed for absences of any one of the two tests
5. * If the college opts quits, 2 quizzes should be conducted

Choice Based Credit System (CBCS)

Guidelines regarding pass minimum:

To get a pass, a student should fulfill the following conditions

I UG Courses

A) Theory:

1. 60% of the aggregate (External + Internal)
2. No separate pass minimum for internal
3. 24 marks out of 75 is the pass minimum for the External.

B) Practicals:

1. 50% of the aggregate (External + Internal)
2. No separate pass minimum for internal
3. 28 marks out of 60 is the pass minimum for the External.

II PG Courses

A) Theory:

1. 50% of the aggregate (External + Internal)
2. No separate pass minimum for internal
3. 34 marks out of 75 is the pass minimum for the External.

B) Practicals:

1. 50% of the aggregate (External + Internal)
2. No separate pass minimum for internal
3. 28 marks out of 60 is the pass minimum for the External.

Project (UG Courses)

1. 40% of the aggregate (Project evaluation + viva-voce)
2. No separate pass minimum for viva voce
3. 28 marks out of 80 is the pass minimum for the Project evaluation.

Project (PG Courses)

1. 50% of the aggregate (Project evaluation + viva-voce)
2. No separate pass minimum for viva voce
3. 36 marks out of 80 is the pass minimum for the Project evaluation.

I Semester

Paper I

Plant Diversity - I (Gymnosperms and Taxonomy of Angiosperms)

Unit I

General characters, distribution, phylogeny, classification (Coulter & Chamberlin) and economic importance of Gymnosperms of the following orders. Pteridospermales, Pentoxylales, Cordaitales, Cycadales, Coniferales and Gnetales.

Unit II

Definition, aims, importance and scope of Taxonomy; Development and phases of classification; Systems of classification - Artificial - Linnaean system. Natural - Bentham and Hooker system. Phylogenetic - Engler and Prantl and Hutchinson, Takhtajan and Cronquist system (Comparative study).

Unit III

Plant nomenclature, Principles and role of ICBN. Effective and Valid publication; type concept and author citation, Retention of names, Publication of names; rules of priority

Unit IV

Modern concepts and trends in Plant taxonomy; Elementary treatment of Cytotaxonomy, Chemotaxonomy, Numerical Taxonomy, Molecular Taxonomy, Cladistics.

Unit V

Study of important taxonomic character and popular examples of the following natural order of Bentham and Hooker Classification - Ranunculaceae, Capparidaceae, Caryophyllaceae, Rhamnaceae, Rosaceae, Lythraceae, Aizoaceae, Apiaceae, Sapotaceae, Gentianaceae, Scrophulariaceae, Bignoniaceae, Verbenaceae, Piperaceae, Loranthaceae, Hydrocharitaceae, Amaryllidaceae, Commelinaceae, Areaceae and Orchidaceae.

Practicals

Gymnosperms

1. Study of the external features of *Cycas*, *Pinus*, *Araucaria*, *Podocarpus*, *Agathis* and *Gnetum*
2. C.S., R.L.S & T.L.S. of stems
3. Micropreparation of leaves and cone
4. Observation of fossil slides

Angiosperms

1. Preparation of dichotomous keys
2. Solving nomenclatural problems
3. Training the student to use computers for cladogram and dendrograms
4. Identification of families mentioned in the syllabus with the help of floral characters.
5. Submission of minimum 25 herbarium sheets representing different locations
6. Submission of 5 permanent slides from gymnosperms
7. Students must be taken minimum 3 days field trips for herbarium collection.

References

1. Biswas, C. and Johri, B.M. 1999. *The Gymnosperms*. Narosa Publishing House, New Delhi.
2. Chamberlain, C.J. 2000. *Gymnosperms*. C B S Publishers and Distributors, New Delhi.
3. Sporne, K.R. 1986. *Morphology of Gymnosperms*. Hutchinson University Press.
4. Vashishta, P.C. 1999. *Gymnosperms*. S. Chand & Company Ltd. New Delhi.
5. Bhatnagar, S.P. and Moitra, A. 1996. *Gymnosperms*. New Age Int, Pvt. Ltd., New Delhi.
6. Sivarajan V. V. 1991. *Principles of Plant Taxonomy*. Oxford & IBH Publishing Co. Pvt Ltd. New Delhi.
7. Bhattacharya, B and Johri, B.M. 1996. *Flowering plant- taxonomy and phylogeny*. Narosa Publishing House, New Delhi. 1996.
8. Heywood, V.H and Moore, DN 1994. *Current concepts in plant taxonomy*. Academic Press London.
10. Naik, VN. 1993. *Taxonomy of Angiosperms*. Tata Mc-Graw-Hill Publishing Company Ltd., New Delhi. 1993
11. Lawrence, GHM 1959. *Taxonomy of vascular plants*. Mac Millan, New York.

12. Sokal R.R. and Sneath P.H.A 1963. Principles of numerical taxonomy. Freeman & Co. San Francisco.USA.
13. Stace, C. 1985. **Plant taxonomy and Biosystematics**, Edward Arnold, London.
14. Subrahmanyam, N.S. 1999. **Modern Plant Taxonomy**. Vikas Publishing House Pvt.Ltd. New Delhi.
15. Cole, A.J. 1969. **Numerical Taxonomy**. Academic Press, London.
16. Takhtajan, A.L. 1997. **Diversity and Classification of Flowering Plants**. Columbia Univ.Press, New York.
17. Woodland, D.W. 1991. **Contemporary Plant Systematics**. Prentice Hall, New Jersey.

I Semester

Paper II

Developmental Botany

Unit I

- Meristems:- Characters, classification and theories – Apical cell theory, Tunica – Corpus theory and Korper – Kappel concept.
- Vascular Cambium – Types, divisions, arrangement and seasonal activity, Factors affecting cambial activity
- Origin, Structure, development and ontogeny of xylem and phloem
- Reaction wood- Structure and Properties
- Identification of common timbers in Tamilnadu
- Heart wood and sap wood-strength, durability, grains, texture and defects
- Anomalous secondary growth in Dicots and monocots.

Unit II

- Leaf ontogeny – initiation, apical, intercalary, marginal and adaxial growth, plate meristem and development of vascular tissues plastochnonic index.
- Transfer cells- Structure, development and functions
- Classical concept of flower; Floral anatomy and its role in classification
- Plant galls: Types, structure and development
- Role of polarity in cell differentiation, Symmetry
- Role of sucrose in Vascular tissue differentiation

Unit III

- Development of microspores and megaspores – types and factors involved.
- Development of microgametophyte – pollen wall development – vegetative and generative cell, pollen viability test.
- Development of megagametophyte – structure and types of ovule. Development of monosporic, biosporic and tetrasporic types of embryo sac and their cellular organization.
- Endosperm- Origin, types, structure, development; Haustorial endosperm

Unit IV

- Pollen-Pistil interaction and fertilization, types of stigma and style, events on stigmatic surface, pollen tube growth, guidance and entry into ovule and embryo sac. Double fertilization – significance.

Incompatibility – interspecific – homomorphic and heteromorphic. Causes and Methods to overcome incompatibility.

Classification of embryo development in Dicots and Monocots.

Development of fruit wall and differentiation.

