

**LOGANATHA NARAYANASAMY
GOVERNMENT COLLEGE (AUTONOMOUS),
PONNERI 601 204**

**M.SC. DEGREE COURSE
BRANCH V-PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS

(2020-2021)

1. CONDITIONS FOR ADMISSION

Candidates who has passed the B.Sc. Degree Examination in Branch V Botany as main subject of study of this University or an examination of some University accepted as equivalent thereto shall be eligible for admission to the M.Sc. Degree in Botany in the Affiliated Colleges of this University.

2. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be eligible for the award of the degree only if he/she has undergone the prescribed course of study in a college affiliated to the University for a period of not less than two academic years, passed the examination of all the four semesters prescribed earning 90 credits and fulfilled such conditions as have been prescribed therefor.

3. DURATION OF THE COURSE

Two years Courses:

The duration of the course is for two academic years consisting of four semesters.

4 EXAMINATIONS

There shall be four semester examinations: first semester examinations at the middle of the first academic year and the second semester examination at the end of the first academic year. Similarly, the third and fourth semester examinations shall be held at the middle and the end of the second academic year, respectively.

5. COURSE OF STUDY AND SCHEME OF EXAMINATIONS

The scheme of examinations for different semesters shall be as follows:

SEM	SUBJECT CODE	COURSE TITLE	Ins. Hours	CRE DITS	MARKS		
					CA	SE	TOTAL
I	20PIM1A	PLANT DIVERSITY-I ALGAE AND BRYOPHYTES	5	4	25	75	100
	20PIM1B	PLANT DIVERSITY-II FUNGI, LICHEN AND PLANT PATHOLOGY	5	4	25	75	100
	20PIM1C	PLANT BIOTECHNOLOGY AND PLANT TISSUE CULTURE	5	4	25	75	100
	20PIE1A (ELECTIVE)	PHARMACOGNOSY / ETHNOBOTANY	2	3	25	75	100
	EDES / EDC	MEDICINAL CHEMISTRY	2	3	25	75	100
	20PIM11	PRACTICAL – I	9	4	40	60	100
	20PIS1A	SOFT SKILLS I	2	2	40	60	100
TOTAL			30	24	205	495	700
II	20PIM2A	PLANT DIVERSITY III: PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY	6	4	25	75	100
	20PIM2B	TAXONOMY AND ECONOMIC BOTANY OF ANGIOSPERMS	6	4	25	75	100
	20PIE2A (ELECTIVE)	ENTREPRENEURIAL BOTANY / HORTICULTURE AND SEAWEED TECHNOLOGY	5	3	25	75	100
	EDES / EDC	AQUA CHEMISTRY	2	3	25	75	100
	20PIM21	PRACTICAL II	9	4	40	60	100
	20PIS2A	SOFT SKILLS II	2	2	40	60	100
TOTAL			30	20	180	420	600
III	20PIM3A	PLANT ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS	6	4	25	75	100
	20PIM3B	PLANT PHYSIOLOGY AND BIOCHEMISTRY	6	4	25	75	100
	20PIM3C	CELL BIOLOGY AND MOLECULAR BIOLOGY	5	4	25	75	100
	20PIE3A (ELECTIVE)	PHYTOCHEMISTRY / PLANT MICROTÉCHNIQUE	2	3	25	75	100
	20PIM31	PRACTICAL III	9	4	40	60	100
	20PII3A	INTERNSHIP *		2			
	20PIS3A	SOFT SKILLS III	2	2	40	60	100
TOTAL			30	23	180	420	600
IV	20PIM4A	GENETICS, PLANT BREEDING AND EVOLUTION	6	4	25	75	100
	20PIM4B	PLANT ECOLOGY, PHYTOGEOGRAPHY AND REMOTE SENSING	5	4	25	75	100
		PROJECT	3	4	25	75	100
	20PIE4A (ELECTIVE)	RESEARCH METHODOLOGY / TECHNIQUES IN BIOLOGY	3	3	25	75	100
	20PIE4B (ELECTIVE)	APPLIED MICROBIOLOGY / BIOPHYSICS, BIOINFORMATICS AND NANOTECHNOLOGY	5	3	25	75	100
	20PIM41	PRACTICAL IV	6	4	40	60	100
	20PIS4A	SS 4- SOFT SKILLS IV	2	2	40	60	100
TOTAL			30	24	205	495	700
GRAND TOTAL			120	91	770	1830	2600

*- Internship will be carried out during the summer vacation of the II semester and credit will be allotted in III semester.

CORE	- 60 CREDITS
ELECTIVE	- 21 CREDITS
SOFT SKILLS	- 08 CREDITS
INTERSHIP	- 02 CREDITS

The following procedure be be followed for Internal Marks:

Theory Papers: Internal Marks - 25 Marks

Best Two tests out of 3	10 marks
Attendance	5 marks
Seminar	5 marks
Assignment	5 marks

25 marks

Break-up Details for Attendance

Below 60%	- No marks
60% to 75%	- 3 marks
76% to 90%	- 4 marks
91% to 100%	- 5 marks

Practical: Internal Marks - 40

Attendance	5 marks
Practical Best Test 2 out of 3	30 marks
Record	5 marks

Project:

Internal Marks Best 2 out of 3 presentations	20 marks
Viva	20 marks
Project Report	60 marks

6. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTERS:

(i) Candidates shall register their names for the First semester examination after the admission in the PG courses.

(ii) Candidates shall be permitted to proceed from the First Semester upto the Final Semester irrespective of their failure in any of the Semester Examination subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subject) Semester subjects.

(iii) Candidates shall be eligible to proceed to the subsequent semester, only if they earn, sufficient attendance as prescribed therefore by the Syndicate from time to time.

Provided in case of candidate earning less than 50% of attendance in any one of the semester due to any extraordinary circumstance such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorized Medical Attendant (AMA), duly certified by the Principal of the College, shall be permitted to proceed to the next semester and to complete the course of study. Such candidate shall have to repeat the missed semester by rejoining after

completion of final semester of the course, after paying the fee for the break of study as prescribed by the University from time to time.

7. PASSING MINIMUM:

- a) There shall be no Passing Minimum for Internal.
- b) For External Examination, Passing Minimum shall be of 50%(Fifty Percentage) of the maximum marks prescribed for the paper.
- c) In the aggregate (External + Internal) the passing minimum shall be of 50% for each Paper/Practical/Project and Viva-voce.
- d) Grading shall be based on overall marks obtained (internal + external).

8. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Candidates who secured not less than 60% of aggregate marks (Internal + External) in the whole examination shall be declared to have passed the examination in the First Class.

All other successful candidates shall be declared to have passed in Second Class.

Candidates who obtain 75% of the marks in the aggregate (Internal + External) shall be deemed to have passed the examination in First Class with Distinction, provided they pass all the examinations (theory papers, practicals, project and viva-voce) prescribed for the course in the First appearance.

9. GRADING SYSTEM:

As per TANCSHE grading system.

10. RANKING:

Candidates who pass all the examinations prescribed for the course in the first appearance itself alone are eligible for Ranking / Distinction.

Provided in the case of candidates who pass all the examinations prescribed for the course with a break in the First Appearance due to the reasons as furnished in the Regulations under “Requirements for Proceeding to subsequent Semester” are only eligible for Classification.

11. PATTERN OF QUESTION PAPER:

PART –A (50 words): Answer 10 out of 12 Questions	10 x 2 = 20 marks
PART –B (200 words): Answer 5 out of 7 Questions	5 x 5 = 25 marks
PART –C (500 words):Answer 4 out of 6 Questions	3 x 10 = 30 marks

12. APPEARANCE FOR IMPROVEMENT:

Candidates who have passed in a theory paper / papers are allowed to appear again for theory paper / papers only once in order to improve his/her marks, by paying the fee prescribed from

time to time. Such candidates are allowed to improve within a maximum period of 10 semesters counting from his/her first semester of his/her admission. If candidate improve his marks, then his improved marks will be taken into consideration for the award of Classification only. Such improved marks will not be counted for the award of Prizes / Medals, Rank and Distinction. If the candidate does not show improvement in the marks, his previous marks will be taken into consideration.

Candidate will be allowed to improve marks in the Practical's, Project, Viva-voce, Field work.

13. TRANSITORY PROVISION:

Candidates who have undergone the course of study prior to the academic year 2008-2009 will be permitted to appear for the examinations under those Regulations for a period of three years i.e., up to and inclusive of April/May 2012 Examinations. Thereafter, they will be permitted to appear for the examination only under the Regulations then in force.

PLANT DIVERSITY I: ALGAE AND BRYOPHYTES
(Admitted from 2020 onwards)
20PIM1A

External Marks: 75 Internal Marks: 25 Total Marks: 100

Semester - I Core –I Credits - 4 Hours - 5

Unit I- Algae

A general account and classification of Algae (F.E.Fritsch - 1945) Range of thallus organization, pigmentation, flagellation, reserve food, life cycles in algae, Phylogeny, Fossil algae. Contribution of M.O.P. Iyengar, T.V.Desikachary, V.S.Sundaralingam towards Phycology.

