

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

B.SC. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

**CHOICE BASED CREDIT SYSTEM (CBCS).
(Effective from the academic year 2020– 2021)**

**REGULATIONS
(2020-2021)**

1. ELIGIBILITY FOR ADMISSION:

Candidates for admission to the first year of the Degree of Bachelor of Science courses shall be required to have passed the Higher Secondary Examinations (Academic or Vocational Stream) conducted by the Government of Tamil Nadu or an Examination accepted as equivalent thereof by the Syndicate of the University of Madras. Provided that candidates for admission into the specific main subject of study shall be Possess such other qualifying conditions as may be prescribed by the University as given in the **APPENDIX-A**.

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 three academic years, passed the examinations all the Six-Semesters prescribed earning 140 Credits (in Parts-I, II, III, IV & V).

3. DURATION:

- a) Each academic year shall be divided into two semesters. The first academic year shall comprise the first and second semesters, the second academic year the third and fourth semesters and the third academic year the fifth and sixth semester respectively.
- b) The odd semesters shall consist of the period from June to November of each year and the even semesters from December to April of each year. There shall be not less than 90 working days for each semester.

4. COURSE OF STUDY:

The main Subject of Study for Bachelor Degree Courses shall consist of the following and shall be in accordance with **APPENDIX-B**

PART – I TAMIL / OTHER LANGUAGES

PART – II ENGLISH

PART – III CORE SUBJECTS
ALLIED SUBJECTS AND ELECTIVES

PART – IV

- 1.(a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two course (level will be at 6th Standard).
 - (b) Those who have studies Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Advanced Tamil comprising of two courses.
 - (c) Others who do not come under a + b can choose non-major elective comprising of two courses.
2. SKILL BASED SUBJECTS (ELECTIVE) - (SOFT SKILLS)
 3. ENVIRONMENTAL STUDIES
 4. VALUE EDUCATION

PART – V EXTENSION ACTIVITIES

5. EXTENTION ACTIVITIES:

A candidate shall be awarded a maximum of 1 Credits for Complusory Extension Service.

All the Students shall have to enrol for NSS /NCC/ NSO (Sports & Games) Rotract/ Youth Red cross or any other service organizations in the college and shall have to put in Complusory minimum attendance of 40 hours which shall be duly certified by the Principal of the college before 31st March in a year. If a student LACKS 40 HOURS ATTENDANCE in the First year, he/she shall have to compensate the same during the subsequent years.

Students those who complete minimum attendance of 40 hours in One year will get HALF A CREDIT and those who complete the attendance of 80 or more hours in Two Years will ONE CREDIT.

Literacy and population Education Field Work shall be compulsory components in the above extension service activities.

6. SCHEME OF EXAMINATION:

Scheme of Examination shall be given in **APPENDIX - C**
Model Scheme

Course Component Name of the course	Inst. Hour	Credits	Exam Hours	Max. Marks		
				Ext.mark	Int. mark	Total
PART-I Language				75	25	100
PART-II English				75	25	100
PART-III Core subject :				75	25	100
Core Subject				75	25	100
Allied Subject				75	25	100
PART – IV 1.(a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two course (level will be at 6 th Standard). (b) Those who have studies Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Advanced Tamil comprising of two courses. (c) Others who do not come under a + b can choose non-major elective comprising of two courses.						
2*Skill based subjects(Elective) – (Soft Skill)						

The following procedure be be followed for Internal Marks:

Theory Papers: Internal Marks 25

INTERNAL MARKS

Tests (2 out of 3) = 10

Attendance = 5

Seminars = 5

Assignments = 5

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 Test best 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

7. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER:

- i. Candidates shall register their names for the First Semester Examination after the admission in UG Courses.
- ii. Candidates shall be permitted to proceed from the First Semester up to 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 subject of earlier semesters along the current (subsequent) Semester Subjects.
- iii. Candidates shall be eligible to go to subsequent semester, only if they earn, sufficient attendance as prescribed therefor by the Syndicate from time to time.

Provided in case of a candidate earning less than 50% of attendance in any one of the Semesters due to any extraordinary circumstances such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorised 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 Candidates 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.

8. PASSING MINIMUM:

A candidate shall be declared to have passed:

- a) There shall be no Passing Minimum for Internal.
- b) For External Examination, Passing Minimum shall be of 40%(Forty Percentage) of the maximum marks prescribed for the paper for each Paper/Practical/Project and Viva-voce.
- c) In the aggregate (External + Internal) the passing minimum shall be of 40% .

- d) He/She shall be declared to have passed the whole examination, if he/she passes in all the papers and practicals wherever prescribed / as per the scheme of examinations by earning 140 CREDITS in Parts-I, II, III, IV & V. He/she shall also fulfill the extension activities prescribed earning a minimum of 1 Credit to qualify for the Degree.

9. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

PART- I TAMIL / OTHER LANGUAGES

TAMIL/OTHER LANGUAGES: Successful candidates passing the Examinations for the Language and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD Class.

PART – II ENGLISH

ENGLISH: Successful candidates passing the examinations for English and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND Class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD class.

PART – III consisting of CORE SUBJECTS, ALLIED SUBJECTS, PROJECT / ELECTIVE with three courses:

Successful candidates passing the examinations for Core Courses together and securing the marks (i) 60 percent and above (ii) 50 percent and above but below 60 percent in the aggregate of the marks prescribed for the Core courses together shall be declared to have passed the examination in the FIRST and SECOND Class respectively. All other successful candidates shall be declared to have passed the examinations in the Third Class.

PART – IV (consisting of sub items 1 (a), (b) & (c), 2, 3 and 4) as furnished in the Regulations 4 Part-IV supra.

PART – V EXTENSION ACTIVITIES:

Successful Candidate earning of 1 credit SHALL NOT BE taken into consideration for Classification/Ranking/ Distinction.

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. 7 (iii) supra are only eligible for classification.

11. 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 TWO 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.

Question Paper Pattern

10 out of 12	-	SECTION – A (30 words) 10 X 2 marks = 20 marks
5 out of 7	-	SECTION – B (200 words) 5 x 5 marks = 25 marks
3 out of 5	-	SECTION – C (500 words) 3x 10 marks = 30 marks

		TOTAL = 75 marks

QUESTION PAPER FOR PRACTICALS

The external examiner will prepare a question paper on the spot with the help of the Question Bank supplied by the Controller's office.

APPENDIX – A

ADDITIONAL ELIGIBILITY CONDITIONS FOR ADMISSION TO THE FOLLOWING COURSES

(1) CANDIDATES FOR ADMISSION TO THE FOLLOWING COURSES SHALL HAVE PASSED THE QUALIFYING EXAMINATION WITH THE SUBJECTS NOTED AGAINST EACH:

- (i) BOTANY OR PLANT BIOLOGY
AND PLANT BIOTECHNOLOGY : ANY SCIENCE GROUP
WITH BOTANY/ BIOLOGY

APPENDIX - B

COURSE OF STUDY

The Course of Study shall comprise the study of Part-I to Part-V Courses; .

PART - I TAMIL/OTHER LANGUAGES comprise the study of:

Tamil or any one of the following Modern (Indian or Foreign) or classical languages at the optional candidate, according to the syllabi and text-books prescribed from time to time.

- (i) Modern (Indian) - Telugu, Kannada, Malayalam, Urdu & Hindi.
(ii) Foreign - Chinese, French, German, Italian, Japanese,
& Russian

PART – II ENGLISH according to the syllabi and text-books prescribed from time to time.

PART – III CORE COURSES Comprise the study of (A) Main Subjects; (B) Allied Subjects; (C) Electives :

(A) MAIN SUBJECTS:

Each candidate shall choose any one of the following Main Subjects [core courses] under the FACULTY OF SCIENCE:

01. B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Syllabi for Allied subjects in Statistics for BSc degrees

(B) ALLIED SUBJECTS: ZOOLOGY AND CHEMISTRY

Each candidate shall choose the Allied subjects prescribed in the Scheme of Examinations.

(C) ELECTIVES with Three Courses

PART – IV

- 1.(a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two course (level will be at 6th Standard).
- (b) Those who have studies Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Advanced Tamil comprising of two courses.
- (c) Others who do not come under a + b can choose non-major elective comprising of two courses.