Unit V

- Endosperm, Anther, Ovule, Ovary and Embryo culture and their significance
- Haploids and their significance
- Paraxial hybridization in crop improvement

Practicals

1. Study of wood anatomy (*Bombax*, *Tectona*, *Azadirachta*, *Terminalia*, *Mangifera*, *Dalbergia*)
2. Structural anomalies in stems of *Antigonon*, *Bignonia*, *Achyranthus*, *Nyctanthus*, *Aristolochia* and *Bougainvillea*.
3. Preparation of 5 permanent slides using microtome and double staining
4. Observation of pollen types and germination studies.
5. Anther dissection (Various types)
6. Embryo dissection (any two stages)
7. Endosperm haustoria

References

1. Easu, 1987. **The Anatomy of seed plants**. Wiley Eastern Ltd. New Delhi.
2. Fahh, A. 1989. **Plant Anatomy**. Pergamon Press, Oxford, New York.
3. Cutler, D. F. 1978. **Applied Plant Anatomy**. Orient Longman Publishers, New Delhi.
4. Bhojwani, S.S and Bhatnagar, S.P. 2000. **The Embryology of Angiosperms**, Vikas Publishing House Pvt. Ltd. New Delhi.
5. Johri, B.M. 1984. **Embryology of Angiosperms**. Springer Verlag, Berlin.
6. Pandey, A.K. 1997. **Introduction to Embryology of Angiosperms**. CBS Publishers and Distributors, New Delhi.
7. Pandey, S.N. and Chadha, A. 2000. **Embryology**. Vikas Publishing House Pvt. Ltd. New Delhi.
8. Shivanna, K.R. 2003. **Pollen biology and biotechnology**. Oxford and IBH publishing house, New Delhi.
9. Fosket, D. E. 1994. **Plant growth and development - A molecular approach**. Academic Press.
10. Varghese T.M. 1984. **An introduction to Experimental and Applied Embryology of Angiosperms**. Oxford

I - Semester

Paper III

Instrumentation and Biotechniques

Unit I

Basic principles and uses of various microscopes (Light, Compound, Phase Contrast, Scanning, Transmission Electron microscopes and Atomic Force Microscope). Photomicrography and videophoto micrography and image processing. Principles, methods and application; uses of camera lucida, stage and ocular micrometer and Haemocytometer.

Unit II

pH : basic principles, different types of electrodes, measurement of pH, preparation of buffers.
Chromatography: basic principles, types- sephadex, ion exchange- column, thin layer and gas liquid (GC and HPLC)

Unit III

Electrophoresis (SDS, PAGE and Immunoelectrophoresis). Two dimensional Electrophoresis - Instrument used, electrophoresis of proteins: Southern, Northern, Western blottings

Unit IV

Spectrophotometer: Visible, UV and Fluorescence - Principles, uses of flame photometer, Bomb calorimeter and atomic absorption spectrophotometer, IR, NMR and FTIR.

Unit V

Sterilization techniques; Culture techniques- media preparation, PDA, Nutrient agar, MS medium. Microtomy; biological sample preparation techniques for microscopy.

Practicals

1. Measurement of plant cells using micrometry
2. Preparation of buffer
3. Chromatography - separation of pigments and amino acids - TLC, paper and column.
4. Separation of protein - SDS-PAGE
5. Antigen - antibody reaction in immunoelectrophoresis.
6. Estimation of biomolecules using spectrophotometer.
7. Preparation of culture media
8. Preparation of specimen and sectioning using microtome.

References

1. Plummer, D.T. 1996. **An introduction to practical biochemistry**. Tata Mc Graw-Hill
2. Johanson, D. A. 1940. **Plant microtechniques**. Mac Graw Hill
3. Stock, R and Rice, C.B.F. 1980. **Chromatographic methods** Chapman and hall
4. Ruzin, Z.E. 1999. **Plant Microtechnique and Microscopy**. Oxford University Press, New York
5. Gahan, P.B. 1984. **Plant Histochemistry and Cytochemistry**, Academic Press, London.
6. Gary, P. 1964. **Hand Book of basic microtechnique**, John Wiley & Sons, New York.
7. Johanson, W.A. 1984. **Plant Microtechnique**. Mc Graw Hill.

8. Johanson, W.A. 1982. *Botanical Histochemistry-Principles and Practice*. Freeman & Co.
9. Kierman, J.A. 1999. *Histological and Histochemical Methods*. Butterworth Publications, London
10. Daphne, J. O and Micheal, B. J. 1989. *Cell separation in plants physiology, Biochemistry and Molecular Biology*. Springer - Verlag, Berlin.
11. Jeffrey, M., Backer et al., 1996. *Biotechnology- A Laboratory Course*. Academic Press, New York.
12. Mahiga, P. Klessing, D.F. Cashmore, A.R. Grinssen, W. and Varner, J.E. 1995. *Methods in Plant Molecular Biology - A Laboratory Course - Manual*. CSHL Press, New York.
13. Burdan R.H. Knippenbergh P.H. (editors). 1989. *Techniques in Biochemistry and Molecular Biology*, 2nd ed, Elsevier

Semester I

Paper IV Practicals (Includes theory Papers I,II and III)

Gymnosperms and Taxonomy of Angiosperms

Gymnosperms

1. Study of the external features of *Cycas*, *Pinus*, *Araucaria*, *Podocarpus*, *Agathis* and *Gnetum*
2. C.S., R.L.S & T.L.S. of stems
3. Micropreparation of leaves and cone
4. Observation of fossil slides

Angiosperms

5. Preparation of dichotomous keys
6. Solving nomenclatural problems
7. Training the student to use computers for cladogram and dendrograms
8. Identification of families mentioned in the syllabus with the help of floral characters.
9. Submission of minimum 25 herbarium sheets representing different locations
10. Submission of 5 permanent slides from gymnosperms
11. Students must be taken minimum 3 days field trips for herbarium collection.

Developmental Botany

1. Study of wood anatomy (*Bombax*, *Tectona*, *Azadirachia*, *Terminalia*, *Mangifera*, *Dalbergia*)
2. Structural anomalies in stems of *Antigonon*, *Bignonia*, *Achyranthus*, *Nyctanthus*, *Aristolochia* and *Bougainvillea*
3. Preparation of 5 permanent slides using microtome and double-staining
4. Observation of pollen types and germination studies
5. Anther dissection (Various types)
6. Embryo dissection
7. Endosperm haustoria

Instrumentation and bio-techniques

1. Measurement of plant cells using micrometry
2. Preparation of buffer.
3. Chromatography - separation of pigments and amino acids - TLC, paper and column.
4. Separation of protein - SDS-PAGE
5. Antigen - antibody reaction in immunoelectrophoresis
6. Estimation of biomolecules using spectrophotometer.
7. Preparation of culture media
8. Preparation of specimen and sectioning using microtome.

Semester I

Major Elective I - Herbal Botany MM1 AS1 SM1 KK
2 2 1 1

Unit I

Brief history and scope of raw drugs of plant origin. Definition, herbals, classification and description. Classification of vegetable drugs. Biological sources of drugs

Unit II

Factors involved in the production of drugs - climate; cultivated and wild plants - collection, drying and storage. Deterioration of drugs - primary factors, mould and bacterial attack, control of insect pests. Methods of preparation of drugs from various plant materials - extraction of plant material (including the traditional method of preparation) - separation and isolation of constituents - distillation, chromatography - TLC.

Unit III

Pharmacological action of plant drugs - action on the autonomic nervous system, central nervous system, heart muscle, blood vessels, the respiratory system, gastro-intestinal tract and on the uterus.

Unit IV

Basic study on the source, structure and medicinal value of the following phytochemicals - glycosides, alkaloids, phenolics, saponins and steroidal saponins. Natural steroid production for pharmaceuticals - *Dioscorea*, *Sarsaparilla* roots.