Unit II

Structure, reproduction and life histories of the following genera: *Anabaena*, *Scytonema*, *Volvox*, *Ulva*, *Chara*, *Navicula*, *Dictyota* and *Polysiphonia*.

Unit III

Economic importance of Algae: Algae in food, fodder, medicine, biofertilizers. Industrial application of algae - (Alginate, Carrageenan, Agar, Oxidation ponds). Pollution indicators, Eutrophication, Algal bloom and Biofuel.

Unit IV -Bryophytes

Classification of Bryophytes (Watson 1971), Structure and evolution of gametophyte and sporophyte. Methods of reproduction –vegetative, asexual, sexual, Phylogeny, Economic importance.

Unit V

Structure, reproduction and life histories of the following genera: *Riccia*, *Porella* and *Funaria*.

Books for Study

Chopra,R.N. and Kumar,P.K. 1988.Biology of Bryophytes. John Wiley, New York.
Watson,E.V. 1971. The structure and life of Bryophytes. Hutchinson and Co., London.
Parihar,N.S. 1987. An Introduction to Embryophyta Volume 1 BRYOPHYTA, Central Book Depot, Allahabad.
Puri, P. 1985. Bryophytes: A Broad perspective.

Books for reference

Fritsch,F.E. 1935. Structure and Reproduction of Algae.Vol I. and Vol II
Cambridge University Press. Cambridge.
South,G.R. and Whittick,A.1987. Introduction to Phycology. Blackwell, scientific Publications.
Oxford.
Round, F.E. 1981. The Ecology of Algae, CUP, Cambridge.
Graham, L.E. 1993. Origin of Land Plants. John Wiley and Sons Inc. New York.
Watson, E.V. The Structure and Life of Bryophytes, London 1964.

PLANT DIVERSITY II: FUNGI, LICHENS AND PLANT PATHOLOGY
(Admitted from 2020 onwards)
20PIM1B

External Marks: 75 Internal Marks: 25 Total Marks: 100

Semester - I Core –II Credits - 4 Hours - 5

Unit I- Fungi

History of Mycology, Classification of Fungi - G.C. Ainsworth, 1971; Webster and Webber, 2007, Structure, Nutrition and Methods of Reproduction. Heterothallism, Sex hormones, parasexual cycle and interrelational between major group of Fungi and Phylogeny. Economic importance of Fungi.

Unit II

Structure, Reproduction and Life cycle of the following genera

Myxomycotina- *Plasmodiophora*; Oomycota – *Pythium*; Zygomycotina - *Pilobolus*; Ascomycotina - *Taphrina*, Basidiomycotina - *Puccinia*, Deuteromycotina - *Colletotrichum*

Unit III- Lichens

Classification –Distribution, Types – Crustose, Foliose and Fruticose -Structure, Reproduction and Economic importance – Food, Fodder, Medicine, Dyes, Cosmetics and Perfumery, Ecological significance, Pollution indicators.

Unit IV- Plant Pathology

Classification of Plant diseases, Koch's Postulates, Dispersal of plant pathogens, Inoculum, Inoculum potential, Prepenetration structures produced by pathogens, Penetration, Infection, Defence mechanism in plants, Role of Enzymes and Toxins in Plant pathogenesis. Epidemiology and disease forecasting.

Unit V

A study of causal organism, symptoms, disease cycle and control measures of the following diseases: Sheath blight Paddy, *Fusarium* Wilt of cotton, Powdery mildew of cucurbits, Angular leaf spot of Cotton, Fire blight of Apple, Leaf curl of Papaya, Yellow vein Mosaic disease of Bhindi, Bunchy top of Banana, Little leaf of Brinjal and Red rust of tea.

BOOKS FOR STUDY

Alexopoulos, C.J. & Mims, C.W. 1997. Introductory Mycology, Wiley, New Delhi.
Webster, J. 1988. The Fungi. Cambridge Univ. Press, Cambridge
Rangaswami, G. 2001. Disease crop plants in India. Prentice- Hall of India Pvt. Ltd., New Delhi, 4th Edition
Mehrotra, R.S. 1980. Plant Pathology. Tata McGraw Hill Publishing Company,
Vyas, S.C. 1984. Systemic Fungicides. Tata McGraw Hill Publishing Company Ltd.
Dasgupta, M.K. 1988. Principles of Plant Pathology. Allied Publishers, New Delhi.
Bilgrami, K.S. and Dube, H.S. 1976. A Text Book of Modern Plant Pathology, Vikas Publishing House Pvt. Ltd.

BOOKS FOR REFERENCE

Elizabeth Moore Landecker, 1982. Fundamentals of the fungi. Prentice Hall, NJ, USA.
Deacon, J. 2006. Fungal Biology (IV ed.), Blackwell.
Talbot, P.H.B. 1978. Principles of Fungal taxonomy, Macmillan Press, London.
Ainsworth, G.C. & Sussman, A.S. The fungi – An Advanced Treatise. Vols. I-IV. Academic Press, New York.
Ahmedjian, V. & Hale, M.E. 1973. The Lichens. Academic Press. London.
Agrios, G.N. 2005. Plant Pathology, Elsevier Press, 5th Edition.
Day, P.R. 1979. Genetics of host parasite interaction. S. Chand & Co. New Delhi.
Baker, H.F. and Cook, R.J. 1974. Biological control of plant pathogens, S. Chand & Co. Ltd.
Walker, J.C. 1969. Plant pathology- Tata McGraw Hill Publication Co. Ltd.

PLANT BIOTECHNOLOGY AND PLANT TISSUE CULTURE
(Admitted from 2020 onwards)

20PIM1C

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - II

Core –III

Credits - 4

Hours - 4

Unit I -Biotechnology

Definition, history, scope and importance. Cloning vehicles, Plasmids, Cosmids, Phages, Shuttle vectors- transposons, DNA polymerase.

Unit II

Method of crop improvements – Gene transfer – Indirect method – *Agrobacterium tumefaciens* mediated gene transfer – Direct DNA gene transfer technology – Liposome mediated gene transfer – Biolistic gun – Electroporation – Silicon carbide method – Microinjection, PCR technique, Blotting.

Unit III

Transgenics-herbicide resistance –resistance glyphosate, Basta resistance pest , insects - *Bacillus thuringiensis* - Bt genes- endotoxins – resistance against pathogens - DNA finger printing and applications - IPR and Protection.

Unit IV - Plant tissue culture

History- laboratory, facilities – Media (MS & B₅) - ingredients and preparation- Explants and their preparation – culture room- Hardening. Haploid production - Anther culture, Embryo culture and meristem culture.

Unit V

Somatic embryogenesis, Synthetic seed, Cryopreservation, Germplasm storage. Applications of Plant tissue culture in Agriculture, Horticulture and forestry.

Books for Study

Satyanarayana, U. 2006. Biotechnology. Allied Publishers. India.

Kalyan Kumar, D. 1992. Plant Tissue culture, New Central Book Agency. Calcutta.

Hammond, J. Mc Garvey P. and Yusibow, V. 2004. Plant Biotechnology (New products and applications) Rekha printers Pvt. Ltd. New Delhi. India

Books for reference

John E. Smith, 1996. Biotechnology, 3rd edition Cambridge University Press.

Slater, Scott,N.W. and Fowler, M.R. 2003. Plant Biotechnology (The genetic Manipulation of plants) Oxford press.

Ratledge,C and Kristiansen, B. 2003. Basic Biotechnology. Cambridge University Press.

ELECTIVE –I PHARMACOGNOSY

(Admitted from 2020 onwards)

20PIE1C

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - I

Elective – I

Credits - 3

Hours - 4

UNIT I

Pharmacognosy – Definition, scope, history. Indian system of medicine : Ayurveda, Siddha, Unani and Homeopathy –Principles, practice and preparation of drugs.

Unit II

Introduction to herbals and herbalism. Classification of drugs - Taxonomical, morphological, pharmacological, chemical and chemotaxonomical Drug adulteration – Types of adulterants. Evaluation of drugs.

UNIT III

Gross anatomical studies of selected medicinal plants parts.

a) Senna – Leaf, b) Datura – Leaf, c) Cinnamon – bark, d) Cinchona – Bark, f) Fennel – Fruit, g) Clove – Flower bud, h) Ginger – rhizome, i) Nuxvomica – Seed.

UNIT IV

Sources, descriptions, constituents and uses of the following:-

Laxative – Aloe, Castor oil,

Cardiotonic – Digitalis, Arjuna,

Carminative – Coriander, Cardamom,

Antitussives – Adathoda, Tulsi,

Diuretics – Gokhru, Punarnava.

UNIT V

Collection of crude drugs – Harvesting of crude drugs – drying – packing, storage and marketing of crude drugs. Nutraceutical and cosmeceuticals.