2. SKILL BASED SUBJECTS (ELECTIVE) - (SOFT SKILLS)

3. ENVIRONMENTAL STUDIES

4. VALUE EDUCATION

PART – V EXTENSION ACTIVITIES

SEM	SUBJECT CODE	COURSE TITLE	Ins. Hours	CRE DITS	MARKS		
					CA	SE	TOTAL
I		GENERAL LANGUAGE – I	6	3	25	75	100
		FOUNDATION ENGLISH – I	4	3	25	75	100
		PHYCOLOGY	5	4	25	75	100
		PRACTICAL – I	2	-	-	-	-
		ALLIED ZOOLOGY I	6	4	25	75	100
		ALLIED ZOOLOGY PRACTICAL	3	-	-	-	-
		MATERIAL CHEMISTRY - I	2	2	25	75	100
		SOFT SKILLS I	2	3	40	60	100
		TOTAL	30	19	205	495	600
II		GENERAL LANGUAGE – II	6	3	25	75	100
		FOUNDATION ENGLISH – II	4	3	25	75	100
		VIROLOGY, BACTERIOLOGY MYCOLOGY AND LICHENOLOGY	5	4	25	75	100
		PRACTICAL – I	2	4	40	60	100
		ALLIED ZOOLOGY II	6	4	25	75	100
		ALLIED ZOOLOGY PRACTICAL	3	2	40	60	100
		MATERIAL CHEMISTRY - II	2	2	25	75	100
		SOFT SKILLS II	2	3	40	60	100
		TOTAL	30	25	205	495	700
III		GENERAL LANGUAGE – III	6	3	25	75	100
		FOUNDATION ENGLISH – III	4	3	25	75	100
		BRYOPHYTES AND PTERIDOPHYTES	5	4	25	75	100
		PRACTICAL – II	2	-	-	-	-
		ALLIED CHEMISTRY I	6	4	25	75	100
		ALLIED CHEMISTRY PRACTICAL	3	-	-	-	-
		ENVIRONMENTAL STUDIES	2	-	-	-	-
		SOFT SKILLS III	2	3	40	60	100
		TOTAL	30	17	140	360	500
IV		GENERAL LANGUAGE – IV	6	3	25	75	100
		FOUNDATION ENGLISH – IV	4	3	25	75	100
		GYMNOSPERMS AND PALEOBOTANY	5	4	25	75	100
		PRACTICAL – II	2	4	40	60	100
		ALLIED CHEMISTRY II	6	4	25	75	100
		ALLIED CHEMISTRY PRACTICAL	3	2	40	60	100
		ENVIRONMENTAL STUDIES	2	2	25	75	100
		SOFT SKILLS IV	2	3	40	60	100
		TOTAL	30	25	245	555	800

SEM	SUBJECT CODE	COURSE TITLE	Ins. Hours	CRE DITS	MARKS		
					CA	SE	TOTAL
V		PLANT MORPHOLOGY AND TAXONOMY	5	4	25	75	100
		PLANT ANATOMY AND EMBRYOLOGY	4	4	25	75	100
		PLANT ECOLOGY AND PHYTOGEOGRAPHY	4	4	25	75	100
		CELL BIOLOGY AND MOLECULAR BIOLOGY	4	4	25	75	100
		PRACTICALS -III	8	4	40	60	100
		HORTICULTURE / ORGANIC FARMING	3	5	25	75	100
		VALUE EDUCATION	2	2	25	75	100
		TOTAL		27	190	510	700
VI		GENETICS, PLANT BREEDING, EVOLUTION AND BIOSTATISTICS	6	4	25	75	100
		PANT PHYSIOLOGY AND PLANT BIOCHEMISTRY	6	4	25	75	100
		ECONOMIC BOTANY	4	4	25	75	100
		PRACTICAL- IV	6	4	40	60	100
		APPLIED PLANT BIOTECHNOLOGY / PLANT BIOTECHNOLOGY	4	5	25	75	100
		PLANT PATHOLOGY / MICROBIOLOGY	4	5	25	75	100
		EXTENSION ACTIVITIES	-	1	-	-	-
		TOTAL	30	27	165	435	600
GRAND TOTAL							

CHOICE BASED CREDIT SYSTEM
(2020 Onwards)
SEMESTER – I

PHYCOLOGY
(2020 Onwards)
Subject Code : 20UIM1A

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

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

UNIT 1

General characters and Classification of Algae – F.E.Fritsch (1945). Distribution and Ecology of Algae.

UNIT 2

General account of thallus structure, pigmentation, plastids , reserve food materials, flagellation, reproduction and life cycle of Cyanophyceae, Chlorophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae.

UNIT 3

Detailed study of structure, reproduction and life cycles of the following forms of Cyanophyceae, Chlorophyceae and Bacillariophyceae (No developmental studies)

Cyanophyceae – *Oscillatoria* and *Nostoc*.

Chlorophyceae – *Chlorella* (unicellular), *Scenedesmus* (colonial), *Coleochaete* (heterotrichous) and *Caulerpa* (thalloid).

Bacillariophyceae – *Navicula*

UNIT 4

Detailed study of structure, reproduction and life cycles of the following forms of Phaeophyceae and Rhodophyceae. (No developmental studies)

Phaeophyceae – *Sargassum*

Rhodophyceae – *Gracilaria*

UNIT 5

Economic importance of Algae – Algae as food (SCP), fodder, bio-fertilizer, Seaweed Liquid extract (SLF), oxidation ponds and medicines. Industrial uses of Algae (alginates, agar and diatomaceous earth and Biofuel).

PRACTICAL : 4 hours

A detailed study of the genera included in the theory.

BOOKS

1. Bilgrami K.S. and Saha L.C. – A text book of Algae – CBS publishers and distributors 1992
2. Bold. HC and Wyne.M.J. 1978, - Introduction to the Algae, Printice Hall of India.
3. Chapman. V.J. and Caphman.D.J. 1973 – The Algae (2nd Edition) Macmillan.
4. Fritsch. F.E. 1935 and 1945 - Structure and Reproduction of Algae Vol.1 and 2 – Cambridge Univ. Press.
5. Kumar. H.D. and Singh. H.N. 1976 – A text book of Algae, Affiliated East West Press Pvt. Ltd.
6. Smith.G.M., 1955 – Cryptogamic Botany Vol.-I, McGraw Hill.
7. Trainor.F.A. 1978 – Introductory phycology, John Wiley.
8. Vashishta. B.R., 1970 – Text book of Botany – Algae, S.Chand.
9. Venkatesvaralu.V. – Text book of algae, Maruthi Publishers.

Non Major Elective (NME)

MEDICINAL BOTANY

Subject Code : 20UIN1A

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

Semester - I MNE –I Credits - 2 Hours - 2

UNIT I

Introduction and importance of Indigenous systems of Medicine –Principles of Ayurveda - Siddha and Homeopathy.

UNIT II

Medicinal gardening – plants for gardening. Poisonous plants e.g. *Nerium oleandar*, *Strychnos nux – vomica* - Toxicity, action and treatment.

UNIT III

Adulteration of drugs and its detection – methods of adulteration- Medicinal uses of Non-flowering plants.

UNIT IV

Botanical description and medicinal value of drugs - Root –*Rauwolfia serpentina*, Rhizome –*Zingiber officinale*, Wood- *Santalum album* and Bark –*Terminalia arjuna*

UNIT V

Botanical description and medicinal value of drugs - Leaves- *Centella asiatica*, flower – *Cassia auriculata*, fruit – *Phyllanthus emblica*, seed – *Mucuna pruriens*, Entire plants-*Catheranthus roseus*.

Books for Study

Gokhale, SB., Kokate, CK. and Purohit, AP 1995. Pharmacognosy. Nirali Prakashan, Pune
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 BookDistributors.
Kirthikar and Basu.(2012) Indian Medicinal Plants
Mohammed Ali, (2008–Vol-1). Pharmacognosyby CBS Publishers and Distributors**28**
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.

SEMESTER-II

PAPER – II :
VIROLOGY , BACTERIOLOGY, MYCOLOGY AND LICHENOLOGY
(Admitted from 2020 onwards)
Subject Code : 20UIM2A

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

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

UNIT- 1

Plant Viruses – Salient features, structure, general classification, replication, mode of transmission and disease causative organism, symptoms and control measures of TMV, Rice tungovirus.

UNIT- 2

Bacteria – Ultrastructure, Shape, Flagellation, nutrition, respiration, reproduction, and their economic importance.

UNIT - 3

Fungi – Classification of fungi (Alexopolous and Mims, 1969). Characteristic features, Vegetative structure, Reproduction– Asexual and Sexual reproduction. Economic importance – Food, Medicine, Biopesticides, Biofertilizers.

UNIT- 4

A detailed study of the structure and reproduction in the following genera :-
Oomycota - *Albugo*, Ascomycota - *Yeast*, *Peziza*, Basidiomycota - *Puccinia*, Deuteromycota – *Fusarium*, *Cercospora*, *Aspergillus*.

UNIT- 5

Lichens – Occurrence, structure and reproduction of Lichen- Structure and reproduction of *Usnea* (No developmental studies). Economic importance of Lichens.

PRACTICAL : I

A detailed study of following genera mentioned in the theory :

Fungi : *Albugo*, *Yeast*, *Peziza*, *Aspergillus*, *Cercospora*, *Puccinia* and *Fusarium*.

Bacteria : Grams staining – Demonstration only

Lichens – A general study of Fruticose type Lichen (*Usnea*).

Virus : Infected plant material.

BOOKS:

1. Webster. J., 1970 – Introduction to Fungi, Cambridge University Press.
2. Biswas. S.B. and Biswas. A, 1976 – An Introduction to Viruses, Vikas Publising House Pvt. Ltd.
3. Misra. A.S. and Agarwal. R. P., 1978 – Lichens: A Preliminary Text, Oxford and IBH Publishing Co.
4. Hawker. I.E., 1966 – Fungi, Hutchinson University Library.

5. Salle. A.J., 1974 – Fundamendal Principles of Bacteriology, Tata McGraw Will.
6. Alexopoulos. G.J., 1962- Introductory Mycology, John Wiley.
7. Vashista. B.R., 1969 – Botany (for degree studes) Part-II Fungi, S. Chand &Co.
8. Dube. H.C., 1978 – A text book of Fungi, Bacteria and Viruses, Vikas Publising House Pvt. Ltd.
9. Pandey. B.P., 2008- A text book of Botany – The Fungi, S. Chand &Co.
10. Sharma. O.P. 2005-Text book of Fungi, McGraw Hill.Comp.