Unit V

Drugs obtained from roots and underground parts - *Rauwolfia*, *Aconite*, *Sarsaparilla*, *Turmeric*, *Ginger* and *Acorus*. Leaves - *Eucalyptus*, *Adhatoda*, *Solanum trilobatum*, *Digitalis*, *Andrographis* and *Leucas aspera*. Fruits - *Embellica*, *Cumin*, *Tamarindus*, *Capsicum* and *Piper*.

References

1. Chopra, R.N., Nager, S.L. and Chopra, I.C. 1956. *Glossary of Indian Medicinal Plants*. CSIR, New Delhi.
2. Nadkarni, K.M. 1982. *Indian Materia Medica*. Popular Prakasham Pvt. Ltd.
3. Trease, G.E. and Evans, W.C. 1980. *Text Book of Pharmacognosy*. ELBS, Bailliere, Tindall.
4. Sambamurthy, A.V.S.S. and Subramanian, M.S. 1989. *A text book of Economic Botany*. Wiley Eastern Co., New Delhi.
5. Wallis, T.E. 1985. *Text book of Pharmacognosy*. CBS Publishers and Distributors, New Delhi.

Common Names of Pteridophytes

- Pteris - Chinese ladder brake or Chinese brake fern
- Adiantum - velvet fern
- Osmunda - royal fern, king fern, common flowering fern
- Equisetum - horse tail
- Lycopodium - club moss, club pine
- Selaginella - Bracken (east fern)

II Semester
Paper V

Plant Diversity - II (Algae, Lichens, Bryophytes & Pteridophytes)

Unit I

Algae: systematic position and classification of algae by Fritsch. Range of thallus organization; Reproduction and various life cycles; Ecology of fresh water and marine algae; Cultivation of algae

Unit II

General characters of Cyanophyta, Chlorophyta, Euglenophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta, Rhodophyta. Economic importance of algae - as food, medicine, agriculture and industry.

Unit III

Lichens: A general account of lichens with particular reference to their mode of life. Gross and fine structure, nutrition, reproduction classification; micro-chemical tests for their classification; their economic importance and ecological significance; role of lichens in biological estimation of pollution. Lichen culture *in vitro* - a detailed study of one or two available species of lichens belonging to *Ascolichen* and *Basidiolichen*.

Unit IV

Bryophytes: Occurrence and distribution; a brief account of Bryophyte flora in India; classification, basis and criteria of classification, (Rothmaler classification only) structural variation in the gametophytes and sporophytes; evolution of sporophyte and gametophytes; Ecology of bryophytes; an account of fossil bryophytes and their significance.

Unit V

Pteridophytes: Principles and outlines of the classification (Christensen, Spome). Comparative morphology, structure, ecology and phylogeny of the following groups - Psilopsida, Lycopsidea, Späenopsida and the Pteropsida. Structure and evolutionary trends with reference to stele and spore. Telome concept in Pteridophytes; the phenomenon of apospory, apogamy and parthenogenesis. Fossil forms: Rhyniales (as given by Arnold) Lepidodendrales, Cocnopteridales, Calamitales, Sphenophyllales.

Sphenophyllum, sphenophylloids, Bowmanites, Evidiacalyx
47
pills -> Extinct

Practicals

1. Critical examination of algal samples of different classes
2. Micropreparation of lichens
3. Critical examination of Bryophyte and Pteridophytes of different classes.
4. Study of fossils mentioned in the syllabus
5. Students must be taken minimum 1 day field trip for herbarium collection.
6. Submission of 5 permanent slides from Pteridophytes

References

1. Bhatia, A. 1994. *Treatise on Algae*. S. Chand & Company, New Delhi.
2. Bold, H.C. & Wynne, M.J. 1985. *Introduction to the Algae*. Prentice Hall of India, New Delhi.
3. Chapman, V.J. Chapman, D.J. 1975. *The Algae*. Macmillan India Ltd., Delhi.
4. Fritsch, F.E. 1945. *Structure and reproduction of Algae*. Cambridge University Press
5. Lewin, R.A. (Ed.). 1962. *Physiology and Biochemistry of Algae*. Academic Press.
6. Pandey, B.P. 1994. *Algae*. S. Chand & Company Ltd. New Delhi.
7. Round, F.E. 1984. *The Ecology of Algae*. Cambridge University Press.
8. Sharma, O.P. 1998. *Text book of Algae*. Tata McGraw Hill, New Delhi.
9. Vashishta, B.R. 1999. *Algae*. S. Chand & Company, New Delhi.]
10. Hale, M.E. (Jr) 1983. *The Biology of lichens*. Edward Arnold. Mayland
11. Parihar, N.S. 1980. *An Introduction to Embryophyta Vol. I. Bryophyta*. Central Book Depot.
12. Prem Puri, 1981. *Bryophytes: Morphology, Growth and differentiation*. Atma Ram and Sons, New Delhi.
13. Vashishta, P.C. 1999. *Bryophyta*. S. Chand & Co. New Delhi.
14. Rashid, A. 1999. *Pteridophyta*. Vikas Publishing House Pvt. Ltd. New Delhi.
15. Sharma, O.P. 1990. *Textbook of Pteridophyta*. Macmillan India Ltd. Delhi.
16. Sporne, K.R. 1986. *The morphology of Pteridophytes*. Hutchinson University Press.
17. Sundara Rajan, S. 1999. *Introduction to Pteridophyta*. New Age International Publishers, New Delhi.

II SEMESTER

PAPER VI

Cell and Molecular Biology

Unit I

MA Cell biology: Ultra structure of cell wall; Cell cycle and its regulation; structure and composition and functions of cell organelles; molecular genetics of chloroplast and mitochondria (semi-autonomous nature of chloroplast & mitochondria)

Unit II

MW Molecular Biology: structure and organization of membranes; Glycoconjugates and proteins in membrane systems; ion transport; Na⁺/K⁺ ATPase; molecular base of signal transduction in bacteria, plants and animals; membrane models.

Unit III

CS The central dogma and structure of DNA & RNA; topology of nucleic acids; chromosome structure in prokaryotes & eukaryotes; levels of DNA packaging; repeat sequences in DNA; C-value paradox; DNA denaturation kinetics; DNA replication - features of DNA replication *in vivo*; DNA polymerases, replication apparatus, enzymes & proteins associated with replication. Bidirectional and rolling circle replication; unique features of eukaryotic chromosome replication.

Unit IV

MW Transcription: prokaryotic RNA polymerase, initiation, elongation & termination, transcription & RNA processing in eukaryotes; RNA editing - RNA splicing, Translation & genetic code - codon tRNA interaction; components of translation & protein synthesis. Mutation: spontaneous and induced-mutation; molecular basis of mutations; mutation by radiation, chemicals and transposable elements; DNA damage and repair mechanism; light dependent repair, excision and error prone repair. Transposons.

Unit V

MW Regulation of gene expression in prokaryotes: Operon concept, regulation of Lac, Ara & Trp, regulation of gene expression in lambda phage. Regulation of gene expression in eukaryotes, heat shock genes, RuBP carboxylase gene in plants, RNAs in gene regulation - RNAi, siRNAs & miRNAs.