BOOKS FOR STUDY

Sivarajan, V.V. and Balasubramaniam, 1994. Ayurvedic drugs and their plant resources. Oxford and IBH, New Delhi.

Chopra R.N., Nagar S.L. and Chopra I.C. 1956, Glosssary of Indian Medicinal plants.

Chopra, R.N., Chopra, I.C. , Handa, K.L. and Kapur L.D. 1994, Indigenous drugs of India.

BOOKS FOR REFERENCE

Wallis, T.E. 1955. Text Book of Phramacognosy, Churchill Ltd

Lewis, W.H. and M.P.F. Elwin Lewis. 1976. Medical Botany. Plants affecting Man’s Health. A Wiley Inter Science Publication. John Wiley and Sons, New York.

Rastogi, R.R. & Mehrotra, B.N. 1993. Compendium of Indian Medicinal Plants Vol. I and Vol.II. CSIR Publication & Information Directorate, New Delhi.

Sivarajan, V.V. and Balasubramaniam, 1994. Ayurvedic drugs and their plant resources. Oxford and IBH, New Delhi.

ELECTIVE –I ETHNOBOTANY

External Marks: 75 Internal Marks: 25 Total Marks: 100

Semester - I Elective – I Credits - 3 Hours - 4

UNIT I

Ethnobotany: Introduction, concept, scope and objectives. Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context. Major ethnic groups in Tamil Nadu. (Any five).

UNIT II

Methodology of Ethnobotanical studies. a) Field work b) Herbarium c) Ancient Literature d) Temples and sacred places. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses.

UNIT III

Plants and Tribal medicine: Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadirachta indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauwolfia serpentina*, *Trichopus zeylanicus*.

UNIT IV

Role of ethnic groups in conservation of plant genetic resources. Participatory forest management. Sharing of wealth concept with few examples from India.

UNIT V

Ethnobotany as a source of drug. a) Reserpine b) Artemisin c) Gugulipid d) Cocaine e) Strychnine.

Books for Study

- Bhattacharjee, S.K. 2004. Hand Book of Medicinal plants. Pointer Publishers, Jaipur.
Frankel, O. H., Brown, A. H. D. and Burdon, J. J. 1995. The Conservation of Plant Diversity. Cambridge University Press, London.
Jain,A. and Jain, S.K. 2016.Indian Ethnobotany - Bibliography of 21st Century Scientific Publishers (India)
Jain,A.K.2015. Indian Ethnobotany:Emerging Trends,Scientific Publishers,Jodhpur
Heywood, V. H. 1995. Global Biodiversity Assessment. UNEP, Cambridge University Press, London
Krishnamurthy, K. V. 2004. An Advanced Textbook on Biodiversity: Principles and Practice. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
Rasheeduz,Z. Medicinal Plants of India, CBS Publishers & Distributors

PRACTIACL – I

Algae, Bryophytes, Fungi, Lichens, Plant Pathology and Plant Biotechnology and Plant Tissue Culture

External Marks: 60 Internal Marks: 40 Total Marks: 100

Semester - I Core Practical – I Credits - 4 Hours - 9

Algae

Study of Morphological, anatomical and reproductive structures of the algal

Genera included in theory.

A local field trip to study algae in their habitat.

Submission of 5 sheets of Herbarium.

Bryophytes

Study of morphological, anatomical and reproductive structures of the genera mentioned in the theory.

Fungi

Study of morphological and reproductive structures of the fungal genera mentioned in the theory.

Methods of isolating fungi from soil, air and water.

Lichens

Study of morphology and anatomy of Crustose, Foliose and Fruticose Lichen.

Plant Pathology

Study of diseases plants with special reference to those given in theory.

Study of morpho-anatomical deformities induced due to a particular disease.

Establishment of Koch's postulates

Test for the efficacy of fungicide to a pathogenic fungus.

Submission of 5 pathological specimens – Herbarium

Field visit to Research stations - 4 to 6 days.

Plant biotechnology and tissue culture

1. Tissue culture laboratory design
2. Inoculation of explants
3. Media preparation
4. Callus culture – Cell suspension culture
5. Plant regeneration- Anther culture, Embryo culture and Meristem culture.
6. Synthetic seeds
7. Spotters taken from standard text books based on theory syllabus.

SEMESTER - II

PLANT BIODIVERSITY III: PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY

(Admitted from 2020 onwards)

20PIM2A

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - II

Core – V

Credits - 4

Hours - 5

Unit I- Pteridophytes

General characteristics, Classification (Reimer, 1954), Stelar evolution. Sporangial organization, Heterospory and seed habit, Telome theory, Apospory and Apogamy. Economic importance of Pteridophytes. Phylogeny.

Unit II

Structure, reproduction and life history of the following genera: *Isoetes*, *Osmunda*, *Adiantum*, *Pteris*, and *Salvinia*.

Unit III- Gymnosperms

General characteristics, Classification (K.R.Sporne, 1965). Affinities and interrelationships with Pteridophytes and Angiosperms. Economic importance of Gymnosperms.

Unit IV

Structure, reproduction and life history of the following genera: *Araucaria*, *Cupressus*, *Ephedra*.

Unit V- Palaeobotany

Geological Time Scale. Gondwana Flora of India – Contribution of Prof. Birbal Sahni. Types of fossils, fossilization, techniques for fossil study- significance. Economic importance of fossils. Brief account on fossil genera – *Rhynia*, *Sphenophyllum*, *Lyginopteris*, *Williamsonia* and *Benetitites*.

Books for Study

Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms, New Age International Ltd.

Campbell, D.H. 1972. The experimental Biology of Ferns. Academic Press.

Chamberlain, C.J. Gymnosperms - structure and evolution

Parihar, N.S. The Biology and Morphology of Pteridophytes. Central Book Depot., Allahabad. 1980.

Rashid, A. 1979. An introduction to Pteridophytes, Vikas publication.

Books for reference

Sporne, K.R. 1965. The morphology of Gymnosperms. Hutchinson Publication, London.

Andrews, H.N. 1961 Studies in Palaeobotany.

TAXONOMY AND ECONOMIC BOTANY OF ANGIOSPERMS
(Admitted from 2020 onwards)

20PIM2B

External Marks: 75 Internal Marks: 25 Total Marks: 100

Semester - II Core –VI Credits - 4 Hours - 4

Unit I

Objectives of Plant taxonomy, Taxonomic hierarchy, Concept of species and genera. Keys and their types. Floras and Monographs. Systems of classification: Linnaeus, Bentham and Hooker, APG system and Dahlgren. Modern trends in Taxonomy –Numerical taxonomy, Chemotaxonomy, Biosystematics, Serotaxonomy, Molecular taxonomy, Plant Barcoding (DNA),

Unit II

Herbarium techniques and its importance. ICBN- importance and principles of binomial nomenclature, Valid and Effective publication, Typification, Principles of priority - Author citation , Botanical survey of India- its organisation and role(BSI).

Unit III

Study of the following families and their economic importance of Magnoliaceae, Menispermaceae, Portulacaceae, Rhamnaceae, Sapindaceae, Moringaceae, Combretaceae, Passifloraceae, Molluginaceae and Zygophyllaceae.

Unit IV

Study of the following families and their economic importance of Oleaceae, Boraginaceae, Convolvulaceae, Bignoniaceae, Acanthaceae, Nyctanginaceae, Polygonaceae, Commelinaceae, Arecaceae, Liliaceae and Cyperaceae.

Unit V

Economic Botany .Cultivation and utilization of selected crop plants : cereals – Wheat, Maize; spices and condiments – Cardamom, Cinnamon; commercial crops – Fibre (Jute, Manila Hemp), Timbers (Teak, Red sandal wood), Resins and Gums (Asafoetida), Vegetable oils (Sesamum, Groundnut), Essential oils (Citronella, Rosemary), Drug yielding plants (*Cinchona*).

BOOKS FOR STUDY

Gurucharan Singh, 2005. Plant systematics Theory and Practice, Second edition, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

Lawrence, G.H.M. 1967. Taxonomy of vascular plants. Oxford & IBH Publishing Co. New Delhi.

Sivarajan, Introduction to Principles of Taxonomy. Oxford IBH, New Delhi.

BOOKS FOR REFERENCE

Davis, P.H. and Heywood, V.H. 1967. Principles of Angiosperm Taxonomy, Oliver and Boyd. Edinburgh.

Hutchinson, J. 1973. The Families of flowering plants 3rd edition Oxford University Press. U.K.

Jeffrey, C. 1982. An Introduction to Plant Taxonomy. Allied Publishers Pvt. Ltd.

Radford, A.E. 1986. Fundamentals of Plant Systematics.