Non Major Elective (NME)

MUSHROOM CULTIVATION (Admitted from 2020 onwards) Subject Code : 20UIN2A

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

Semester - II NME –I Credits - 2 Hours - 2

UNIT I :

Introduction: Morphology, Types of Mushroom, identification of edible and poisonous mushroom, Nutritive values, life cycle of common edible mushrooms.

UNIT II:

Mushroom cultivation, prospects and scope of mushroom cultivation in small scale Industry.

Unit III:

Life cycle of Pleurotus, Agaricus .

UNIT IV :

Spawn production, growth media, spawn running and harvesting of mushrooms.

UNIT V:

Diseases and post harvest technology. Insect, pests, nematodes, mites, viruses, fungal competitors and other important diseases and Control measures.

Books for Study

1. Handbook of Mushroom Cultivation, 1999, TNAU publication.
2. Nita Bahl, 2002, Handbook on Mushroom 4th edition vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.
3. Suman, 2005, Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.
4. Sing, 2005, Modern Mushroom Cultivation, International Book Distributors, Dehradun.

Books for Reference

1. Bahl, N., Handbook on Mushroom, Oxford and IBM, New Delhi.
2. Dey S.C., Mushroom growing, Agrobios (India), Jodhpur.
3. Handbook of Edible Mushroom Today and Tomorrows printers and publishers.
4. Kapoor J.N., Mushroom cultivation, Krishi Bhavan, New Delhi.
5. Manibushan Rao, K., Text Book of Horticulure, Mac Millan India Ltd.,
6. Parthiban, Malathi and Bala Mohan, Mushroom culture (Tamil).

7. Pathak, V.N., Yadav N. and Gaur, M., Mushroom production and processing Technology Agrobios (India), Jodhpur.
8. Sharma, O.P., Textbook of Fungi, Tata McGrawHill Publishing Co., New Delhi.
9. Sharma V.P., 2006, Diseases and Pests of Mushrooms, M/s. IBD Publishers and Distributors, New Delhi.

I YEAR- II SEMESTER

PAPER- III - PRACTICAL- I . (20UIM21)

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

Semester - II Core –III Credits - 4 Hours - 2

(COVERING THEORY PAPERS(PAPERS I and II) IN II SEMESTER)

I YEAR- II SEMESTER

ALLIED PAPER- III – ALLIED PRACTICAL- I . (20UIA21)

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

Semester - VI Allied Practical Paper –I Credits - 2 Hours - 2

(COVERING THEORY PAPERS(PAPERS I and II) IN II SEMESTER)

SEMESTER - III
BRYOPHYTES AND PTERIDOPHYTES
(Admitted from 2020 onwards)

Subject Code : 20UIM3A

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

Semester - III Core –IV Credits - 4 Hours - 5

UNIT- I

General characters of Bryophytes, Classification (Watson 1967) and life cycle , origin and Evolution of Bryophytes. Economic importance of Bryophytes.

UNIT- II

General characters of Hepaticopsida, Anthocerotopsida and Bryopsida.

Detailed study of structure and reproduction of

- a) *Marchantia*
- b) *Anthoceros*
- c) *Polytrichum*

(No developmental studies)

UNIT- III

General characters, Classification of Pteridophytes (Reimer 1954), apogamy, apospory, homospory and heterospory. Economic importance of Pteridophytes.

UNIT- IV

Detailed study of morphology, anatomy, reproduction and life cycle of following genera:-

- a) *Lycopodium*, b) *Equisetum*, c) *Dicranopteris*, d) *Marsilea*,

(No developmental studies)

UNIT- V

Stelar evolution, Sporangial organization and origin and evolution in Pteridophytes.

Practical :

Detailed study of the genera included in the theory.

REFERENCE BOOKS

1. Eames.A, 1963 – Morphology of lower vascular plant, McGraw Hill
2. Forster and Gifford, 1959 – Comparative morphology of vascular plants.
3. Pandey B.R., 1977 – A text book of Botany, Pteridophytes and Gymnosperms, K. Nath & Meerut.
4. Parihar. N.S., 1967 – An introduction of Embryophyta, Vol.III – Pteridophyta, Central book depot, Allahabad.
5. Smith.G.M., 1955- Cryptogamic Botany, Volume-II– McGraw Hill
6. Sporne.K.L., 1976 – Morphology of Pteridophytes, 4th edition, B.I.Publication.
7. Vashista.P.C., 1971 – Botany for Degree students : Pteridophyta. S.Chand&Co.
8. Watson, E.V. The structure and Life of Bryophytes
9. Prem Puri. 1973. Bryophytes-A broad perspective, Atma Ram & Sons, New Delhi
10. Parihar, N.S. 1991. Bryophytes. Central Book Depot, Allahabad.
11. Parihar, N.S. 1996. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.

12. Puri, P. 1980. Bryophytes. Atma Ram & Sons, New Delhi.
- 13 Sporne, K.R. 1991. The Morphology of Pteridophytes. B.I. Publ. Pvt. Ltd.

SEMESTER – IV

GYMNOSPERMS AND PALEOBOTANY

(Admitted from 2020 onwards)

Subject Code : 20UIM4A

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - IV

Core –V

Credits - 4

Hours - 5

UNIT- I

General characters, distribution, morphology, structure and reproduction of Gymnosperms. Classification of Gymnosperms (Sporne 1954).

UNIT- II

Detailed study of morphology, structure and reproduction of *Cycas* , *Pinus* and *Gnetum* (No developmental studies). Economic importance of Gymnosperms.

UNIT- III :

Fossils – Kinds of fossils-impressions, compression, casts, mold and coal ball, Petrification and Amber. Dating of fossils- Radio carbon dating.

UNIT- IV

Geological time scale. Contributions of Birbal Sahni in paleobotany.

UNIT- V

Study of the following fossil form genera *Lepidodendron*, *Lepidocarpon*, *Calamites* and *Pentoxylon*.

PRACTICALS :

Morphology, anatomy and reproduction structure of *Cycas*, *Pinus* and *Gnetum*.

Fossil slides of *Lepidodendron*, *Lepidocarpon* and *Calamites*.

REFERNCE BOOKS :

1. Sporne. K.R., 1954- Morphology of Gymnosperms, Hutchinson University Library.
2. Gupta.M.N., 1972, - The Gymnosperms (2nd Edition) Shiva Lal Agarwala & Co., Agra.
3. Vashista, P. C .,1976, Gymnosperms, S.Chand & Co.
4. Sporne, K.R.1991. The Morphology of Gymnosperme. B.I. Publications, New Delhi.
5. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms, New Age Int. Pvt. Ltd., New Delhi
6. Stewart, W.N. and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press

II YEAR- IV SEMESTER

PAPER- VI - PRACTICAL- II . (20UIM41)

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

Semester - II Core –VI Credits - 4 Hours - 2

(COVERING THEORY PAPERS(PAPERS VI and V) IN IV SEMESTER)

SEMESTER – V

PLANT MORPHOLOGY AND TAXONOMY

(Admitted from 2020 onwards)

Subject Code : 20UIM5A

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - V

Core –VII

Credits - 4

Hours - 5

UNIT – I

Morphology – root system – modifications. Shoot system – modifications – (Aerial, sub-aerial and underground). Leaf-simple and compound- phyllotaxy, modifications, (phyllode, pitcher) tendrils, stipules. Inflorescences – definition and types – racemose, cymose, mixed and special types. Fruits - Classification.

UNIT -II

Taxonomy and its importance, herbarium techniques. Concept of a taxon – genus and species. Citation of authors, Binomial nomenclature and ICBN, Numerical taxonomy and chemotaxonomy. BSI.

UNIT – III

Systems of plant classification – Artificial (Linnaeus), Natural (Bentham & Hooker), Modern and Phylogenetic (Cronquist) – merits and demerits. APG.

UNIT – IV

Detailed study of the range of characters and economic importance of the following families: Capparidaceae, Annonaceae, Caesalpiniaceae, Myrtaceae, Cucurbitaceae.

UNIT – V

Detailed study of the range of characters and economic importance of the following families; Asteraceae, Apocynaceae, Verbenaceae , Amaranthaceae, Cannaceae, Orchidaceae, Poaceae.

Practical

Reference Books :

1. Lawrence.G.H.M, 1985 – An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Porter.C.L., 1982 – Taxonomy of Flowering Plants, Eurasia Publications House, New Delhi
3. Rendle.A.B., 1980 – The Classification of Flowering Plants (Vol. I & II), Vikas Students Education.
4. Pandely.B.P., 1987 – Taxonomy of Angiosperms.
5. Clive AS.1989. Plant Taxonomy and Biosystematics, Chapman and Hall Inc. New York.
6. Harborne, JB & Turner, BL. 1984. Plant Chemosystematics, Acad. Press, London.
7. Lawrence, GH. 1955. Taxonomy of Vascular Plants, MacMillan Co., USA.
8. Samuel, BJ & Arlene, EL. 1987. Plant Systematics, Mc Graw Hill Inc. New York

9. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms. New Age International Pvt. Ltd., New Delhi
10. Grant, W.E. 1984. Plant Biosystematics. Academic Press London.
11. Harrison, H.J. 1971. New Concepts in Flowering Plant Taxonomy. Rieman Educational Book Ltd., London.
12. Heslop-Harrison, J. 1967. Plant Taxonomy -English Language Book Soc. & Edward Arnold Pub. Ltd. U.K.
13. Heywood, V.H. and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
14. Jones, A.D. and Wilbins, A.D. 1971. Variations and Adaptations in Plant Species. Hiemand & Co. Educational Books Ltd. London.
15. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). McGraw-Hill Book Co., New York.
16. Nordenstam, B., EI Gazaly, G. and Kassas, M. 2000 Plant Systematics for 21st Century. Portlant Press Ltd., London.
17. Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper & Row Publications, USA.
18. Singh, H. 1978, Embryology of Gymnosperms, Encyclopaedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.
19. Solbrig, O.T. 1970. Principles and Methods of Plant Biosystematics. The MacMillan Co-collier-MacMillan Ltd., London.
20. Solbrig, O.T. and Solbrig, D.J. 1979. Population Biology and Evolution, Addison-Wesley Publishing Co. Ind USA.
21. Stebbings, G.L. 1974. Flowering Plant - Evolution Above Species Level. Edward Arnold Ltd. London.
22. Stace, C.A. 1989. Plant Taxonomy and Biosysteainatics (2nd edition) Edward Arnold Ltd., London.
23. Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
24. Woodland, D.W. 1991. Contemporary Plant Systematics. Prentice Hall. New Jersey.