Practical

1. Cell Biology: Root tip squash for mitosis. Acetocarmine preparation of *Rheo* anthers for meiosis - Microscopic view of cell organelles in plant cells - viewing cytolith & raphides. Isolation of plant organelles by centrifugation techniques.
2. Isolation of spontaneous mutations in bacteria by gradient plate technique.
3. Isolation of auxotrophs by UV mutagenesis
4. Colorimetric estimation of DNA & RNA

References

1. David. E. Sadava. 1993. Cell Biology. Jones and Bartlett Publishers, Boston.
2. De Robertis and De Robertis 1998. Cell and Molecular Biology. B.I. Waverly Pvt. Ltd. New Delhi.
3. Geoffrey M. Cooper 1997. The Cell - A Molecular approach. ASM Press Washington.
4. Gerald Karp, 1984. Cell Biology. McGraw Hill, New Delhi.
5. Satyesh Chandra Roy and Kalyan Kumar De. 1999. Cell Biology. New Central Book Agency (P) Ltd. Calcutta.
6. William D. Stansfield et al., 1996. Schaun's out line of theory and problems of Molecular and Cell biology. McGraw Hill, New York.
7. Lodish, et al. 2000. Molecular and Cell Biology. W. H. Freeman & Co. New York
8. Gupta, P.K. 1999. Elements of Biotechnology. Rastogi Publications, Meerut
9. David Freifelder, 1985. Essentials of Molecular Biology. Narosa Publishing House, New Delhi
10. Kumar, H.D. 1999. Molecular Biology. Vikas Publishing House Pvt. Ltd. New Delhi.
11. Lewin, B. 2000. Genes VII. Oxford University Press. New York.

II Semester

Paper VII Environmental Biology

UNIT I

Introduction, historical account, concepts and Significance. Biosphere; Major Ecosystems of the world; Terrestrial ecosystems-forest, deserts, grassland; Aquatic ecosystems - freshwater, marine, estuarine, mangrove with special reference to Indian situation; Food chain, food web; energy flow models; Production ecology; Biogeochemical cycles C, N, P, S and water.

Unit II

Resource Ecology: Energy Crisis, Renewable and non-renewable energy sources; Conventional and non-conventional / alternative: Coal, Solar, Petroleum, Thermal, Nuclear; Biomass, Wind and Wave energy. Conservation of Natural resources: soil, forest, Water, Wildlife, post-desalination, Desertification, Reclamation of land.

Unit III

Environmental Issues: Pollution, Air, gaseous & particulate; Water: industrial effluents, eutrophication-natural and cultural; Land, radiation, pollution, noise pollution; Recycling of waste.

Unit IV

Urban Ecology: Causes and effects of urbanization; Aspects of urban planning; Waste disposal. Human Ecology: Population explosion, effects, control

Unit V

Ecological concept of species, geneecology, ecotypes, ecophenes in relation to climatic, edaphic and photoperiodic factors. Biogeography: Principle, factors of distribution of plants and animals, continuous and discontinuous distribution, continental drift, endemism, age and area hypothesis

Practical

1. Assessment of Plant diversity - Field work to list herbs, shrubs and trees in the college campus and mapping them on graph.
2. Morphological and Anatomical features of typical Xerophytes - Phylloclade - *Opuntia*, cladode - *Casuarina*, Succulent - Bryophyllum and Hydrophytes - *Hydrilla*.
3. Vegetation study by Quadrat and Line transect

4. Estimation of dissolved oxygen in water samples by Winkler's method
5. Estimation of CO₂ in water samples.
6. Biomonitoring of water pollution by species index method
7. Biodiversity centers—marking location on world map
8. Marking locations of endemic species, biosphere reserves, and vegetation on world map.
9. Visit to forest institution and field interest.

References

1. Arora, 1995. *Fundamentals of Environmental Biology*. Kalyani Publishers, New Delhi.
2. Billings, W.D. 1972. *Plants man and ecosystem*. Macmillan India, New Delhi.
3. Chapman, 1999. *Ecology – Principles and Applications*. Cambridge University Press. Foundation Books, New Delhi.
4. Crawford, R.M.M. (Ed.) 1986. *Plant Life in aquatic and amphibious habitats*. Black Well Scientific Publications, Oxford London.
5. Jeffrey, D.W. 1987. *Soil Plant relationship – An ecological approach*. Croom Helm. Kershaw, K. A and Looney, J.H.H. 1985. *Quantitative and dynamic plant ecology*. Edward Arnold.
6. Krishnamurti, C. R. and Viswanathan, P., (Eds.) 1991. *Toxic metals in the Indian Environment*. Tata McGraw Hill Publishing Co. Ltd. New Delhi.
7. Kumar, H. D. 1997. *General Ecology*. Vikas Publishing House Pvt. Ltd. New Delhi.
8. Mackenzie, A. Ball, A.S. and Virdee S. R. 1999. *Instant notes in Ecology*. Viva Books Pvt. Ltd., New Delhi.
9. Odum, F. E. 1971. *Fundamentals of Ecology*. W. B. Saunders & Company.
10. Ray, P.K. 1992. *Pollution and Health*. Wiley Eastern Ltd. New Delhi.
11. Trivedi, P.R. and Gurudeep Raj. 1995. *Environmental Biology*. Akashdeep Publishing House, New Delhi.
12. Ambashi, R.S. and Ambashi, N.K., 1996. *A Text book of Plant Ecology*. Students Friends and Co. Varanasi.
13. Satake et al., 1997. *Environmental Toxicology*. Discovery Publishing House, New Delhi.

Semester II

Paper VIII Practical (Includes theory Papers V, VI and VII)

Plant Diversity

1. Critical examination of algal samples of different classes
2. Micropreparation of lichens
3. Critical examination of Bryophyte and Pteridophytes of different classes.
4. Study of fossils mentioned with the syllabus.

Cell and Molecular Biology

1. Cell Biology: Root tip squash for mitosis, Acetocarmine preparation of *Rheo* anthers for meiosis – Microscopic view of cell organelles in plant cells – viewing cystolith, Raphides, Druses, Starch grains.
2. Isolation of plant organelles by centrifugation techniques.
3. Colorimetric estimation of DNA & RNA

Environmental Biology

1. Assessment of Plant diversity – Field work to list herbs, shrubs and trees in the college campus and mapping them on graph.
2. Morphological and Anatomical features of typical Xerophytes – *Phylloclade* – *Opuntia*, cladode – *Casuarina*, Succulent – *Bryophyllum* and Hydrophytes – *Hydrilla*.
3. Vegetation study by Quadrat and Line transect
4. Estimation of dissolved oxygen in water samples by Winkler's method
5. Estimation of CO₂ in water samples.
6. Biomonitoring of water pollution by species index method
7. Biodiversity centers—marking location on world map
8. Marking locations of endemic species, biosphere reserves, and vegetation on world map.
9. Visit to forest institution and field interest.

II semester

Major elective II

Biodiversity and Conservation

Unit I

Biodiversity: definition, concept, scope; Levels of biodiversity: Genetic, species and ecosystem diversity; Magnitude of biodiversity; Concept of Hot Spots distribution of hotspots in India and the world; values of biodiversity: economic, ecological and societal. Island biogeography theory: Endemic diversity.

Unit II

Measures of biodiversity – alpha, beta and gamma diversity – Diversity indices – dominance and Evenness – methods of studying diversity, quadrat method, transect method, pit fall method, sweep net method and all out searches. Landscape elements; role of remote sensing in biodiversity conservation

Unit III

Bioprospecting, Indigenous knowledge, Biopiracy, Intellectual property rights and its impact on biodiversity; Impact of new technologies: biotechnology and genetic engineering; Impact of exotic species on local biodiversity – causes for the extinction of species – Red data book.

Unit IV

Causes and consequences of loss of biodiversity; Impact of exotic species on local biodiversity; Deforestation; causes for the extinction of species; Red data book and its importance; Key stone species and their significance in an ecosystem function.