ELECTIVE – II
ENTREPRENEURIAL BOTANY
20PIE2A

(Admitted from 2020 onwards)

External Marks: 75 Internal Marks: 25 Total Marks: 100

Semester - I

Credits - 4

Hours - 5

UNIT I

General account of algae- Economic importance of Algae- Industry and cosmetics- small scale and large scale cultivation of *Spirulina*, *Dunaliella*, *Botryococcus*. Seaweed cultivation, extraction of liquid seaweed fertilizer (LSF) and its application – single cell protein- Extraction of Agar and Alginate.

UNIT II

Introduction and scope of mushroom cultivation- Biology and cultivation of paddy straw and oyster mushroom- Nutritional value and uses of mushroom - diseases- Post –harvest technology- Marketing, Packaging, Storage.

UNIT III

Gardening-Importance - types of gardens- Rockery, water garden-Lawn- formation and Maintenance. Nursery structure and maintenance. Vegetable carving - Ikebana technique and Topiary. Floriculture- Rose, Chrysanthemum, Jasmine and cut flowers - Bouquet making.

UNIT IV

Food spoilage- causes- Preservation of fruits and vegetables- Principles- different methods of preservation and preservatives- canning of fruits and vegetables- Drying of fruits- Preparations of Jams, Jellies, marmalades.

UNIT V

Vermicomposting and organic farming, Methods of organic farming, vermicomposting- methods -preparation. Entrepreneurship development programme(EDP), SHG, Funding Agencies to promote EDP . Need and its importance.

BOOKS FOR STUDY

ManibhusanRao,K. 1991. Text Book of Horticulture. Mac Millan India Pvt. Ltd. New Delhi.

Mathew, I.P. & Karikari,1994. Horticulture; Principles & Practice: Mac Millan Press Ltd. New Delhi.

Prasad, S. & Kumar, U. 1999.Principles of Horticulture, Agro Botanica, Bikaner, India.

Marshall Woodrow, G. 1999. Gardening in India, Biotech Books, New Delhi.

Kapoor, J.N. Mushroom cultivation, KrishiBhavan, New Delhi

Suman, 2005 Mushroom cultivation, International Book Distributors, Dehradun.

Smith, G.M. Cryptogamic Botany Vol.I 1955, McGraw Hill.

BOOKS FOR REFERENCE

Gedaliah, S. and Soeder, C.J. 1980. Algal Biomass production and use. Elsevier-North Holland, Oxford.

Stein, J.R. 1973. Hand Book of phycological methods. Cambridge University Press, Cambridge.

Ahluwalia, A.S. 2003. Phycology- Principles, Processes and applications. Daya Publishing House, Delhi. Chapman, V.J. 1970 Seaweed and their uses. Methuen & Co. Ltd. London

Dey, S.C. Mushroom growing, Agrobios (India) Jodhpur.

Siddappa, G.S. and Tandon, G.L. 1998. Preservation of Fruits and Vegetables Lal G., ICAR, New Delhi.

Borowitzka, M.B.L. 1998 Microalgal biotechnology, Cambridge University Press, Cambridge

.

ELECTIVE – II

HORTICULTURE AND SEAWEED TECHNOLOGY

(Admitted from 2020 onwards)

20PIE2A

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - III

Elective –II

Credits - 3

Hours - 3

UNIT-I:

Importance and History of Gardening - Garden implements -, Indoor plants and Outdoor plants- Flower arrangement-massing and Ikebana- Fruit and Vegetable carving. Nursery structures- Green house, Shade house, Mist chamber- topiary- Bonsai culture. Floriculture- Rose, *Chrysanthemum*, Jasmine- cultivation. Hydroponics.

UNIT-II:

Types of pots and containers, Potting media –components and types. Propagation, seed and vegetative- cutting, layering and grafting-

UNIT-III:

Gardening- Types of gardens - formal garden- vegetable garden- orchard- terrace garden- water garden - formation and maintenance of lawns. Manures- microbial inoculants- composting- vermicomposting - fertilizers and their application -Role of phytohormones in horticulture and irrigation.

UNIT-IV:

Seaweeds - Introduction and taxonomic identification of micro and macroalgae of fresh water and marine habitats. Seaweed resources in India and abroad. Ecology of Seaweeds: Distribution, Nutrients and Environment. General principles of Culturing Algae in Laboratory and growth measurement. . Culture media for fresh water and marine algae. Bio-pond – Production in Open Ponds – Harvesting and Oil Extraction - principles and methods.

UNIT-V:

Seaweeds - Morphology and Classification, Chemical Constituents of Seaweeds. Seaweeds farming –construction of farm – Line method, Rope & Raft methods, Net method – Floating bamboo method – Mangrove stakes and nets-method. Uses of seaweeds - Human food, Seaweed Baths, Cosmetics, Seaweed as agricultural fertilizers.

PRACTICAL:

1. Preparing and recording of microscopic preparation as in unit III.
2. Learning the skills of special techniques as in unit IV.

Reference Books:

1. Alan Peacock H. 1966 Elementary Microtechnique Edward Arnold (Pub) Ltd.
2. Duddington - C.L. 1960 Practical Microscopy, Pitman.
3. Cray P. Hand Book of Basic Microtechnique. Mac - Graw Hill, New Delhi.
4. Johnson D.A. 1940 Plant Microtechnique. Mac - Graw Hill, New Delhi.

5. MC Clung, C.L.1961, Hand book of Microscopical Technique.
6. Patki L.R.1992 An Introduction to Microtechnique S.Chand & Company, New Delhi.
7. Prasad & Prasad 2000 Emkay Replications, Delhi.
8. Puru's M.J.et al 1966 Laboratory Techniques in Botany Butter Worths.
9. Sasse John, E. 1964. Botanical Microtechnique.Oxford & IBH.
10. Grav, P. 1964. Hand Book of Basic Microtechniques. McGraw Hill.
11. Mc Cluney, C.L. 1961. Hand book of Microscopical Technique. Wafner

PRACTICAL II - 20PIM21
**Pteridophytes, Gymnosperms, Palaeobotany, Taxonomy and Economic Botany Of
Angiosperms**

(Admitted from 2020 onwards)

External Marks: 60 Internal Marks: 40 Total Marks: 100

Semester - II Core Practical – II Credits - 4 Hours - 9

Pteridophytes

Study of the morphology and anatomy of the vegetative and reproductive structures of the genera given in the theory.

Gymnosperms

Study of the morphology and anatomy of the vegetative and reproductive structures of the genera given in the theory.

Palaeobotany.

Study of forms given in the theory.

Taxonomy

Identification and description of species based on herbarium and live specimens of the families mentioned in the theory.

Preparation of keys at generic and species level.

Field visit for 5-7 days to collect specimens in and outside the state.

Submission of not less than 25 herbarium sheets representing the families studied.

Economic Botany

Spotters – Study of plant/plant parts included in the syllabus to know the binomials of plants and their economic importance.

SEMESTER – III

PLANT ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

(Admitted from 2020 onwards)

20PIM3A

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - III

Core –VIII

Credits - 4

Hours - 4

Unit I- Anatomy

Tissues – Definition and Classification. Meristems- types- Theories regarding shoot and root apex- apical cell theory, Histogen theory, Tunica corpus theory, quiescent centre. Vascular cambium and cork cambium – types, origin and development - periderm, polyderm, rhytidome, lenticels. Cambial activity- normal and anomalous secondary growth in dicotyledons (*Achyranthes*, *Bougainvillea*, *Calotropis*, and *Aristolochia*), Anomalous thickening in monocotyledons (*Dracaena* stem).

Unit II

Xylem – Ontogeny, xylary elements, tyloses, reaction wood: Heart wood and sap wood, Annual rings –Dendrochronology. Phloem – ontogeny, Phloem elements, Leaf anatomy and stomatal types. Nodal anatomy – uni, tri and multilacunar node.

Unit III

Microtechniques – Microtome types, killing and fixing of plant parts. Major types of fixative agents, Dehydration, wax infiltration and embedding of plant organs. Wax embedding, preparation of serial rotary microtome section. Dewaxing and double staining (Safranin and Fast green), Cell maceration. whole mount, squash, smear, peeling and vein clearing.

Unit IV – Embryology

Microsporangium and microspores. Microsporogenesis – Pollen – structure and morphological types. Introduction to Palynology – Pollen analysis – Aeropalynology – Pollen allergy and Palynological calendars.

Unit V

Megasporangium and Megaspores. Ovule – types. Megasporogenesis – Monosporic, Bisporic, Tetrasporic, fertilization and development of zygote. Endosperm - types, Development of monocot (*Najas*) and dicot embryo (*Capsella*), Apomixis, Parthenocarpy and Polyembryony, Basic structure of seed (Bean seed).

Books for Study:

Bhojwani, S.S. and Bhatnagar, S.P. 1978. The embryology of Angiosperms. Vikas Publishing Pvt. Ltd.

Esau, K. 1960, Anatomy of seed plants. John Wiley Publications. NY.

Maheswari, P. 1971 An Introduction to the embryology of Angiosperms. Tata McGraw Hill.