PLANT ANATOMY AND EMBRYOLOGY

(Admitted from 2020 onwards)

Subject Code : 20UIM5B

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - V

Core –VIII

Credits - 4

Hours - 4

UNIT- I

Cell wall –structure, and functions. Tissues – Definition, types – simple permanent – parenchyma, collenchyma, sclerenchyma (fibres and sclereids). Complex permanent tissues – xylem and phloem. Meristems – classifications, theories of shoot apex and root apex organization.

UNIT- II

Tissue systems – Dermal tissue system, Fundamental or ground tissue system, Vascular tissue system and types of vascular bundles. Stem – primary anatomical structure of dicotyledonous and monocotyledonous stem. Secondary growth in dicotyledonous stems. Anomalous secondary growth in *Nyctanthes*, *Boerhavia* and *Dracaena*. Nodal Anatomy and stomatal types.

UNIT- III

Root - Primary anatomical structure of dicotyledonous and monocotyledonous roots. Secondary growth in dicot roots. Leaf - anatomy of dicot and monocot leaf. Leaf abscission.

UNIT- IV

Microsporangium, microsporogenesis and development of male gametophyte. Structure of matured ovule, Megaspore (ovule) different types, Germination of pollen grain, megasporogenesis, development of female gametophyte – Monosporic – *Polygonum* , Bisporic – *Allium* and Tetrasporic – *Peperomia*.

UNIT- V:

Double fertilization and triple fusion. Development of dicot embryo-*Capsella*. Development of monocot embryo – *Najas* . Endosperm and its types – Free nuclear, cellular, helobial. Endosperm haustoria. Apomixis – definition and types. Polyembryony – types. Parthenogenesis and Parthenocarpy.

PRACTICALS :

Anatomy :

Study of simple and complex tissues by maceration. Study of internal structure of primary (young) and secondary (old) stems. Internal structure of monocot stem. Anomalous secondary growth in the stems of *Boerhaavia*, *Nyctanthes* and *Dracaena*. Anatomy of aerial roots. T.S of dicot and monocot leaves. Stomatal types.

Embryology

T.S. of (young and mature) anther.(Permanent slides only).

Observation of pollinia (slide only).

Types of ovules, different stages of embryo sac-development.

Types of Endosperm- Nuclear, cellular and helobial.

Stages in development of embryo in Dicotyledons (*Capsella*) Monocotyledons (*Najas*).
Dissection and display of any two stages of embryo in *Tridax*.

REFERENCE BOOKS :

1. Esau.K. (1985) – Anatomy of Seed Plants –John Willey
2. Cutter.E.G (1989) – Plant Anatomy – Part I – Addison – Wesley Publishing Co..
3. Vashista.P.C. (1988) – A Text Book of Plant Anatomy. S.Nagin & Co.
4. Maheswari.P. (1991) – An Introduction to Embryology of Angiosperms, Tata McGraw Hill Publishing Co. Ltd.,
5. Swamy B.G.L. and Krishnamoorthy. K.V. (1990) – From Flower to Fruits, Tata McGraw Hill Publishing Co. Ltd.
6. Bhojwani S.S. and Bhatnagar.S.P. (1987) – Embryology of Angiosperms, Vikas Publishing House Pvt. Ltd.,
7. Bhojwani, S S. & Bhatnagar, SP. 1994. Embryology of Angiosperms, Vikas
8. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
9. Burgess, J. 1985. An Introduction to Plant Cell Development. Cambridge University Press, Cambridge.
10. Fageri, K. and Van der Pijl, L. 1979. The Principle of Pollination Ecology. Pergamon Press, Oxford.
11. Fahn, A. 1982. Plant Anatomy. (3rd edition). Pergamon Press, Oxford.
12. Fosker, D.E. 1994. Plant Growth and Development. A Molecular Approach. Academic Press, San Diego.
13. Howell, S.H. 1998. Molecular Genetics of Plant Development. Cambridge University press, Cambridge.
14. Leins, P., Tucker, S.C. and Endress, P.K. 1988. Aspects of Floral Development, J. Cramer, Germany.
15. Lyndon, R.F. 1990. Plant Development. The Cellular Basis, Unwin Hyman, London.
16. Murphy, T.M. and Thompson, W.E, 1988. Molecular Plant Development. Prentice Hall, New Jersey.
17. Proctor, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
18. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
19. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer-Verlag, New York.
20. Raven, P.H., Evert, R.F. and Eichhorn, S. 1992. Biology of Plants (5th edition). Worth, New York.
21. Steeves, T.A. and Sussex, I.M., 1989. Patterns in Plant Development (2nd edition). Cambridge University Press, Cambridge.
22. Waisel, Y., Eshel, A. and Kafkaki, U. (eds.). 1996. Plant Roots : The Hidden World (2nd edition). Marcel Dekker, New York.
23. Shivanna, K.R. and Sawhney, VK. (eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge.
24. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology : A Laboratory Manual. Springer-Verlag. Berlin.
25. Shivanna, K.R. and Johri, B.M. 1995. The Angiosperm Pollen : Structure and Function. Wiley Eastern Ltd.. New York.

PLANT ECOLOGY AND PHYTOGEOGRAPHY
(Admitted from 2020 onwards)
Subject Code : 20UIM5C

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

Semester - V Core – IX Credits - 4 Hours - 4

UNIT- I

Ecology -definition, types and scope. Abiotic factors and biotic factors- Biotic and abiotic factors and their influence on vegetation – a brief account of microbes, plants, animals, soil, wind, light, temperature, rain fall and fire.

UNIT- II

Ecosystem – Concept processes and components. Food chain, food web, energy flow in ecosystem. Types of Ecosystems : Pond, Coastal and grassland. Ecological pyramids. Biogeo- chemical cycles (H₂O, CO₂, N₂ and P Cycle).

UNIT-III

Plant succession – Primary succession –secondary succession - Xerosere- hydrosere- Adaptation of plants to various habitats- xerophytes- hydrophytes- halophytes.

UNIT- IV

Biodiversity : definition, types, Importance, need for conservation in situ conservation (afforestation, sanctuaries) and on-farm conservation. Ex situ conservation (Gene bank and DNA bank). A brief account of national and international agencies of conservation. Pollution – Air, Water, soil-causes and consequences.

UNIT- V

Phytogeography : Principles - vegetation types of India – tropical rain forest, mangrove vegetation and scrub jungle, Detailed study of vegetation types of Tamil nadu. Plant distribution-continuous, discontinuous- endemism and its types. Age and area hypothesis.

PRACTICAL :

1. Study of morphological and structural adaptations of locally available hydrophytes, mesophytes, halophytes and epiphytes and correlate to their particular habitats.
Hydrophyte : *Nymphaea, Hydrilla*.
Xerophyte : *Nerium, Casuarina*.
Mesophyte : *Tridax, Vernonia*.
Halophyte : *Avicennia, Rhizophora*.
Epiphyte : *Vanda*.
2. Field trips to places for study and observation of vegetational types prescribed in the syllabus for 2 to 5 days under the guidance of teachers.
3. Map of the phytogeographical regions of India.

REFERENCE BOOKS :

1. Atlas. R.M. and Bartha.R. (1987) – Microbial Ecology : Fundamentals and applications. The Benjamin/ Cummings Publishing Co. Inc.
2. Colinvaux.P. (1986) – Ecology, John Wiley and Sons.
3. Kumar.H.D. (1990) – Modern concepts of Ecology, Vikas Publishing House Pvt. Ltd.,
4. Krishna Iyer.V.R (1992) Environmental protection and legal defence. Sterling Publishers Pvt. Ltd.,
5. Mabberley.D.J. (1983) – Tropical Rain forest \ecology, Blackie and Son Ltd.,
6. Odum.E.P. (1983) – Basic Ecology, Holt-Saunders International Editions.
7. Shukla.R.S. and Chandel.PS. (1990) – Plant Ecology, S.Chand & Co. Pvt. Ltd.,
8. Singh.D.V (1985), The Eco Vote : - People's representatives and global environment.
9. Smith.W.H. (1981) – Air pollution and forest : Interactions between air contaminants and forest ecosystems.
10. Vickery.M.L. (1984) – Ecology of Tropical plants, John Wiley and Sons.
11. Krishnamurthy KV. 2003. An advanced text book on Biodiversity – Principle and Practice. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
12. Melchias, G., 2001. Biodiversity and Conservation, Science Publishers Inc. USA.
13. Sharma, PD. 1999. Ecology and Environment, Rastogi Publishers, Meerut.
14. Asthana, DK & Meera Asthana. 2006. A text book of Environmental studies. S.Chand & Company Ltd. New Delhi.
15. Brian Groombridge. 1992. Global Biodiversity, Chapman and Hall, UK.
16. IUCN, 1985. The World Conservation Strategy, IUCN, Switzerland.
17. Odum, EP. 1970. Fundamentals of Ecology, 3rd edn, W.B.Saunders Ltd., UK
18. Simmons et al., 1980, Conservation of Threatened Plants, NATO Scientific affairs, New York.