Unit V

Conservation – need for conservation – *in situ* conservation: Sanctuaries, national parks, biosphere reserves – *ex situ* conservation: gene banks and cryopreservation – Role of indigenous people in conservation – sacred species, sacred groves; Biodiversity conservation – human-animal conflicts.

References

1. Melchias, G. 2001. *Biodiversity and Conservation*. Oxford and IBH publishing company Pvt. Ltd. New Delhi.
2. Gadgil, M., Ghate, U. and Pramod, P. 1996. *Biodiversity resource materials, center for ecological sciences*. Indian Institute of Sciences, Bangalore and Biodiversity Unit, Jawaharlal Nehru Centre for Advanced scientific research Bangalore
3. Agrawal, K.C. 2000. *Biodiversity*. Agrobios (India), Jodhpur.
4. Prabhakar, V.K. 2001. *Environment and Biodiversity*. Amol Publications, Pvt. Ltd. New Delhi.
5. Kumar, H.D. 1999. *Biodiversity and sustainable conservation*. Oxford and IBH publishing company. New Delhi.
6. Krishnamurthy K.V. 2003. *An advanced Book on Biodiversity – Principles and practice*. Oxford and IBH publishing company, New Delhi.
7. *Biodiversity – CPR Environmental Education center 2003*, Chennai.

III Semester

Paper IX General Microbiology

Unit I

Early development of microbiology – contribution of Anton-Van Leeuwenhoek, Louis Pasteur, Joseph Lister, Robert Koch and his postulates. General characteristics of bacteria: morphological, Cultural and Biochemical characteristics. Ultrastructure of bacterial cell and its components (including capsules and endospores). Bacterial cell wall: nature, chemistry and biosynthesis.

Unit II

Growth and multiplication: Bacterial growth curve: Phases of growth. Different methods of measurement of growth: continuous culture; synchronous growth: principles and parameters employed in studying growth and their use. Classification of bacteria: Bergey's major groups (as per Bergey's manual of determinative bacteriology VII edition)

Unit III

Plant viruses – bacteriophages -lytic -temperate phage-cyanophage: properties, multiplication, isolation and purification of plant viruses.

Unit IV

General characteristics of fungi – Gymnomycota, Mastigomycota and Amasigomycota upto order level as per Alexopoulos and Mims classification of ^{Fungi} (1979)

Unit V

Plant pathology: general principles, concepts, symptoms and classification. Infection process: primary and secondary infection. Defense mechanism: chemical and biological control methods. Plant diseases: Red rot of sugarcane, Tikka diseases of groundnut, Bunchy top of banana, Citrus canker, cotton wilt, Paddy blast, TMV.

Practical

1. Sterilization methods
2. Preparation of media
3. Isolation of microbes from soil and water using serial dilution technique
4. Staining of Bacteria – simple and gram staining
5. Standard analysis of water for the presence of coli forms
6. Micropreparation and observation of the following fungi:
Albugo, Mucor, Rhizopus, Pilobolus, Aspergillus, Penicillium, Xylaria, Peziza, Puccinia, Polyporus, Lycoperdon, Pleurotus, Agaricus, Fusarium and Alternaria
7. Observation of infected plant specimens mentioned in the syllabus.

References

1. Atlas, M. and Bartha, R. 2000. *Microbial Ecology*. Addison Wesley Longman, Inc. New York.
2. Black, J.G.: 1999. *Microbiology - Principles and Explorations*. Prentice Hall, New Jersey.
3. Brock, T.D. 1996. *Biology of Micro-organisms*. Prentice Hall.
4. Casida, I.E. 1997. *Industrial Microbiology*. New Age International Publishers, New Delhi.
5. Dubey, R.U. and Maheswari, D.K. 2000. *A Text Book of Microbiology*. S Chand & Co. Ltd. New Delhi.
6. Kumar, H.D. and Swati Kumar. 1999. *Modern Concepts of Microbiology*. Vikas Publishing House Pvt. Ltd. New Delhi.
7. Lydyard, P.M. et al., 1999. *Instant notes in immunology*. Viva Books Pvt. Ltd. New Delhi.
8. Mathew, R.E.F. (1981) *Plant Virology*. Academic Press.
9. Nicklin, J et al., 1999. *Instant notes in Microbiology*. Viva Books Pvt. Ltd. New Delhi.

10. Pelezar, M.J. Chan, E.C.S and Kreig, N.R. 1993. *Microbiology-Concepts and Applications*. McGraw Hill, Inc. New York.
11. Stainer, R. Y. et al.; 1990. *The Microbial World*. Prentice Hall.
12. Marshall, H. 1999. *Diseases of Plants*. Anmol Publications Pvt. Ltd. New Delhi.
13. Mehrotra, R.S. 2000. *Plant Pathology*. Tata McGraw Hill Publishing Co. New Delhi.
14. Rangaswamy, G. 1992. *Diseases of Crop Plants in India*. Prentice Hall of India, New Delhi.
15. Singh, R.S. 1991. *Plant Diseases*. Oxford IBH. New Delhi.
16. Singh, R.S. 1994. *Introduction to the Principles of Plant Pathology*. Oxford IBH, New Delhi.
17. Swarup et al., 1999. *Plant Diseases*. Anmol Publications Pvt. Ltd., New-Delhi.
18. Vashishta, P.C. and Gill, P.C. 1998. *Plant Pathology*. Pradeep Publications, Jalandhar.
19. Wheeler, B.E. 1972. *An Introduction to Plant Diseases*. John Wiley.
20. Alexopoulos, C.J., Mims, C.W. Blackwell, M. 1996. *Introductory mycology*. John Wiley & Sons., New York

III Semester

Paper X. Genetics and Evolution

Unit I

Mendelism: Monohybrid, Dihybrid ; multiple alleles; Gene interaction: dominant epistasis (12:3:1); recessive epistasis (9:3:4), duplicate dominant gene (15:1) and Duplicate receive gene (9:7). Inheritance of quantitative characters.

Unit II

Recombination genetics: methods of genetic recombination: conjugation transformation and transduction in prokaryotic cells; crossing over, linkage maps; conventional and molecular theories of crossing over; cytological basis of crossing over in corn : position effect and gene conversion; self sterility; male sterility

Unit III

Cytogenetics: Nucleocytoplasmic interactions: differentiation and development: cytogenetics of polyploids and aneuploids, haploid plastids; cytogenetic value, sex chromosomes, sex determination and sex linked inheritance, chromosomal aberration.

Unit IV

Population genetics: frequency of genes in population: Hardy-Weinberg law: basic mechanics of genetic engineering and its applicability for plant improvement.

Unit V

Evolution: Cytogenetic basis of variations: specialization and further progress in evolution: natural selection; modern synthetic theories on evolution.

Practicals

1. Solving problems related to monohybrid, dihybrid crosses, Test cross, incomplete dominance and multiple alleles.
2. Solving problems related to gene interactions mentioned in the syllabus
3. Calculating gene frequency
4. Problem in three point test cross and chromosome mapping.

References

1. Blackie, 1983. *Evolutionary Principles*. Oxford & IBH, New Delhi.
2. Briggs, D. and Walters, S.M. 1984. *Plant variation and Evolution*. Cambridge University Press, London.
3. Ehrlich & Holm. 1974. *Process of Evolution* Oxford & IBH, New Delhi.
4. Jha, A.P. 1997. *Genes and Evolution*. Macmillan India Ltd. Delhi.
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6. Strickberger, M.W. 1996. *Evolution*. Jones and Bartlett Publishers, New York.
7. Theodosius Dobzhansky et al., 1986. *Evolution*. Surjeet Publications, Delhi.
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9. Dyansager, V.R. 1986. *Cytology and Genetics*. Tata Mc Graw-Hill, New Delhi.
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11. Kiichi Fukui and Shigeaki Nakayam (Eds.) 1996. *Plant Chromosomes - Laboratory Methods*. CRC Press, New York.
12. Strickberger, M. W. 1985. *Genetics*. Macmillan India, New Delhi.
13. Swanson, C.P. (Ed.) 1980. *Cytogenetics*. Prentice Hall.