Sass, J.E. Botanical Microtechnique

Johansen, D.A. Principles of Microtechnique

Books for reference

Elizabeth G. Cutter. 1978. Plant Anatomy Part I: Cell and Tissues. Second Edition. The English Language Book Society and Edward Arnold Publishers Ltd. London.

Maheswari, P. 1971 An Introduction to the embryology of Angiosperms. Tata McGraw Hill.

Fahn, A. 1974. Plant Anatomy. Pergamon Press.

PLANT PHYSIOLOGY AND BIOCHEMISTRY

(Admitted from 2020 onwards)

20PIM3B

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - III

Core –IX

Credits - 4

Hours - 4

Unit I

Water relations of plants :Uptake, transport and translocation of water, ions, and macromolecules from soil, through xylem and phloem; osmotic potential, solute potential, water potential stomatal movement -transpiration- antitranspirants; mechanisms of loading and unloading of photo assimilates.

Unit II

Plant hormones: Biosynthesis of Auxins, Gibberellins and Cytokinins, physiological effects and mechanisms of action. Sensory photobiology: Structure, function, mechanisms and action of Phytochromes, Cryptochromes - Photoperiodism and Biological clocks. Secondary metabolites- biosynthesis of alkaloids, flavonoids, terpenes, phenols and their roles.

Unit-III

Stress physiology: Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses; mechanisms of resistance to biotic stress – antifreeze agents - genes regulating stress.

Unit IV – Biochemistry

Structure of atoms, molecules and chemical bonds.Composition, structure and function of biomolecules (carbohydrates, lipids, proteins- Ramachandran plot, Secondary, tertiary and quaternary structure). Enzymes –properties – apo enzyme, co factors, metallic activators – co enzyme, Nomenclature and classification - Enzyme kinetics – concept of active sites Michaelis Menton equation – mechanism of enzyme action, enzyme inhibition, enzyme regulation.

Unit-V

Photosynthesis: Light harvesting complexes; mechanisms of electron transport; CO₂ fixation-C₃, C₄ and CAM pathways. Biochemistry and Molecular biology of RUBISCO. Photorespiration- mechanism and significance, Respiration - Citric acid cycle; plant mitochondrial electron transport and ATP synthesis, Glyoxylate cycle. Nitrogen metabolism: Nitrogen fixation - Nitrate and ammonium assimilation, Amino acid biosynthesis – GDH and GS-GO- GAT pathways.

Books for Study

Salisbury, F.B. and C. Ross. 1991. Plant Physiology. Wadsworth Publishing Company. Belmont.

Bidwell, R.G.S. 1974. Plant Physiology. Macmillan Pub. Co., N.Y.

Books for reference

Stryer, L. 1981. Biochemistry. W.H. Freeman and Company. New York.

Ting, I.P. 1982. Plant Physiology. Addison Wesley Pub. Co. Philippines.

Moore, T.C. 1979. Biochemistry and Physiology of Plant Hormones. Springer-Verlag. Berlin.

CELL BIOLOGY AND MOLECULAR BIOLOGY

(Admitted from 2020 onwards)

20PIM3C

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - III

Core -X

Credits - 4

Hours - 4

Unit I: Cell Biology

Cell organization- Cell theory- Prokaryotes and Eukaryotes. Cell wall- Primary, Secondary, Middle lamellae. Plasma membrane Unit membrane, fluid mosaic model- functions. Cytoplasm – physical and chemical properties. Ultra structure and function of intra cellular organelles – Chloroplast, Mitochondria. Golgi bodies, Endoplasmic reticulum, Lysosomes, Peroxisomes, Ribosome.

Unit II:

Nucleus – Structure, Nuclear envelope, nucleolus. Chromosomes - types. Structure of chromatin – Heterochromatin and Euchromatin. Nucleosome – structure. Cell cycle and Cell division - Mitosis and Meiosis. Synoptoneal complex.

Unit III: Molecular Biology

Nucleic acids- Isolation of nucleic acids – base pairing- variations in base composition- types of DNA. Chargaff's rule- DNA Size - fragility- melting curves- hydrophobic interaction- – denaturation- renaturation - Cot curves -circular and superhelical DNA- topoisomerase- special bases- unique and repetitive DNA.

UNIT IV :

DNA replication- basic rule of replication – DNA replication in prokaryotes and Eukaryotes - enzymes involve in DNA replication and synthesis. Sequencing of DNA- Maxam Gilbert and Sanger's method –Types of DNA damage and their repair mechanisms. Genetic code - characteristics. Types of RNA.

Unit V:

Transcription in prokaryotes and Eukaryotes – Post transcriptional modification of mRNA- RNA editing -reverse transcriptase. Translation – post translational modification of proteins. Gene regulation – Operon concept - Lac repressor - *ara*- operon and *trp*- operon. Gene expression in eukaryotes.

Books for reference

Barton, N. H., Briggs, D.E.G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring Harbour Laboratory Press.

Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Brown, C.W. and Thorpe, T.A. 1984. Cell culture and Somatic Cell Genetics of plants, Academic Press Orlands,

- Cherayil, J.D. 1974. Gene and the Genetic Code. Tata Macgraw Hill, New Delhi.
- Cooper, G.M. and Hausman, R.E. 2007. The Cell-IV Ed. ASM Press, Washington.
- De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
- Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th ed. John Wiley & Sons.
- Lewin, B. 2004. GENES VIII. International Edition. Pearson Education Inc. London.
- Ridley, M. (2004) Evolution. III Edition. Blackwell Publishing
- Sharma, A.K and Sharma, A. 1980. Chromosome Technique- Theory and Practice, Butterworths, London
- Stern, H. and Manney, D.L. 1975. The Biology of Cells. Wiley Eastern Pvt. Ltd., New Delhi.
- Verma, P.S. and Agarwal, V.K. 2004. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. New Delhi.
- Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene 6th edition. Cold Spring Harbour Lab. Press, Pearson Pub.

ELECTIVE - III
PHYTOCHEMISTRY
(Admitted from 2020 onwards)

20PIE3A

External Marks: 75 Internal Marks: 25 Total Marks: 100

Semester - II Elective –III Credits - 3 Hours - 3

UNIT- I

Phytochemistry - Scope of Phytochemistry. Importance in pharmaceuticals industry. Preparation of plant extracts - maceration, infusion, digestion, decoction, percolation, sonication, hot continuous extraction, aqueous alcoholic extraction, superficial fluid extraction and counter-current extraction. Parameters for selecting appropriate extraction method.

UNIT - II

Secondary metabolites - definition, Pathway of secondary metabolites products, classification, preliminary phytochemical screening by chemical test. Methods for separation and isolation of constituents. Synergy and polyvalent action of phytomedicines. Attenuation of toxicity. Factors influencing secondary metabolites production.

UNIT- III

Flavonoids: Definition, properties, classification, natural sources and therapeutic applications of flavonoids, anthocyanins, carotenoids, and alkaloids.

UNIT - IV

Glycosides: Definition, properties, classification, natural sources, pharmacological and toxicological effects of glycosides, terpenes, coumarins and tannins.

UNIT - V

Volatile oils - source, constituents, properties, extraction and utilization of Sandal wood oil, Lemon grass oil, Vetiver oil, Clove oil and *Eucalyptus* oil. Medicinal uses of resins.

Reference Books

1. Gurdeep Chatwal, 1983. *Organic Chemistry of Natural Products*, Himalaya Publishing House, Mumbai.
2. Jean Bruneton, 1999. *Pharmacognosy*, Second Edition, Lavoisier Publishers, Inc. USA.
3. Kokate, C.K., Purohit, A. P and Gokhale, S.R. 2004. *Pharmacognosy*, Nirali Prakashan Publications, Pune.
4. Nitin Suri, 2010. *Phytochemical Techniques*, Oxford Book Company.
5. Roseline, A. 2011. *Pharmacognosy*, MJP Publishers, Chennai.
6. Rमित M Shah and Rupesh T Nayak, 2012. *Pharmacognosy*, Global Academic Publishers, New Delhi. (Part I and Part II).
7. Wallis, T.E. 1985. *Text Book of Pharmacognosy*, CSB Publishers, New Delhi.
8. William Charles Evans, 2002. *Pharmacognosy*, Fifteenth edition, Harcourt Brace & Company, Asia Pvt. Ltd.

ELECTIVE - III

PLANT MICROTECHNIQUE

(Admitted from 2020 onwards)

20PIE3A

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - III

Elective –III

Credits - 3

Hours - 3

UNIT-I:

Light Microscopy - History - Optical Principles - uses and care of Microscopes - A brief survey of types of microscopes (Dark field, Fluorescent, Phase contrast, Polarizing, Transmission Electron Microscope (TEM) and Scanning electron Microscope (SEM)).

UNIT-II:

Microphotography - Principles - Working Mechanism. Camera lucida - Working principles and uses. Micrometry - Stage and ocular micrometer - method of measurement - uses.

UNIT-III:

Microtechnical Process - Principles - Techniques - Killing, Fixation and Fixatives. Stains - types - staining procedures.