CELL BIOLOGY AND MOLECULAR BIOLOGY

(Admitted from 2020 onwards)

Subject Code : 20UIM5D

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester - V

Core – X

Credits - 4

Hours - 4

UNIT- I

Introduction – definition, cell theory, cell organization – Prokaryotic and Eukaryotic. Plasma membrane ,occurrence, structure (Fluid mosaic model), chemistry, function and origin.

UNIT- II

Occurrence, structure, function and origin of endoplasmic reticulum, golgi bodies, lysosomes, ribosomes, peroxisomes, mitochondria, chloroplast and Centrosomes.

UNIT- III

Nucleus, nuclear membrane, chromosomes, euchromatin, heterochromatin, giant chromosomes polytene and lampbrush. Cell cycle, cell division - mitosis, meiosis and cytokinesis.

UNIT- IV

Nature and function of genetic materials-DNA-structure and replication – RNA structure and types . DNA repair mechanism. Protein synthesis-transcription, translation, genetic code . Mutation and plastid DNA

UNIT- V

Gene regulation in prokaryotes-lac-operon. Genetic engineering – recombinant DNA technology , isolation of DNA, vector, restriction enzymes and DNA ligase. Transformation – screening for recombinants.

Practical

REFERENCE BOOKS :

1. Verma, P.S. & V.K. Agarwal, 2002, Cytology. S. Chand & Co.Ltd., New Delhi-55.
2. Verma, P.S. & V.K. Agarwal, 2003, Genetics. S. Chand & Co.Ltd., New Delhi-55.
3. Freifelder, D.1987. Essentials of Molecular Biology, Jones & Bartlett, Boston.
4. Gardner, E.J., Simmons, M.J. & Snustad, D. 1991. Principles of Genetics, John Wiley Sons Inc., 8th Edn., New York.
5. Sinnott, E.W., Dunn, L.L. & Dobzhansky, T. 1997. Principles of Genetics, Tata Ma Graw Hill Publishing Co., New Delhi.
6. Brown W.V. and Bertke.E.M., 1974, A text book of Cytology C.V.Mosley Co., St. Louis.

7. Cohn.N.S., 1979, Elements of Cytology, Freeman Book Co.,
8. De Robritis E.D.P. and DeRobrities. E.M.F.jr 1987 – Cell and Molecular biology Lea and Febiger..
9. Feifelder.D., - Molecular Biology, Narosa. Publication
10. Watson. J.D., et.al Molecular biology of the Gene The Benjamin/ Cummings.
11. Freifelder, D. 1987. Essentials of Molecular Biology, Jones Bartlett, Boston, USA.
12. De Robertis & De Robertis. 1990. Cell and Molecular Biology, Saunders College, Philadelphia, USA.
13. Gardner, E.J., Simmons, M.J. & Snustad, D. 1991. Principles of Genetics, 8th Edn., John Wiley & Sons Inc., New York.
14. Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular, Biology and Biotechnology. CRC Press, Boca Raton, Florida.
15. Hackett, P.B., Fuchs, J.A. and Messing, J.W. 1988. An Introduction to Recombinant. DNA Techniques : Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co. Inc., Menlo Park, California.
16. Hall, J.L. and Moore, A.L. 1983. Isolation of Membranes and Organelles from Plant Cells. Academic Press, London, UK.
17. Harris, N. and Oparka, K.J. 1994. Plant Cell Biology : A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
18. Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press Oxford.

ELECTIVE - I
HORTICULTURE
(Admitted from 2020 onwards)
Subject Code : 20UIE5A

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

Semester - V Elective –I Credits - 5 Hours - 3

UNIT- I

Brief history of horticulture , horticultural classification, Essentials of nursery Management – Soil management: Garden soil, Physical and chemical properties of soil, Organic matter, Compost, Cultural practices. Water management: Water quality, Irrigation, Mulching.

UNIT- II

Plant propagation- cutting, layering, grafting. Indoor gardening . Orchardng, vegetable farming, floriculture, ornamental gardening and landscape horticulture and Bonsai.

UNIT- III

Hydroponic culture-types of containers, Use of manures and fertilizers in Horticultural crop production. Organic farming.

UNIT- IV

Horticultural crops protection - Physical control: Pruning. Biological control, chemical control-pesticides, fungicides and insecticides and flower arrangement.

UNIT- V

Technology of horticultural crops – market preparation: harvesting and handling, packaging and transport, storage; chemical treatment. Food processing -freezing, bottling and canning, drying and chemical preservation.

REFERENCE BOOKS :

1. H.T. Hartmann and D.E. Kester 1989. Plant propagation – principles and practices. Half of India New Delhi.
2. T.K.Bose and Mitra and Sadhu, 1991. propagation of tropical and subtropical horticultural crops. Naya Prakash.
3. Singh S.P 1989 Mist propagation Metropolitan book Co., New Delhi.
4. Arditti, A., 1977. Orchid biology, Gornell Univ., Press. Ithaca.
5. Bose, T.K., and Bhattacharjee, S.C., 1980. Orchids of India.
5. Mukherjee, S.K., 1983. Orchids ICAR, New Delhi.
6. Wltz., S., 1972. The world of gladiolus, NAGC, USA.
7. Bailey, S., 1971. Perpectual flowering carnation, Fabner and Fabner, London.
8. Laurie, A., Kiplingr, D.D., and Nelson, K.S., 1968. Commercial flower forcing. Mc Graw-Hill Book, London.
9. Bunt, A.C., 1976. The chrysanthemum. Nat., Chrysanthemum Soc., London.

10. Cumming, R.W., 1964. The chrysanthemum Book. D.Van., Nostrand Inc.
11. Guenther, F., 1952. The essential oil. Van, Nostrand, Inc., New York.
12. Bhattacharjee, B.S., 1959. Rose growing in tropics. Thackarspink and Co., Calcutta.
13. Biswas, T.D., 1984. Rose growing – Principles and Practices – Assoc., Pub., Co., New Delhi.
14. Champneys, H.P., 1956. Pearsons encyclopedia of roses. Arthur Pearsons Ltd., New Delhi.
15. Hartman, H.T. and Kester, D.E., 1989. Plant propagation printice hall Ltd., New Delhi.
16. Larsen, R.A., 1981. Introduction to floriculture. Academic Press, New York.
17. Abraham, A. and Vatsala, P., 1981. Introduction to Orchids. Trop. Bot. Garden, Trivendrum.
18. Bose, T.K. and Yadav, L.P., 1989. Commercial flowers. Naya Prakash, Calcutta.
19. Chadha, K.L., 1986. Ornamental horticulture in India ICAR, Krishi Bhavan, New Delhi.
20. Meninger, E.A., 1970. Flowering vines. Hearside Press, New York.
21. Trivedi, P.P., 1983. Home gardening, ICAR, New Delhi.
22. Helleyer, A., 1976. The Collingridge Encyclopedia of gardening Chartwell Book, Inc., New Jercey.
23. Bailey, L.H., 1963. The Standard Encyclopedia of Horticulture. Mc Million & Co., London.
24. Bose, T.K., and Mukharjee, D., 1977. Gardening in India. Oxford & IBH Pub., Co., Calcutta.
25. Gopalswamy Iyyangar, 1970. Complete gardening in India, Kalyan Printers, Bangalore
26. Rangaswami, G. and Mahadevan, A. 1999. Diseases of Crop Plants in India (4th edition). Prentice Hall of India Pvt. Ltd., New Delhi

ELECTIVE - I

ORGANIC FARMING Subject Code : 20UIE5A

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

Semester - V Elective –I Credits - 5 Hours - 3

Unit I :

Organic farming – definition, basic concept of organic farming, integrated plant nutrient supply management, integrated insect pest and diseases management, integrated soil and water management. Sustainable agriculture practice-crop rotation, crop diversification, mixed cropping, biological nitrogen fixation.

Unit II:

Management of organic wastes and green manures: Farm manures, Composts, Mulches, Tillage and pest control. Organic manures-organic residue, chemical nature of organic manure, green manure, importance of green manure, crops of green manure, oil cake.

Unit III:

Soil- physical, chemical properties. Soil pollution-oil, chemicals-fertilizers, pesticides and herbicide- non-degradable solids, biomagnifications, consequences of land pollution-damage to soil and crops, heavy metal contamination.

Unit IV:

Biofertilizers-classification, nitrogen fixers-*Rhizobium*, *Azotobacter*, cyanobacteria, *Azolla*, *Frankia*, *Azospirillum* and Vesicular Arbuscular Mycorrhizae. Animal based- cow dung, poultry waste, fish waste amino acid-vermicompost, vermiwash methods, production and utilization. Preservation of Panchakavya.

Unit V:

Pest and disease management: classification of pest, integrated pest management components; cultural, mechanical, physical control of pest. Biopesticides against microbial parasites, predators and insects. Principles of biosafety-organic produce-consumer confidence, conversion period. Inspection and certification. Accredited certifying agents (National and International) Quality assurance – logo and labeling.