14. Goodenough, U. *Genetics*. 3rd edn. Holt. Saunders, New York.
15. Gupta, P.K. *Genetics*. Rastogi Publications, Meerut
16. Mitra, S. 1994. *Genetics - A blue print of life*. Tata McGraw Hill, New Delhi
17. Singh, B.D. 2000. *Fundamentals of Genetics*. Kalyani Publishers, New Delhi
18. Strickberger, M. W. 1999. *Genetics*. Prentice Hall of India Pvt Ltd, New Delhi

III Semester

Paper XI Biochemistry

Unit I

Chemistry of Enzymes: Classification and nomenclature of enzymes: IUB. Isolation and purification of enzymes; Concept of active site, mechanism of enzyme action: Michaelis-Menton equation and K_m value. Enzyme modifiers-activators, inhibitors, allosteric enzymes: Regulation of enzyme action: Isozymes-diagnostic applications.

Unit II

Amino acids and Proteins: biosynthesis of amino acids; properties and chemical reaction concerned with amino acids; Proteins: primary, secondary, tertiary structure of protein. 3D structure and protein folding, physicochemical properties of proteins.

Unit III

Metabolism of Carbohydrates: chemical reactions & derivatives of monosaccharide; Glycolysis-T.C.A. Cycle, E.T.Chain- ATP synthesis; Glycogenolysis-H.M.P Pathway. Glyconeogenesis.

Unit IV

Metabolism of Lipids: Oxidation of any one fatty acids and its bioenergetics; Biosynthesis of any one fatty acid; palmitic acid unsaturation; biosynthesis of cholesterol; Importance of cholesterol and plant lipids.

Unit V

Chemistry of vitamins, hormones and alkaloids; vitamins as co-enzymes; chemistry and biosynthesis of hormones-thyroxine, catecholamines, steroidal hormones. Biologically important alkaloids; intermediary metabolism; integration of metabolic pathways.

Practical

1. Estimation of Glucose, starch, protein and lipid in plant tissue
2. Qualitative test for carbohydrates, lipids, proteins and amino acids
3. Determination of enzyme activities - Amylase, nitrate reductase, peroxidase.

Reference

1. Campbell, M.K. 1999. *Biochemistry*. Saunders College Publishing, New York.
2. Conn, E.E. and Stumpf P.K. et al., 1999. *Biochemistry*. John Wiley and Sons, New Delhi.
3. David T. Dennis and David H. Trupin (Eds.) 1993. *Plant Physiology, Biochemistry and Molecular Biology*. Longmann Scientific and Technical, Singapore.
4. Fisher J. et. al., 1999. *Instant notes in Chemistry for Biologists*. Viva Books Pvt. Ltd. New Delhi.
5. Goodwin and mercer 1996. *Introduction to plant Biochemistry*. CBS Publishers and Distributors, New Delhi.
6. Hames, B.D. et al., 1999. *Instant notes in Biochemistry*. Viva books Pvt. Ltd. New Delhi.
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8. Jain, J.L. 2000. *Fundamentals of Biochemistry*. S. Chand & Co. New Delhi.
9. Plummer, D.T. 1996. *An Introduction to practical Biochemistry*. McGraw Hill
10. Satyanarayana, U. 1999. *Biochemistry*. Books and Allied (P) Ltd. Calcutta.

Semester III

Paper XII Practical (Includes theory Papers ¹² X and XI)

General Microbiology

1. Sterilization methods
2. Preparation of media
3. Isolation of microbes from soil and water using serial dilution technique
4. Staining of Bacteria - simple and gram staining
5. Standard analysis of water for the presence of coli-forms
6. Micropreparation and observation of the following fungi
Physarium, Albugo, Mucor, Rhizopus, Pilobolus, Aspergillus, Penicillium, Xylaria, Peziza, Puccinia, Polyporus, Lycoperdon, Pleurotus, Agaricus, Fusarium and Alternaria
7. Observation of infected plant specimens mentioned in the syllabus.

Genetics and Evolution

1. Solving problems related to monohybrid, dihybrid crosses, Test cross, incomplete dominance and multiple alleles.
2. Solving problems related to gene interactions mentioned in the syllabus
3. Calculating gene frequency
4. Problem in three point test cross and chromosome mapping.

Biochemistry

1. Estimation of Glucose, starch, protein and lipid in plant tissue
2. Qualitative test for carbohydrates, lipids, proteins and amino acids
3. Determination of enzyme activities - Amylase, nitrate reductase, peroxidase

III Semester

Non Major elective – Mushroom cultivation

Unit I

General characters of mushroom – present status of the mushroom industry in India – common edible and non-edible mushrooms

Unit II

Nutritional value of edible mushrooms: proteins, vitamins, minerals, carbohydrates and fats. Energy value of mushrooms

Unit III

Methods of spawn production – factors determining the spawn production, storage of spawn

Unit IV

Methods of cultivation and harvesting – paddy straw mushroom, oyster mushroom, white button mushroom and milky mushroom

Unit V

Diseases and pests of mushrooms; preservation of mushrooms; Recipes; Marketing of mushroom products – Role of Mushrooms in compost preparation.

References

1. Nita Bahl 1988. **Hand book on Mushrooms**. Oxford & IBH publisher, New Delhi
2. Muthusamy A.D. and I. Yesuraja 1999. **Mushroom culture**. TNAU Publication, Madurai.

IV Semester

Paper XIII
Plant Physiology

Unit I

Water relations – physico-chemical properties of water; th permeability; diffusion, osmosis and imbibition; plasmolysis significance; water potential – definition, water potential g continuum. Absorption of water: Types of soil water, water ab mechanism of water absorption, ac ve and passive absorption, sign – Transpirational pull theory.

Unit II

Mineral salt absorption: mechanism of mineral salt absorption the theory, apoplastic, mass flow theo Donnan's equilibrium, acti symplast, carrier concept theory, pro in lecithin and cytochrome pu Transpiration: types, significance, r mechanism of stomatal opening starch, glycolate, K⁺ ions. Antitranspirants and guttation.

Unit III

Photosynthesis – excitement and gr und state; electromagnetic sp apparatus. PSI and PSII Reaction c tres, components of cyclic ar "Z" scheme, Emerson's enhance and Red drop effect. CO₂, C₃, C₄ (three types NADP-ME, NA -ME & PCK types). CAM₃ and differences

Unit IV

Respiration – RQ – aerobic, (EMP, T A: ETP) HMP Pathway – si respiration, Fermentation types, ETP complexes, Cyanide resistant p Nitrorespiration – Dual action of Ru b -sco – Glycolate (C₂) pathway and β oxidation. Glyoxylate metab ism – gluconeogenesis and germination.

Unit V

Growth curve, bioassay, chemistry and physiological applicatio auxin, gibberellins, cytokinins, AB ethylene and brassinoster Photoperiodism – types and signific; vernalization, senescence (brief account). Phytochromes – pro perties, mechanism of actior physiology – drought, salt, heat and adiation stress – adaptator clock – circadian rhythm in plants (a f account).