UNIT-IV:

Microscopic preparations - Temporary, Semi Permanent and Permanent, Special techniques - Whole mount - Smear - Squash – Maceration, Vein clearing.

UNIT-V:

Microtomes - Types of Microtome's - Rotary Microtome - Rocking Microtome - Sledge microtome and their uses.

PRACTICAL:

1. Preparing and recording of microscopic preparation as in unit III.
2. Learning the skills of special techniques as in unit IV.

Reference Books:

1. Alan peacock H.1966 Elementary Microtechnique Edward Arnold (Pub) Ltd.
2. Duddington - C.L. 1960 Practical Microscopy, Pitman.
3. Cray P.Hand Book of Basic Microtechnique. Mac - Graw Hill, New Delhi.
4. Johnson D.A. 1940 Plant Microtechnique. Mac - Graw Hill, New Delhi.
5. MC Clung, C.L.1961, Hand book of Microscopical Technique.
6. Patki L.R.1992 An Introduction to Microtechnique S.Chand & Company, New Delhi.
7. Prasad & Prasad 2000 Emkay Replications, Delhi.
8. Puru's M.J.et al 1966 Laboratory Techniques in Botany Butter Worths.
9. Sasse John, E. 1964. Botanical Microtechnique.Oxford & IBH.
10. Grav, P. 1964. Hand Book of Basic Microtechniques. McGraw Hill.
11. Mc Cluney, C.L. 1961. Hand book of Microscopical Technique. Wafner

PRACTICAL - III

**Plant Anatomy, Embryology, Plant Physiology and Biochemistry,, Cell and Molecular Biology
(Admitted from 2020 onwards)**

20PIM31

External Marks: 60

Internal Marks: 40

Total Marks: 100

Semester - III

Core Practical – III

Credits - 4

Hours - 9

Plant Anatomy

Study of internal structure of Dicot and Monocot – Root, Stem and Leaf.

Nodal anatomy Sections of uni,tri, multilacunar nodes, stomatal types.

Secondary structure of dicot stem and root.

Anomalous secondary thickening in dicotyledons – *Achyranthes*, *Bougainvillea*, *Calotropis*, and *Aristolochia*, Anomalous thickening in monocotyledons - *Dracaena* stem.

Submission 5 slides – whole mount, free hand, Peeling, Maceration, Clearing.

Embryology

Preparation of dissected whole mounts of embryo (any two stage)

Study of pollen (acetolysis/ non acetolysis).

Study of permanent preparations- structure of anther, pollen, ovule, embryo sac, endosperm and embryo.

Plant Physiology

1. Determination of water potential by Plasmolysis method.

2. DPD by weighing method.

3. Factors affecting temperature permeability in beet root cells.

4. Separation of chlorophyll pigments of C₃ and C₄ plants –Paper Chromatography and TLC and Column.

5. Quantification of Chlorophyll a, b total chlorophyll by Arnon method.

6. Determination of absorption spectra of Chlorophyll a and b using colorimeter.

7. Effect of varying intensities of light on photosynthetic rate- Wilmot's bubbler.

8. Effect of varying wavelength of light on photosynthetic rate- Wilmot's bubbler.

9. Effect of varying concentration of CO₂ on photosynthetic rate - Wilmot's bubbler.

10. Determination of respiratory rate in different substrates using titration method.

11. Extraction and separation of plant pigments by chemical method.

12. Bio assay of 2, 4 – D.

13. Bio assay of Cytokinin.

Biochemistry

1. Basic biochemistry- preparation of different types of solutions

2. Principles of photometry –Colorimeter, Spectrophotometer-principles and applications.

3. To find complementary colour for different coloured solutions using colorimeter.

4. Extraction and separation of known and unknown amino acids using Paper Chromatographic method.
5. Principles of pH meter and applications-pH of lemon juice and detergent powder.
6. Estimation of sugar (Anthrone reagent method).
7. Estimation of free amino acids by ninhydrin method.
8. Estimation of proteins (Lowry's method / Bradford method).
9. Catalase enzyme activity.
10. To test the germination capacity of seeds using Tetrazolium chloride.

Cell Biology

Mitosis –Onion root tip –Squash preparation – Calculation mitotic of index.

Meiosis –Smear technique –Flower bud.

Study of induced aberrations in onion root tips employing chemicals and plant extracts.

Demonstration of Salivary gland chromosome – *Chironomous* larva.

Study of cellular organelles from electron micrographs.

Molecular Biology

Isolation of genomic DNA

Isolation of plasmid DNA

Electrophoresis of nucleic acids

Isolation of RNA

Spotters related to DNA replication, Transcription, Translation and Lac operon.

Solving problems in molecular biology and gene regulation.

SEMESTER – IV

GENETICS, PLANT BREEDING AND EVOLUTION

(Admitted from 2020 onwards)

20PIM4A

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - IV

Core – XII

Credits - 4

Hours - 6

Unit I: Mendelian inheritance (Monohybrid and Dihybrid cross – Laws of Mendel) Back cross and test cross. Non - mendelian inheritance– gene interactions (Epistasis, Complementary factor, supplementary factor, Duplicate factors) Polygenic inheritance. Lethal alleles, Penetrance and expressivity.

Unit II : Linkage and crossing over, sex linked inheritance, chromosome mapping, mapping using somatic cell hybrids and molecular markers Sex determination in plants, Multiple alleles, pseudo alleles. Extra nuclear inheritance, Mitochondrial genome – Yeast , chloroplast genome – *Antirrhinum* , Male sterility in corn.

Unit III : Microbial genetics – Transformation, Conjugation, Transduction and sexduction, Biochemical genetics – Beadle and Tatum experiment in *Neurospora*. Population Genetics – Hardy-Weinberg Law and applications- gene pool, Genetic drift, Inbreeding, Founder effect, Genetic load and balanced polymorphism

Plant Breeding

Unit IV: Principles of plant breeding – Conventional methods of plant breeding-, Selection methods- Mass, pureline, clonal. Modern methods of breeding- Mutation, Polyploidy in plant breeding - Hybridisation methods – Heterosis or Hybrid vigour - Breeding for disease resistance – Back cross method - crop improvement through plant breeding – Rice, Cotton

Evolution

Unit V : Origin of Life- Chemosynthetic theory, Theories of Evolution- Darwin, Lamarck, Hugo de Vries - Molecular Evolution -Modern synthetic theory. Variation in Nature, Analysis of variation, Isolation mechanisms .Speciation- Allopatric and sympatric. Adaptive radiation.

Books for Study

- Arora, M.P. 2000. Organic Evolution, Himalaya Publishing House.
Chaudhari, H.K. 1983. Introduction to Principles of Plant Breeding, 2nd edition. Oxford & IBH Publishing Co. New Delhi.
David Friefelder, 1993. Microbial Genetics. Narosa Publishing House.
Freifelder, D. 1986. Essentials of Molecular Biology, Jones & Bartlett Publishers
Gardner, E.J. And Snustad, D.P. 1984. Principles of Genetics. Wiley, New York.
Sharma, A. 1990. The Chromosomes, Oxford and IBH. Delhi.
Strickberger, M.W. 2003. Genetics- 3rd edition, Prentice Hall India.

Books for reference

- Allard, R.W. 1960 . Principles of Plant Breeding. John Wiley & Sons Inc. New York
Cherayil, J.D. 1974. Gene and the Genetic code, Tata McGraw Hill, New Delhi.
Goodenough, U. 1984. Genetics, 3rd edition, Holt Saunders International Edition, Japan.
Rastogi, V.B. 2003. Organic Evolution, Kedar Nath Ram Nath, Meerut
Stansfield. 1996. Theory & Problems in Genetics. III Ed. Schaum's Series. McGraw & Hill.
Karp, G .1995. Cell and Molecular Biology, John Wiley and Sons, New York
Krebs, J.E., Goldstein, E.S. and Kilpatrick, S.T. 2017. Lewin's Genes XII Jones and Bartlett Learning, Burlington.

PLANT ECOLOGY, PHYTOGEOGRAPHY AND REMOTE SENSING
(Admitted from 2020 onwards)

20PIM4B

External Marks: 75 Internal Marks: 25 Total Marks: 100

Semester - IV Core – XIII Credits - 4 Hours - 6

Unit I- Plant Ecology

Basic Ecological principles: Definition of Environment and Ecology – components and characteristic features of ecosystem – homeostasis. Ecosystem: composition structure and function. Diversity of plant life – analytical and synthetic characters – growth form, life form – community classification diversity, dominance and similarity indices of plant communities. Population ecology: Population characteristics - Population density, structure, mortality, natality, Age and distribution. – r and k selection, Gause's exclusion principle.