Books for Study

Bansal, M. 2017. Basics of organic farming, Cbs Publishers and Distributors Pvt Ltd

Panda, H. 2013. Handbook on Organic Farming and Processing, Asia Pacific Business Press Inc.

Dr. Ranjan Kumar Biswas, 2014, Organic farming in India. Renu Publishers. Kolkatta.

Books for reference

Hansen, A.L. 2010. The Organic Farming Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farm, Kindle Edition, Storey publishing, USA.

Fossel, P.V. 2014. Organic Farming: Everything You Need to Know, Voyageur Press

V SEMESTER

PAPER- XI- PRACTICAL- III . (20UIM51)

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

Semester - II Core –XI Credits - 4 Hours - 2

(COVERING THEORY PAPERS(PAPERS VII - X) IN V SEMESTE)

SEMESTER – VI
UIM6G

GENETICS, PLANT BREEDING, EVOLUTION AND BIOSTATISTICS
(Admitted from 2020 onwards)
Subject Code : 20UIM6A

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

Semester - VI Core –XII Credits - 4 Hours - 6

UNIT- I:

Mendelian genetics – monohybrid, dihybrid and test cross. Allelic gene interactions - Incomplete dominance, Lethal Genes and Non-allelic gene interactions – Epistasis (Dominant and Recessive), Complementary factors. Polygenic inheritance, multiple alleles, pseudo alleles and lethal alleles. Chromosome theory of linkage, crossing over, recombinations and mapping of genes on chromosomes. Sex determination in plants.

UNIT- II

Chromosome number and structure. Polyploidy origin, types and significance. Extra nuclear inheritance and its significance. Mutation – types, chromosomal aberrations mutagenic agents (Physical & Chemical) and significance. Population genetics – Hardy Weinberg principle.

UNIT- III

Plant Breeding: Objectives, Plant introduction, selection, hybridization techniques, heterosis cause and effects. . Mutation -Polyploidy and its applications in plantbreeding. Breeding for crop improvement for Paddy, Groundnut and Sugarcane.

UNIT- IV

Origin of Life - chemosynthetic theory –evidences (any five). Evolution: Evolutionary theories of Lamarck, Darwin, De Vries, Modern synthetic theory of evolution. Concept of species- Allopatric and Sympatric.

UNIT- V

Measures of central tendency – mean, median, mode and measures of dispersion. Standard deviation, mean deviation. Testing of hypothesis. Simple definition of Null hypothesis, t-test, chi-square test.

PRACTICAL :

1. Genetic problems-test cross, back cross and allelic interactions.
2. Biostatistical Problems covered in the theory.
3. Gene mapping-3 point test cross.
4. Models/ photographs/ charts/ equipment/ chemicals.
Any mutagen, Protein synthesis, DNA structure and replication, RNA structure
5. Plant breeding – Emasculation.

REFERENCE BOOKS :

1. Atherly, A.G., Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics. Saunders College Publishing, Fort Worth, USA.
2. Burnham, C.R. 1962. Discussions in Cytogenetics. Burgess Publishing Co. Minnesota.
3. Busch, H. and Rothblum, L. 1982. Volume X. The Cell Nucleus rDNA Part A. Academic Press.
4. Hartl, D.L. and Jones, E.W. 1998. Genetics : Principles and Analysis (4th edition). Jones & Bartlett Publishers, Massachusetts, USA.
5. Khush, G.S. 1973. Cytogenetics of Aneuploids. Academic Press, New York, London.
6. Karp, G. 1999. Cells and Molecular Biology : Concepts and Experiments. John Wiley & Sons, Inc., U.S.A.
7. Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.
8. Lewis, R. 1997. Human Genetics : Concepts and Applications (2nd editions). WCB McGraw Hill, USA.
9. Malacinski, G.M. and Freifelder, D. 1998 : Essentials of molecular Biology (3rd edition). Jones and B Artlet Publishers, Inc., London.
10. Russel, P.J. 1998. Genetics (5th edition). The Benjamin/Cummings Publishing Company INd., USA.
11. Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics (2nd edition). John Wiley & Sons Inc., USA.
12. Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular, Biology and Biotechnology. CRC Press, Boca Raton, Florida.
13. Glover, D.M. and Hames, B.D. (Eds.), 1995. DNA Cloning 1 : A Practical Approach, Core Techniques. 2nd edition. PAS, IRL Press at Oxford University Press Oxford.
14. Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology : Structure and Function. Jones and Bartlett Publishers. Boston, Massachusetts.
15. Hackett, P.B., Fuchs, J.A. and Messing, J.W. 1988. An Introduction to Recombinant DNA Techniques : Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co. Inc., Menlo Park, California.
16. Hall, J.L. and Moore, A.L. 1983. Isolation of Membranes and Organelles from Plant Cells. Academic Press, London, UK.
17. Harris, N. and Oparka, K.J. 1994. Plant Cell Biology : A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
18. Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press Oxford.
19. Fukui, K. and Nakayama, S. 1996. Plant Chromosomes : laboratory Methods. CRC Press, Boca ratan, florida.
20. Sharma, A.K. and Sharma, A. 1999. Plant Chromosome Analysis, Manipulation and Engineering. Hoarwood Academic Publisher, Australia
21. Albert B. Bray, D., Lewis, J., Raff, M., Robert, K. and Watson, J.D. 1989., Molecular Biology of the Cell (2nd editions), Garland Publishing Inc., new York.

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY
(Admitted from 2020 onwards)
Subject Code : 20UIM6B

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

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

UNIT- I

Atomic structure, chemical bonds- ionic bond and covalent bond- pH and buffer- basic knowledge of carbohydrates, proteins and lipids .

Water relations – diffusion, permeability, osmosis, water potential and its components. Absorption of water , apoplast and symplast, mechanism – passive and active. Transpiration – types and factors affecting transpiration and significance. Opening and closing of stomata- mechanisms.

UNIT- II

Elementary concept of bioenergetics – entrophy and free energy. Enzymes:- properties, nomenclature, classification, mode of action, factors affecting enzyme action. Michaelis- menton equation.

UNIT- III

Photosynthesis :- Radiant energy, absorption spectrum and action spectrum of chlorophyll. Red drop phenomenon, Emerson’s enhancement effect, pigment systems I and II. electron transport system in the chloroplast (Z scheme), cyclic and noncyclic photo phosphorylation. PCR pathways- Calvin cycle, Hatch and Slack pathway and photorespiration- Crassulacean acid metabolism (CAM).

Respiration :- Types. Aerobic – Glycolysis, HMP (outline only), Krebs Cycle, electron transport system, oxidative phosphorylation, respiratory quotient. Anaerobic respiration and fermentation

UNIT- IV

Nitrogen assimilation :- Conversion of nitrate to ammonia by plants, biological nitrogen fixation – nitrogen fixing organisms, legume – Rhizobium symbiosis, ammonia assimilation, synthesis of aminoacids – reductive and transamination.

UNIT- V

Growth – plant growth regulators (auxins, gibberellins, cytokinins, ethylene and abscissic acid) – mechanism of action and practical applications.

Photomorphogenesis – Photoperiodism, vernalization, phytochromes, dormancy (seed and bud), seed viability and germination.

PRACTICALS :

Experiments to be performed and recorded by students individually :

1. Determination of water potential by plasmolytic method.
2. Effect of temperature and chemicals on membrane permeability.
3. Study of rate of transpiration under different environmental factors..
4. Separation of plant pigments by paper chromatography and TLC.
5. Study of rate of photosynthesis under different light intensities.
6. Study of rate of photosynthesis under different wavelengths (red & blue) of light.
7. Comparison of rate of respiration of different respiratory substrates..
8. Catalase enzyme activity.
9. Determination of degree of porosity of leaves.

Demonstration – Experiments

1. Demonstration of Stomatal movement.
2. Induction of roots in leaves by auxins.
3. To test the germination capacity of seeds using Tetrazolium chloride.

REFERENCE BOOKS :

1. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, USA.
2. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (Eds) 1997. Plant Metabolism (second edition). Longman Essex, England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.
4. Hooykaas, P.J.J., Hall M.A. and Libbenga, K.R. (eds) 1999. Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands.
5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
6. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (fourth edition). W.H. Freeman and Company, New York, USA.
7. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer-Verlag, New York, USA.
8. Nobel, P.S. 1999. Physicochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, USA.
9. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California, USA.
10. Singhal, G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee 1999., Concepts in Photobiology : Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
11. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
12. Thomas, B. and Vince-Prue, D. (1997) Photoperiodism in Plants (second edition). Academic Press, San Diego. USA.
13. Westhoff, P. (1998) Molecular Plant Development from Gene to Plant. Oxford University Press, Oxford, UK.
14. Jain, J.L. 1979. Fundamentals of Biochemistry, Chand & Co. Ltd., New Delhi
15. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand&Company Ltd.,
16. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi
17. Conn, E & Stumpf, P.K. 1979. Outline of Biochemistry Niley Easdtern Ltd., New Delhi
18. Metz, E.T. 1960. Elements of Biochemistry. V.F & S (P) Ltd., Bombay
19. Noggle and Fritz, 1976. Introductory Plant Physiology, Prentice Hall, New Delhi
20. Pandey, S.N & Sinha, B.K. 1989. Plant Physiology, Vikas Publishing House Ltd., New Delhi
21. Robert M. Devlin. 1970. Plant Physiology, East West Press, New Delhi

ECONOMIC BOTANY
(Admitted from 2020 onwards)
Subject Code : 20UIM6C

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

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

UNIT- I

Introduction – Food Plants – Plant and Plant products of Industrial value. Cereals – rice wheat, millets , Sorghum and pearl millet. Pulses / beans – nuts with protein content (Soybean). Nuts with fat content (peanuts), Essential oil yielding plants and Essential kernal oils – *Eucalyptus* oil (*Eucalyptus globulus*).