Practicals

1. Determination of water potential – plasmolytic Chardakov's and gravimetric method
2. Quantification of photosynthetic pigments (Chl a, b, a+b)
3. Quantification of non-photosynthetic pigments (Anthocyanin and flavonoids)
4. Estimation of photosynthetic activity in mesophyll cells
5. Effect of pH, temperature and detergents on membrane permeability
6. Senescence – effect of kinetin (Chlorophyll estimation in young and senesced leaves)
7. Seed viability test (tetrazolium blue dye reduction)
8. Estimation of proline oxidase activity
9. Estimation of IAA oxidase activity
10. Bioassay of auxins curvature test
11. Effect of different pH on *in vivo* nitrate reductase.

References

1. Brett, C.T. and Waldron, K.K. 1996. *Physiology and Biochemistry of Plant Cell Walls*. Chapman and Hall London.
2. Daphne, J. O, Micheal, B.J. 1989. *Cell separation in Plant Physiology, Biochemistry and Molecular Biology*. Springer – Verlag, Berlin.
3. David T. D. and David H. T. (Eds.) 1993. *Plant Physiology, Biochemistry and Molecular Biology*. Longman Scientific and Technical, Singapore.
4. Devlin and Witham, 1997. *Plant Physiology*. CBS Publishers and Distributors, New Delhi.
5. Fitter, A.H. and Hay R.K.M. 1987. *Environmental physiology of plants*. Academic Press.
6. Hall, D.O. and Rao, K.K. 1999. *Photosynthesis*. Cambridge University Press.
7. Hess, D. 1975. *Plant physiology*. Narosa Publishing House, New Delhi
8. Lincoln Taiiz and Eduardo Zeiger, 1991. *Plant Physiology*. The Benjamin/Cummings publishing Company, Inc.
9. Noggle and Fritz, 1999. *Introductory Plant physiology*. Prentice hall, London.
10. Salisbury, F.B. and Ross, C. 2000. *Plant physiology*. John Wiley & Sons, New Delhi.
11. Strafford, G.A. 1979. *Essentials of Plant Physiology*. Heinemann Publishing Co. New York.
12. Wilkins, M.B. (Ed) 1984. *Advanced Plant Physiology*. Pitman Publishing Co. New York.
13. William G. Hopkins, 1999. *Introduction to Plant Physiology*. John Wiley & Sons, Inc. New York.

IV SEMESTER

PAPER XIV Biostatistics and Bioinformatics

Unit I

Biostatistics: definition and Scope – Descriptive and inferential statistics, population samples, variables, parameters, collection of data, sampling methods, organizing data into summary tables and graphing the data.

Unit II

Measures of central tendency – arithmetic mean, mode and median, least dispersion – Mean deviation and standard deviation and standard error. Probable addition and multiplication theorems – normal distribution and binomial distribution analysis of variance (one way and two way), correlation and regression – T-test significance (t,F) – χ^2 test and its applications.

Unit III

Bioinformatics: definition, objectives, basic components of computers – Internet, web Application of Bioinformatics

Unit IV

Genome and proteome analysis: genomics- structural and functional and comparative genomics, tools in genomics, - isolation of genes, Genomic sequencing – Maxam – G method, sanger method, Genome mapping, Genome analysis – Microarray, proteo structural and functional proteomics: tools – proteomic analysis – 2D PAGE, MS, TOF.

Unit V

Databases, importance, types, database entries, sequence formats, database record, DB types, SQL; Nucleic acid sequence databases – EMBL, DDJ, BLAST, FASTA, GSE Protein sequence databases – Primary, PIR, SWISS-PROT, rEMBL, SCOP, CATH, composite databases, secondary databases, specialized analysis packages – GCG, EGC studen, lasergene, sequencer, vector packages, synergy, CIN, MA.

Practical

1. Frequency distribution
2. Histogram, frequency polygon, frequency curves and cumulative frequency curves
3. Graphic location of median and mode
4. Bar and Pie diagrams
5. Computation of mean, median, mode, quartile deviation, variance standard deviation and co-efficient or correlation
6. Regression equations of X or Y on X estimation of X and Y values
7. Problems connected with probability rules.
8. χ^2 test problems – a) Test of Goodness of fit b) Test of independence
9. Calculation of probability using binomial and normal distributions
10. t-test for significance of mean of a random sample b) testing significance between means of two samples (independent and period samples)
11. Calculation of standard deviation error of mean and limits of acceptance using Z table
12. Solving the problem related to basic bioinformatics using various tools through on-line and off-line strategy.
13. Visit to bioinformatics centers.

References

1. Khan and Khan. 1994. *Biostatistics*. Vikas Publishing House Pvt. Ltd. New Delhi
2. Daniel W.W. 1995. *Biostatistics*. 7th edition. John Wiley and Sons. New York, USA.
3. Bliss C.I. 1970. *Statistics in Biology*. Vol. I and II. McGraw-Hill Inc. USA.
4. Shanmughavel, P. 2005. *Principles of Bioinformatics*. Pointer Publishers. Jaipur. India.
5. Lehinger. A.L. *Principles of biochemistry*. CBS publishers and distributors. New Delhi, India
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7. Baxevanis AD and Francis B.J. 1998. *Bioinformatics. A practical Guide to the analysis of genes and proteins*. John Wiley & sons, Inc.
8. Shanmughavel, P. 2006. *Trends in Bioinformatics*, Pointer Publishers. Jaipur. India.
9. Attwood T.K and Parry – Smith. 1999. *Introduction to bio-informatics*. AW Longman Ltd. UK.

IV SEMESTER

PAPER XV

Plant Biotechnology

Unit I

Scope – definition, multidisciplinary approach of biotechnology. Recombinant DNA technology – molecular tools – nomenclature and characteristics of Restriction enzymes, ligases and DNA modifying enzymes. Plasmid vectors- properties and classification – pBR 322, pUC 18, lambda (gt 10) and M13 phage vectors, cosmids (pJB⁸), Yeast vectors – cloning genes using above vectors. Genomic library and cDNA library – construction, screening libraries by colony, Plaque hybridization.

Unit II

Methods of gene delivery – *Agrobacterium* and CaMV mediated gene transfer; direct gene transfer using PEG, electroporation, biolistics, microinjection and liposome mediated. Transposons as vectors; use of mixed vectors. *Agrobacterium* and genetic engineering in plants – Ti plasmid (Octopine and Nopaline) – Disarmed Ti plasmid vectors – Ri plasmid. Gene maps and expression of T-DNA. Incorporation of T-DNA into the nuclear DNA of plant cells – role of virulent genes.

Unit III

Plant genome - Nuclear, Chloroplast and Mitochondrial: structure, organization and expression. Analysis and expression of cloned genes - DNA sequencing, DNA markers Southern, Northern and Western blotting: PCR – types and applications.

Unit IV

Micropropagation – somatic hybridization, cybrids, artificial seeds and somaclonal variation. Transgenic plants – Herbicide resistant plants, Virus resistant plants. Development of Bt cotton, Golden rice and Flavr Savr Tomato, Agricultural Biotechnology – Biofertilizers – BGA, Mycorrhiza, bacterial *Rhizobium*, *Azospirillum*, *Azotobacter*, Bioinsecticides, BC NPV. IPR, patent right Social and ethical considerations- Indian scenario – a brief account.

Unit V

Applications of rDNA technology – DNA finger printing – DNA vaccines – Plants as edible vaccines – Hybridoma. Production of secondary metabolites. Cell immobilisation, bio-reactor technology; conservation of germplasm *in vitro* strategies.