Unit II

Flow of energy in Ecosystem, Major types of biomes; Terrestrial ecosystem – Forest biomes - Coniferous biomes - tropical rain forest biomes - deciduous forest biomes. Deserts biomes - Grass lands biomes - Tundra biomes. Aquatic ecosystem - Fresh water ecosystem – lentic – lotic – wetland, Marine ecosystem. Succession – Hydrosere and Xerosere. Plant adaptation. Biogeochemical cycles (CO₂, N₂, S and P).

Unit III

Biodiversity types – genetic and species diversity – loss of biodiversity. Conservation – *in situ* conservation (Afforestation, Social forestry and Agro forestry), *ex situ* conservation (Cryopreservation and Gene bank). Man and Biosphere (MAB), IBP, Endangered plants of India – IUCN category of endangered species.

Environmental pollution: Air, water, soil and noise pollution – effects and control measures.

Unit IV – Phytogeography

Phytogeography – Definition, principles, scopes of phytogeography. Phytogeographical regions of India, patterns of plant distribution – age and area hypothesis- continental drift. Endemism – Definition, characteristics, types, formation and Endemic plants, Ecotone and Edge effect.

Unit V - Remote sensing

Concept of remote sensing- Platforms for remote sensing- satellites, sensors and satellite data products- Application of remote sensing in Agriculture and forestry.

Books for Study

Barucha, F.R. A Text Book of Plant Geography. Oxford University. Press, New Delhi.
Misra K.C. 1989. Manual of Plant Ecology. Oxford IBH Publishing Co. Pvt. Ltd. New Delhi.
Misra, R. and Puri, G.S. 1954. Indian Manual of Plant Ecology. The English Book Depot, Dehradun.
Odum, E.P. Fundamentals of Ecology- W.B. Saunders Co., Philadelphia.

Remote sensing

Books for reference

Cain.S.A. 1944. Foundations of Plant geography, New York and London
Turrill,W.B. 1959.Plant Geography, In W.B. Turrill(ed.) Vistas in Botany. 171-229. Pergamon Press, London.
Crawley, M.J. Plant Ecology. Backwell Scientific Publication, Oxford
Kellman Methuen, M.C. Plant Geography.London
Rampal, K.K. Text Book of Photogrammetry. Oxford & IBH Publishing Co. New Delhi. India.

Major Paper –XI

Semester IV

PROJECT WORK

20PIM4C

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - IV

Core –XIV

Credits - 4

Hours - 5

(Individual project work to be done and submission of dissertation)

ELECTIVE

RESEARCH METHODOLOGY

(Admitted from 2020 onwards)

20PIE4A

External Marks: 75 Internal Marks: 25 Total Marks: 100

Semester - IV Elective – IV Credits - 4 Hours – 4

Unit I

Choosing the problem for research – Review of Literature – Primary, Secondary and Tertiary sources – Bibliographs – Indexing and Abstracting – Reporting the results of research in conference – Oral and Poster presentation.

Unit II

Planning and preparation of thesis – Research journals – National and International monographs – Reprints – Proof correction – Full paper – Short communication – Review paper.

Unit III

Microscopy- Bright field Principle and uses- Phase contrast, Dark field, Polarization, fluorescent, TEM,SEM. Preparation of specimens for microscopy. Micrometry, Camera lucida, Microphotography.

Unit IV

Spectroscopy- principles and applications- visible and UV , Infra-red spectrophotometer, Circular dichroism (CD) spectroscopy, spectrofluorimetry, Atomic, Flame spectrophotometry, Electron spin Resonance (ESR)and Nuclear Magnetic Resonance (NMR) spectrometry, Mass spectrometry, X-ray diffraction. Application of Radioisotopes in the field of Biology.

Unit V

Biostatistics – Scope – Collection – Tabulation and classification of data – Graphical diagrammatic representation – Mean, Median, Mode. Standard Deviation – Standard Error – Probability analysis - Test of significance – ‘t’-test – Chi-square test – ANOVA Table – Correlation and its types.

BOOKS FOR STUDY

Gurumani, N. 2006. Research Methodology for Biological sciences. MJP

Rastogi,S.C. 2002 Elements of Immunology, CBS. Publishers.

Wilson, K. and Walker, J. 2006. Principles and Techniques of Biochemistry and Molecular Biology Cambridge Low Price Edition, Cambridge University Press.

ELECTIVE – IV
TECHNIQUES IN BIOLOGY
20PIE4A

Maximum Mark -100
External Marks -75
Internal Marks -25

Total Hours -64
Hours /Week -4
Credits -3

Techniques in Biology

Unit I

Microscopy – principle, construction, working and applications of Bright field, Phase contrast, Dark field, Fluorescence, TEM, SEM. Micrometry-Camera lucida. Tissue preparation in light and electron Microscopy, Microtomy- fixatives, dehydration, infiltration, preparation of paraffin block, Microtomes- types, Staining – single and double.

Unit II

Chromatography- Principle and applications- paper-Column-Affinity-TLC-GLC-HPLC. Electrophoresis-SDS-PAGE- Agarose- Blotting-Northern-Southern-In situ hybridization-FISH- Immunotechniques-ELISA.

Unit III Colorimetry-Beer-Lambert law, single and double beam photo colorimeter - spectrophotometry- Principles-working-applications.

Unit IV Centrifuges-ultra centrifuge- density gradient- principle- application- Radio active techniques – radioisotopes-alpha, beta, gamma rays- half life principle and working of scintillation counters-Applications of radio-isotopes-medicine–biology. Autoradiography

Biometry

Unit V

Sampling methods, Measures of Central tendency – Mean- Median and Mode - Graphical representation of data – Histogram - frequency curve- Standard deviation and applications standard error. Chi-square test ,t-test and applications.

Books for Study

Bajpai,P.K. 2008. Biological Instrumentation and Methodology,S.Chand &Company Ltd. New Delhi.

Bailey,N.J.1965. Statistical Methods in Biology, The English Lang. Book. Soc. & The Eng. Univ. Press Ltd.

Khan, J.D and Khanum, A. 1994. Fundamentals of Biostatistics. Ukaaz Publications, Hyderabad.

Palanichamy. S., M. Manoharan & Ramakrishnan P. (1995). Statistical methods for Biologists Palani Paramount Publications, Palani, Tamilnadu.

Marimuthu, R. 2008. Microscopy and Microtechnique. MJP Publishers,Chennai.

Bailey,N.J.1965. Statistical Methods in Biology, The English Lang. Book. Soc. & The Eng. Univ. Press Ltd.

Books for Reference

Plummer D.T. 2003.An introduction to practical Biochemistry. 3rd Edn. Tata McGraw Hill Publishing Company Ltd. New Delhi

Williams, B. L. and Wilson, K. 1983. A Biologist's Guide to Principles Techniques of Practical Biochemistry. Edward Arnold, London.

Zar, J.K. 1984. Biostatistical analysis, Prentice-Hall International, INC, Engleword chiffs, New Jersey.

ELECTIVE – V
APPLIED MICROBIOLOGY
(Admitted from 2020 onwards)

20PIE4B

External Marks: 75 Internal Marks: 25 Total Marks: 100

Semester - IV Credits - 3 Hours - 5

Unit I - General Microbiology

History of Microbiology, Diversity and classification of Microorganisms (R.H. Whittaker, 1969), Bacteria – Outline Classification (Bergey's Manual of Determinative Bacteriology), Actinomycetes – Reproduction, Viruses - structure and multiplication, Viroids, Prions, PPLO and Bacteriophages.

Unit II

Methods of sterilization. Components and types of culture media. Methods of isolating microbes Gram staining, Strain improvement, Culture types, collection. Preservation and Maintenance of cultures.

Unit III – Food Microbiology

Microbiology of Food - Composition of Milk, Dairy Products; Cheese and Yoghurt. Food spoilage (Milk, Fruits and vegetable, canned foods). Preservation Methods, Microbial examination of food and milk, Food poisoning - control measures.

Unit IV – Soil and Agricultural Microbiology

Soil as consortium of microbes. Nutrient cycles – Carbon, Sulphur and Nitrogen. Biofertilizers - Preparation and application of *Rhizobium* and Mycorrhiza. Biopesticides - *Bacillus thuringiensis* and *Verticillium lecanii*.

Unit V - Industrial Microbiology

Introduction to industrial microbiology – suitability of microbes in industrial processes and their source, Fermentation types. Designing of industrial fermenters- fermenter types. Production of alcohol, lactic acid, Vinegar, Penicillins. Immobilization techniques, Bioremediation, Biodegradation and Xenobiotic compounds.

Books for study

Tortora, B. Funke and C. Case, 1995. Microbiology: An Introduction 5th edition, Menlo Park CA: Benjamin Cummings.

Dubey, R.C. and Maheswari, D.K. 2009. A Text Book of Microbiology S. Chand and Company Ltd., New Delhi.

Kumar, H.D. and Rai, L.C., 1986. Microbes and Microbial processes. Affiliated East west Press Ltd. New Delhi.

Dubey, R. C. 2005. A Text Book of Biotechnology 4th edition. S. Chand and Co. New Delhi.