UNIT- II

Fibers and fibrer yielding plants – Cultivation, classification, extraction and uses of Fibres. Soft fibres- *Corchorous*. Hard Fibres- *Manila hemp* and *Musa textiles*. Surface Fibres – *Gossypium*. Timber – *Tectona grandis* . Rubber –*Hevea braziliensis*.

UNIT- III

Sugar – Cultivation, harvesting and extraction with reference to *Saccharum officinarum*. Spices cultivation and harvesting (*Zingiber officinale* and *Eugenia caryophyllata*). Beverages:- cultivation, harvesting of *Coffea arabica* and *Thea sinensis*.

UNIT- IV

Pulp and Paper Industry (Bamboos)– *Casuarina*, *Eucalyptus* - Raw materials and manufacture of pulp . Gums and Resins-(*Acacia nilotica* and *Pterocarpus marsupium*)

UNIT- V

Definition, history and scope of pharmacognosy. Indigenous systems of medicine -Ayurvedic, Siddha, Unani and Homeopathy.

Sources, descriptions, constituents and uses of the following:- antirheumatic – *Colchicum*, antitumour – *Vinca*, antidiabetic – *Gymnema* and antiseptic – Neem.

PRACTICAL : Items included in the theory.

REFERENCE BOOKS :

1. Anonymous 1997. National Gene Bank : Indian Heritage on Plant Genetic Resources (Booklet). National Bureau of Plant Genetic Resources, New Delhi.
2. Arora, R.K. and Nayar, E.R. 1984. Wild Relatives of Crop Plants in India. NBPGR Science Monograph No.-7.
3. Baker, H.G. 1978. Plants and Civilization (3rd edn.) C.A. Wadsworth, Belmont.
4. Bole, P.V. and Vaghani, Y. 1986. Field Guide to Common Indian Trees. Oxford University Press, Mumbai.

5. Chandel, K.P.S., Shukla, G. and Sharma, N. 1996. Biodiversity in Medicinal and Aromatic Plants in India : Conservation and Utilization. National Bureau of Plant Genetic Resources, New Delhi.
6. Chrispeels, M.J. and Sadava, D. 1977. Plants, Food and People, W.H. Freeman and Co., San Francisco.
7. Cristi, B.R. (ed.) 1999. CRC Handbook of Plant Sciences and Agriculture. Vol. I. In-situ conservation. CRC Press, Boca Raton, Florida, USA.
8. Conway, G. 1999. The Doubly Green Revolution : Food for All in the 21st Century. Penguin Books.
9. Conway, G. and Barbier, E. 1990. After the Green Revolution. Earthscan Press, London.
10. Conway, G. and Barbier, E. 1994. Plant. Genes and Agriculture. Jones and Bartlett Publishers, Boston.
11. Council of Scientific and Industrial Research 1986. The Useful Plants of India. Publications and Information Directorate, CSIR, New Delhi.
12. Council of Scientific and Industrial Research (1948 - 1976). The Wealth of India. A Dictionary of Indian Raw Materials and Industrial Products. New Delhi. Raw Materials I-XII, Revised Vol. I-III (1985-1992) Supplement (200).
13. Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York, USA.
14. Directory of Indian Wetlands, 1993. WWF INDIA, New Delhi and AWB, Kuala Lumpur.
15. Falk, D.A., Olwel, M. and Millan C. 1996. Restoring Diversity, Island Press. Columbia, USA.
16. FAO/IBPGR 1989. Technical Guidelines for the Safe Movement of Germplasm. FAO/IBPGR, Rome.
17. Frankel, O.H., Brown, A.H.D. and Burdon, J.J. 1995. The Conservation of Plant Diversity. Cambridge University Press, Cambridge, U.K.
18. Gadgil, M. and Guha, R. 1996. Ecology and Equity : Use and Abuse of Nature in Contemporary India. Penguin, New Delhi.
19. Gaston, K.J. (Ed.) Biodiversity : a Biology of Numbers and Differences. Blackwell Science Ltd., Oxford, U.K.
20. Heywood, V. (Ed). 1995 Global Biodiversity Assessment. United Nations Environment Programme. Cambridge University Press, Cambridge, U.K.
21. Heywood, V.H, and Wyse lackn, P.S. (Eds) 1991. Tropical Botanical Gardens. Their Role in Conservation and Development. Academic Press, San Diego.
22. Kocchar, S.L. 1998. Economic Botany of the Tropics, 2nd edition. Macmillan India Ltd., Delhi.
23. Kothari, A. 1997. Understanding Biodiversity : Life Sustainability and Equity. Orient Longman.
24. Kohli, R., Arya, K.S., Singh, P.H. and Dhillon, H.S. 1994. Tree Directory of Chandigarh. Lovdale Educational, New Delhi.
25. Nair, M.N.B. et. al. (Eds.) 1988. Sustainable Management of Nonwood Forest Products. Faculty of Forestry, University Putra Malaysia. 43004 PM Serdang. Selangor, Malaysia.
26. Paroda, R.S. and Arora, R.K. 1991. Plant Genetic Resources Conservation and Management. IPGRI (Publication) South Asia Office, C/o NBPGR. Pusa Campus, New Delhi.
27. Pimentel, D. and Hall, C.W. (Eds.) 1989. Food and Natural Resources, Academic Press, London, New York.
28. Pinstrup-Anderson, P. et. al. 1999. World Food Prospects :Critical Issues for the Early 21st Century. International Food Policy Research Institute. Washington, D.C., USA.
29. Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy B-63.

30. Plucknett, D.L., Smith, N.J.H., William, J.T. and Murti Annishetty, N. 1987. Gene Banks and Worlds Food. Princeton University Press, Princeton, New Jersey, USA.
31. Rodgers, N.A. and Panwar, H.S. 1988. Planning a Wildlife Protected Area Network in India. Vol. I. The Report. Wildlife Institute of India, Dehradun.

ELECTIVE - II
APPLIED PLANT BIOTECHNOLOGY
(Admitted from 2020 onwards)
Subject Code : 20UIE6A

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

Semester - VI Elective –II Credits - 5 Hours - 4

UNIT-I

Biotechnology – definition, history and scope. Isolation and cultivation techniques of economically important microbes - (a) Fresh water Alga (*Scenedesmus*) (b) Fungus (*Aspergillus*).

UNIT- II

Tissue culture-media, callus formation and protoplast fusion with reference to improvement of plants. Single cell protein (SCP) – Micro-organism used in SCP (*Scenedesmus* and *Spirulina*). Nutritional value of SCP. Algal Biomass production and maintenance.

UNIT- III

Mushroom cultivation – Paddy straw and oyster mushrooms, nutritional value and methods of cultivation and control of pests and pathogens.

Biofertilizers – Blue green algae, *Azolla*, Mycorrhiza, Bacterium - *Azospirillum* and *Rhizobium*.

UNIT- IV

Production of primary metabolites – ethanol production by *Yeast*, citric acid production by *Aspergillus niger*. Production of secondary metabolites – antibiotics-penicillin. enzymes from microbes and their application - amylase, proteases and cellulase.

UNIT- V

Genetic engineering. Development of transgenic plants with reference to insect and herbicide resistance. Transgenic edible vaccine, alkaloid production, vaccine production Luminescent plants and protein sweetener system. Phytoremediation - Pros and cons of GM food.

Biotechnology and intellectual property- Patenting of biological material.

Practical:

1. A detailed study mentioned in the theory .
2. Synthetic seeds

BOOKS :

1. Bernard R Glick & Jack J Pasternak. 2001. Molecular biotechnology-principles and applications of recombinant DNA, (2nd Edition), ASM Press, Washington, D.C.
2. Jogdand, SN. 1997. Gene biotechnology, Himalaya Publishig House, New Delhi.
Books for Reference
3. Ernst L. Winnaccker, 2002. From Genes to Clones-introduction to gene technology,
VCR Pub., Weintein.
4. James D Watson et al., 1992. Recombinant DNA (2nd Edition), WH Freeman and Co., New York.
5. Maniatis & Sambrook. 2003. Molecular Cloning- A lab manual Vol.I, II & III,

Coldspring Harbor Laboratory Press, New York.

6. Old, RW & Primrose, SB. 2001. Principles of Gene Manipulation-an introduction to genetic engineering, Black Well Science Ltd., New York.
- 7 . Bhojwani. S., Dhawan, V. and Cocking, E.C. Plant tissue culture. Springer – Verlag
8. Bajaj, Y.P.S. Plant, cell and organ culture. Springer – Verlag.

Elective –II
PLANT BIOTECHNOLOGY
Subject Code : 20UIE6A

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

Semester - VI Elective –II Credits - 5 Hours - 4

Unit - I

Plant Biotechnology - Biotechnology – Scope and Applications, History of Plant tissue culture-Totipotency. Sterilization Techniques, Media Preparation. Types of media – MS, and B5 - explant preparation and inoculation- callus induction, organogenesis (embryogenesis)

Unit - II

Protoplast Isolation, Fusion and Culture Regeneration – Somatic Hybrids and Cybrids. Establishment and Maintenance of Callus and Suspension Cultures. Somatic embryogenesis, Synthetic seeds, Plant Micropropagation,

Unit - III

Shoot tip Culture (Virus Free Plants), Haploid Plant Production, Anther and Microspore Culture, Embryo Culture and Rescue, *in vitro* Pollination and Fertilization, Secondary Metabolites, Cryopreservation and Germplasm conservation, Role of tissue culture in agriculture and Forestry.