Practical

1. Isolation of Bacterial chromosomal DNA
2. Isolation of Plant Chromosomal DNA
3. Isolation of Bacterial plasmid - Demonstration
4. Agarose gel Electrophoresis and visualization of DNA
5. 'Plant tissue' culture, suspension culture' induction - Demonstration
6. Demonstration of regeneration from callus cultures
7. Demonstration of isolation of plant protoplasts.
8. Photographs of DNA on Agarose gel; Blue/White clones, Plant tissue cultures, Protoplasts, Transgenic plants.
9. Diagram of vectors, Southern blot, Western blot setups
10. Amplification of DNA using PCR procedure – demonstration.

References

1. Brown, C. M. 1987. *Introduction to Biotechnology*. Blackwell Scientific Publications, Oxford, London.
2. Brown, C.M. Campbell, I. and Priest, F.G. 1990. *Introduction to Biotechnology*. Blackwell Scientific Publications, Oxford, London.
3. Brown, T.A. 1999. *Genomes*. John Wiley & Sons. New York.
4. Chawla, H.S. 2000. *Introduction to Plant Biotechnology*. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Dixon, R.A. and Gonzales, R. A. (Eds.) 1994. *Plant Cell Culture - A Practical Approach*. Oxford University Press, New York.
6. Gamborg, O.L and Phillips, G.C. 1998. *Plant Cell, Tissue Organ Culture*. Narosa Publishing House, New Delhi.
7. Griffiths et al., 1999. *Modern Genetic Analysis*. W.H. Freeman & Co. New York.
8. Gupta, P.K. 1999. *Elements of Biotechnology*. Rastogi Publications, Meerut.
9. Jeffrey, M. Backer et al., 1996. *Biotechnology- A Laboratory Course*. Academic Press, New York.
10. Keshav Trehan, 1991. *Biotechnology*. Wilcy Eastern Ltd, New Delhi.
11. Kumar, H.D. 2000. *Modern concepts of Biotechnology*. Vikas Publishing House Pvt. Ltd. New Delhi.

12. Pamela Peters. 1993. *Biotechnology- a guide to Genetic Engineering*. Wim.C Brown Publishers, USA.
13. Primrose, S.B. 1989. *Modern Biotechnology*. Blackwell Scientific Publications, Oxford, London.
14. Thorpe, T.A. 1981. *Plant Tissue Culture*. Academic Press, London.
15. Trivedi, P.C. (Ed.) 2000. *Plant Biotechnology - Recent Advances*. Panima Publishing Co. New Delhi.

Semester IV

Paper XVI Practicals (Includes theory Papers XIII, XIV and XV)

Plant Physiology

1. Determination of water potential –Plasmolytic, Chardakov's and gravimetric method
2. Quantification of photosynthetic pigments (Chl a, b, a+b)
3. Quantification of non-photosynthetic pigments (Anthocyanin and flavonoids)
4. Estimation of photosynthetic activity in mesophyll cells
5. Effect of pH, temperature and detergents on membrane permeability
6. Senescence – effect of kinetin (Chlorophyll-estimation)
7. Seed viability test (tetrazolium blue dye reduction)
8. Estimation of proline oxidase activity
9. Estimation of IAA oxidase activity
10. Bioassay of auxins curvature test
11. Effect of different pH on *in vivo* nitrate reductase.

Biostatistics and Bioinformatics

1. Frequency distribution
2. Histogram, frequency polygon, frequency curves and cumulative frequency curves
3. Graphic location of median and mode
4. Bar and Pie diagrams
5. Computation of mean, median, mode, quartile deviation, variance standard deviation and co-efficient or correlation
6. Regression equations of X or Y on X estimation of X and Y values
7. Problems connected with probability rules.
8. χ^2 test problems – a) Test of Goodness of fit b) Test of independence
9. Calculation of probability using binomial and normal distributions

10. t-test for significance of mean of a random sample b) testing significance between means of two samples (independent and period samples)
11. Calculation of standard deviation error of mean and limits of acceptance using Z table
12. Solving the problem related to basic bioinformatics using various tools through on-line and off-line strategy.
13. Visit to bioinformatics centers.

Plant Biotechnology

Demonstration

1. Isolation of Bacterial chromosomal DNA
2. Isolation of Plant Chromosomal DNA
3. Isolation of Bacterial plasmid
4. Agarose gel Electrophoresis and visualization of DNA
5. Plant tissue culture, suspension culture induction - Demonstration
6. Demonstration of regeneration from callus cultures
7. Demonstration of isolation of plant protoplasts.
8. Photographs of DNA, Blue/White clones, Plant tissue cultures, Protoplasts and Transgenic plants.
9. Diagram of vectors, Southern blot, Western blot setups
10. Amplification of DNA using PCR procedure - demonstration

IV SEMESTER

Major Elective - III

Optional I: Fermentation Technology

Unit I

Industrially important microorganisms - Screening industrially important microorganisms, thermophilic microorganisms improvement by classical and recombinant methods: Principles fermentation - liquid and solid state fermentations, medium development industrial fermentation.

Unit II

Design of fermenters and bioreactors - Basic fermenter and control of basic fermenter, various designs of fermenters - lift - fixed-bed reactor, fluidized bed reactor, batch, fed batch and fermentation cell and enzyme immobilization.

Unit III

Large scale fermentation and downstream processing - scale up of microbial fermentation growth kinetics, effect of pH, temperature, nutrient concentrations. Downstream processing, precipitation, centrifugation, filtration, solvent extraction, chromatographic purification, affinity purification, fermentation economics - cost analysis.

Unit IV

Major products of industrial microbiology - single cell protein industrial enzymes - amylases & proteases, alcoholic fermentation - beer and wine, antibiotics - penicillin, organic acid - citric acid, amino acid - glutamate, vitamins B12, biogas production.

Unit V

Fermentation of foods; Fermented milk and milk products - food spoilage and methods of preservation.

References

1. Demain, A.L. (et al). 1999. **Manual of Industrial Microbiology and Biotechnology**. 2nd Edition ASM press.
2. Michael, J., Waites, 2001. **Industrial Microbiology: An introduction (Illustration)**. Blackwell Science Inc.
3. Stanbury, P.R., Whitaker, A. and Hall, S.J. 1999. **Principles of Fermentation technology**. Pergamon Press.
4. Mittal, D.P. 1999 **Indian Patents Law**, Taxmann allied services P. Ltd
5. Gerald Reed E/c., 1981. **Prescott and Dunn's Industrial Microbiology**. Chapman & Hall.

IV SEMESTER

Major Elective III

Optional II Plant Tissue Culture

Unit I

(Science and technology of tissue culture - Definition, scope and its impact - an overview; Laboratory requirements and general techniques; Tissue culture media., Somatic, embryogenesis; micropropagation; organ culture)

★Unit II

Development of transgenic plants - Transformation in plants - *Agrobacterium* mediated direct methods, Vectors in transformation. Biosafety and ethical issues.

Unit III

Role of tissue culture in practical plant breeding; micropropagation: (anther culture, ovule culture, embryo culture and protoplast fusion)

Unit IV

Commercial plant tissue culture - setting up of a commercial tissue culture unit, Commercial tissue culture units in India, cost management and marketing, commercially available plants, visit to commercial unit. Protocols for commercial production of Banana, Sugarcane and Potato.

Unit V

Practical applications of Plant tissue culture - hybridization; production of haploid plants; production of secondary metabolites; pathogen-free plants; synthetic seeds.

References

1. Razdan, M.K., 1993. An introduction to plant tissue culture. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
2. Bhojwani, S.S. and Razda, M.K. 2004 Plant Tissue Culture. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
3. Ramawat, K.G. 2000. Plant Biotechnology. 1st edition, S. Chand and Co. New Delhi.