Pelczar, Reid and Chan, Microbiology. Tata McGraw Hill publication Ltd. New Delhi.

Books for reference

Ingraham J. and Ingraham, C. 1995 Introduction to Microbiology. Belmont, CA: Wadsworth.

Prescott, L.M. and Dunn. Industrial Microbiology. G. Reed (Eds.) CBS Publishers, New Delhi.

Agarwal, 2006. Industrial Microbiology: Fundamentals and Applications, M/S., IBD, Publishers and Distributors, New Delhi.

Glazer, A.N. and Nikaido, H. 1995. Microbial Biotechnology. Fundamentals of Applied Microbiology W.H. Freeman, New York.

ELECTIVE - V
BIOPHYSICS, BIOINFORMATICS AND NANOTECHNOLOGY
(Admitted from 2020 onwards)

20PIE4B

External Marks: 75 Internal Marks: 25 Total Marks: 100

Semester - III Elective –V Credits - 3 Hours – 3

Biophysics

Unit I

Bioenergetics – Laws of thermodynamics- enthalpy –entropy – free energy –exergonic and endergonic reactions – redox potential – structure and hydrolysis of ATP - high energy compounds - Principles of biophysical chemistry (pH, buffer, colligative properties) – Bioluminescence.

Bioinformatics

Unit III

Introduction , Branches of bioinformatics, Aims, Scope and research areas of Bioinformatics. Databases – Introduction, biological databases, Classification of biological databases. Biological database retrieval system. NCBI-Tools and database of NCBI, BLAST, FASTA, Nucleotide database, Protein Database, Gene Expression database,. EMBL, DDBJ, PIR.

Unit IV

Sequence Alignment - Introduction, concept of alignment, Multiple sequence Alignment (MSA), MSA by CLUSTAL W, Methods of phylogeny, software for phylogenetic Analysis, Structural Bioinformatics in drug discovery, drug design. Microbial genome application crop improvement.

Nanotechnology

Unit IV

Nanotechnology –Introduction- Nanomaterials and Nanoparticles - Nano shells – Nanopores, Nanofibres, Nanotubes - Nanowire, Nanocrystals, Nanoscale devices - Carbon nano tubes – applications - Quantum dots - Nanorobots for medical application DNA- protein nanostructures.

Unit V

Biosensors- Nanosensors, Enzyme, protein, nucleic acids based devices - Bar code with DNA & RNA – Nano medicine- Targetted drug delivery using Nano particles - Molecular therapeutics- social implications and Nano biotechnology- Green Nano biotechnology – Nano navigation – Nano fabrication.

Books for study

VasanthaPattabhi and Gautam _Biophysics- Narosa Publishing House

Murthy, C.S.V. 2003.Bioinformatics. (Ist edition. Tata McGraw Hill,

C.M. Niemeyer and Mirkin,C.A., Nanobiotechnology, Concepts, Applications and perspectives Wiley – VCH; VerlagGmbH&Co., 2004.

Eric Drexler, K. Nanosystems – molecular, Machinery, Manufacturing and computation.

Jean- Michel Claverie and Cedric Notredame, 2006. Bioinformatics – A Beginners Guide. Wiley Publishing Ltd.

BOOKS FOR REFERENCE

Claudio Nicolini, Nanotechnology Nanosciences – PonstansfordPub.pvt.Ltd, 2009

Robert,A., Freitas Jr. Nanomedicine, Volume I : Basic capabilities Landes Bioscience 1999.

Lesk, A.M. 2006. Introduction to Bioinformatics, (2nd Edition) Oxford University Press, New Delhi.

Jean- Michel Claverie and Cedric Notredame, 2006. Bioinformatics – A Beginners Guide. Wiley Publishing Ltd

PRACTICAL IV

**Genetics, Plant Breeding, Evolution, Plant Ecology, Phytogeography and Remote Sensing,
(Admitted from 2020 onwards)**

20PIM41

External Marks: 60

Internal Marks: 40

Total Marks: 100

Semester - IV

Core Practical –IV

Credits - 4

Hours - 9

Genetics

Genetics problems based on the theory

Chromosome mapping

Plant breeding

Spotters taken from the standard text books.

1. Hybridization – Emasculation
2. Bagging.

Evolution

Photographs related to theories of evolution and Evolutionist.

Plant ecology, Phytogeography and Remote sensing

1. Study of morphological, anatomical structure of different plant groups- Hydrophytes, Xerophytes, Halophytes, Mesophytes and Epiphytes.
2. Determination of air temperature at different time intervals in a day.
3. Construction of species area curve using quadrat method.
4. Determination of quantitative characters by belt transect method.
5. Determination of soil moisture content by oven drying method.
6. Determination of water holding capacity
7. Determination of pH of the soil and water using a pH meter.
8. Mapping of world vegetation and Indian vegetation
9. One day field trip to study natural vegetation/flora.
10. Estimation of above ground and below ground biomass in grazing land.
11. Remote sensing – Analysing and interpretation of Satellite photographs-
I) Vegetation, II) Eastern and Western ghats of india, III) The Chennai city, IV) Phytoplankton.

SEMESTER - I
EDC - M.SC – CHEMISTRY
HORTICULTURE

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - I Elective –I Credits - 3 Hours – 3

UNIT I

Importance and History of Gardening - Garden implements -, Indoor plants and Outdoor plants- Flower arrangement-massing and Ikebana- Fruit and Vegetable carving.

UNIT II

Nursery structures- Green house, Shade house, Mist chamber- topiary- Bonsai culture. Floriculture- Rose, *Chrysanthemum*, Jasmine- cultivation. Hydroponics.

UNIT III

Types of pots and containers, Potting media –components and types. Propagation, seed and vegetative- cutting, layering and grafting-

UNIT IV

Gardening- Types of gardens - formal garden- vegetable garden- orchard- terrace garden- water garden - formation and maintenance of lawns.

UNIT V

Manures- microbial inoculants- composting- vermicomposting - fertilizers and their application - Role of phytohormones in horticulture and irrigation.

Books for study

Manibushan Rao, K. 1995. Text book Horticulture Macmillan India Ltd.

Anthony Youdeowei, Ezedinma F.O.C., and Ochapa C. Onazi, 1986. Introduction to Tropical Agriculture (edited). English Language Book Society (ELBS). Longman.

George Acquah, 2002. Horticulture Principles and Practices. 2nd edition. Pearson Education (Singapore) Pvt. Ltd.,

Lateeq Futehally, 1997. Gardens. 3rd edition. National Book Trust. India.

Randhawa, G.S. and Amitabh Mukhopadhyay, 1986. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi.

Books for Reference

Edmund, Senn and Andrews, 1981. Fundamentals of Horticulture. Tata McGraw Hill Publishing Company Ltd., New Delhi.

Percy Lancaster, 1979. Gardening in India. Mohan Makhijani and Rekha Printers, New Delhi.

SEMESTER - II
EDC - M.SC – CHEMISTRY

HERBAL BOTANY

External Marks: 75 Internal Marks: 25 Total Marks: 100

Semester - II Elective –I Credits - 3 Hours – 3

UNIT I

Indigenous systems of Medicine-Siddha-Ayurveda-Unani and Homeopathy, Importance of herbal products and formulations in traditional medicine.

UNIT II

Herbal gardening – Gardens in the Hills and plains – Ethnomedicine - House gardens; plants for gardening – processing of plant products –powders – drying –powdering –preparing decoctions.

UNIT III

Herbs in Cosmetology – Cucumber – *Aloe vera* –Lemon –fenugreek- Turmeric – Sandal wood.

UNIT IV

Herbs as pharmaceuticals - Plant parts used as drugs - root drugs – reserpine – Ginseng – Stem – Curcuma -Leaves – Adhathoda – Coleus – Neem - Whole plant – Tulsi – Fruit - Myristica – Terminalia.

UNIT V

Herbs as Nutraceuticals –plant parts used as nutraceuticals -roots – Nannari - leaves -Vallarai – Fruit - Amla – Dates – Seeds- Almonds – Pistachio.

Books for Study

John Jothi Prakash, E. 2003. Medicinal Botany and Pharmacognosy. JPR Publication, Vallioor, Tirunelveli.

Kumar,NC 1993. An Introduction to Medical Botany and Pharmacognosy

Prajapathi, Purohit, Sharma and Kumar. 2003. A Hand book of Medicinal plants. Agrobios Publications, Jodhpur.

Srivastava A.K., 2006 Medicinal Plants, International Book, Distributors, Dehradun.

Books for Reference

Kanny, Lall, Dey and Raj Bahadur, (1984). The indigenous drugs of India, International Book Distributors.

Mohammed Ali, (2008–Vol-1). Pharmacognosyby CBS Publishers and Distributors

Sivarajan V.V and Balachandran Indra (1994). Ayurvedic drugs and their plant source. Oxford IBH Publishing Co.

Wallis,T.E (2005) Text Book of Pharmacognosy by CBS Pub. Delhi.