Unit - IV

Molecular biology of Nitrogen fixation (plants and cyanophytes, Nif gene). Plant Gene Expression Cassettes – Selectable Marker, Reporter Genes, Promoters in Plant Vectors. Transposons in plants, Somaclonal and Gametoclonal Variations in Plants.

Unit - V

Genetic engineering of plants – Insect Resistance, Virus Resistance, Herbicide Resistance, Bacterial Resistance, Stress (Biotic and Abiotic) Resistance. Delayed Fruit Ripening, Edible Vaccines and Plantibodies. Terminator seed concepts.

Books for study

- Dubey, R.C., 2001. A text book of biotechnology. S. Chand & Co., New Delhi.
Gupta, P.K. 1998. Elements of Biotechnology, Rastogi Publications, Meerut
Ignacimuthu, S.J. 2003. Plant Biotechnology. Oxford & IBH Publishing, New Delhi.
Kalyankumar De 2008. Plant tissue culture. New Central Book Agency, Calcutta
Pandian T.T., Kandavel, D., 2008. Text Book of Biotechnology, I.K International Publishing House Pvt. Ltd., New Delhi.
Ramawat, K.G. 2003. Plant Biotechnology, Ramawat, K.G., 2003. S. Chand and Company Ltd. New Delhi.

Books for Reference

- Bhojwani, S.S. and Razdan, M.K. 2004. Plant Tissue Culture, Read Elsevier India Pvt. Ltd.
Dix, P.J. 1990. Plant cell line and selection: Procedures and Applications, Wiley VCH Publ.
Hammond, J.C. McGarvey and V. Yusibov, 2009. Plant Biotechnology, Springer Verlag. New York.
Purohit S.S. 2010. Plant tissue culture, Student edition, Jodhpur

Elective - III
PLANT PATHOLOGY
(Admitted from 2020 onwards)
Subject Code : 20UIE6B

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

Semester - VI Elective –III Credits - 5 Hours - 4

UNIT- I

Introduction of plant pathology; Disease symptoms of fungal, bacterial and viral pathogens; Leaf spot, Blight, Wilt, Rot, Rust, Smut, Powdery mildew, Downy mildew, Leaf mosaic and Phyllody.

UNIT- II

Dissemination of pathogens – Spore dispersal, role of vectors in viral transmission, influence of weather-wind, temperature and humidity.

UNIT -III

Disease resistance – Morphological, cytological, biochemical and genetical. Role of toxins and enzymes in plant pathogenesis.

UNIT -IV

Modern methods of disease forecast-epiphytotics-causes , course, decline and prophylaxis; Cultural, chemical and biological control. Molecular techniques in plant pathology, Diagnosis of plant pathogens using molecular tools. Incorporation of resistant genes.

UNIT -V

Study of causal organisms , symptoms and control of a) Blast disease of Rice b) Red rot of Sugarcane c) Tikka of Ground nut d) Bacterial blight of Rice e) Citrus canker f) Leaf curl of Papaya g) Tobacco mosaic disease.

REFERENCE BOOKS

1. Bilgrami, K.S. and Dubey, H.C.1985. Text book of Modern Plant Pathology. Vikas Publishing House Pvt.Ltd.
2. Chandhiwala, K.M.1996. Recent advances in Plant Pathology, Series 1 : Introduction to Plant Pathology. Anmol Publications Pvt., Ltd., New Delhi.
3. Pathak, V.N., Khattri, N.K. and Manish Pathak. 1996. Fundamentals of Plant Pathology. Agro Botanical Publishers(India), Bikaner.
4. Vander Plank, J.E.1963. Plant diseases: Epidemics and control. Academic Press, London.
5. Vidhyasekaran, P. 1997. Fungal pathogenesis in plants and crops : Molecular biology and host defense mechanisms. Marcel Dekker, New York p.553.
6. Vidhyasekaran,P. 1988. Physiology of disease resistance in plants. Vol.I. CRC Press, Florida, p.149.
- 6 Vidhyasekaran,P.1988. Physiology of disease resistance in plants. Vol.II. CRC Press, Florida, p.127.

7. Gurr, S.J., Mc Pherson, M.J and Bowles, D.J, 1982. Molecular Plant Pathology: A Practical approach Vol. II. IRL Press, Oxford, England, p.304.
8. Goodman, R.N. Kiraly, Z and Wood, K.R, 1986. The Biochemistry and physiology of plant diseases. University of Missouri Press, Columbia, MO, p.433.
10. Agrios, G.N. 1992. Plant Pathology. Academic Press, London.

ELECTIVE -III
MICROBIOLOGY
Subject Code : 20UIE6B

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

Semester - VI Elective –III Credits - 5 Hours - 4

Unit - I

Introduction to microbiology Definition and scope of microbiology Viruses-General characteristics structure and multiplication of TMV and Bactriophage. Transmission of viruses , symptoms and control Rabies and AIDS.

Unit –II

Food microbiology – microbial flora of food – Food poisoning and food Infection. Industrial manufacture of Ethanol Antibiotics – Penicillin, Vitamin B12 , Aminoacids, Glutamic acid Production of SCP Industrial Effluent.

Unit –III

Dairy microbiology- composition of milk, diary products – cheese and yoghurt. Source and processing of the following fermented foods: saukraut and kimchi tempeh, soysauce, sago and manihot.

Unit-IV

Soil microbiology – soil micro –organism the Rhizophere micro organisms – Organic matter, decomposition Humans functions of Humans. microbial degradation of Cellulose.

Unit- V

Microbiology of domestic water - Microbiologyof drinking water ,municipal water and sewage water - Brief account sewage treatment process . Determination of sanitary quality . Chemotherapy and control of micro – organisms through antibiotics.

Books for study

Tortora, B. Funke and C. Case, 1995. Microbiology: An Introduction 5thedtion, MenloparkCA: 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.

PAPER- XV PRACTICAL – IV (20UIM61)

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

Semester - VI Core –XV Credits - 4 Hours - 2

(COVERING THEORY PAPERS IN VI SEMESTER – PAPERS XI and XIII)

ALLIED BOTANY – I
(2020 onwards)
Subject Code : 20UIA1A

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

Semester - I Allied Paper –I Credits - 4 Hours - 6

UNIT I Outline classification of Plant kingdom - General characters of Algae – Study of structure, Reproduction , Life cycle and economic importance of the following Genera : *Nostoc*, *Chlorella*, *Gracilaria*.

UNIT II Bacteria- General characters, shape, flagellation , structure and reproduction – fission, conjugation and transformation- Economic importance. Viruses –structure of TMV and T4 phage - lytic and lysogenic cycles. Study of structure, reproduction, life cycle and Economic importance of the following genera: *Albugo*, *Penicillium*.

UNIT III General Characters of Bryophytes –Structure, Reproduction and Life cycle of *Marchantia*. General characters of Pteridophytes and Gymnosperms – Study of Structure, Reproduction , Life cycle and economic importance of the following Genera:

a) *Lycopodium* b) *Cycas*

UNIT IV

Taxonomy

Binomial Nomenclature – Bentham and Hooker’s Classification -Study of the range of characters and economic importance of the following families Annonaceae, Cucurbitaceae, Apocynaceae, Euphorbiaceae and Poaceae.

UNIT V

Cell Biology: Structure of a Plant cell, structure of Cell wall – Cell organelles and functions.

Ultrastructure and functions of the following organelles -Chloroplast, Mitochondria, Nucleus –Cell Division – Mitosis and Meiosis.

Practical

A detailed study of the genera included in the theory.

Books for study

Narayanaswamy, R.V. and Rao, K.N. 1976. Outlines of Botany. Viswanathan Printers and Publishers Pvt. Ltd.

Palaniappan, S. 1985, Thavaraviyal Thunaippadam(Tamil), Mohan Padippagam, Chennai.

Pandey B.P, 1986, Text Book of Botany (College Botany) Vol I and II, S.Chand and co. New Delhi.

Rasool SK and Sekar T (2002). Allied Botany ,Populer Book Hour chennai -15.

Books for reference

Dutta, A.C. 1999. Botany for Degree students. Oxford University Press, Calcutta.

Ganguly, A.K., 1971, General Botany, Vol.I, The New Book Stall, Calcutta.

Gangulee, H.C., Das, K.S and Datta, C., College Botany, 2011 Vol.I New Central Book Agency, Kolkatta

Text book of Botany. Pandey, S.N. & Misra S.P Trivedi P.S. vol I and II 2016 -Vikas Publishing House Pvt Ltd., New Delhi.

ALLIED BOTANY – II
(Admitted from 2020 onwards)
Subject Code : 20UIA2A

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

Semester - II Allied Paper –II Credits - 4 Hours - 6

(4 HOURS)

UNIT I

Genetics : Laws of Mendel, Monohybrid and Dihybrid cross –Test cross –Back cross.

Biotechnology - Definition, Principles of Genetic Engineering and applications. Techniques in Plant tissue culture and applications.

UNIT II

Embryology

Structure of mature anther and ovule – structure of mature embryo sac - pollination – types. Double fertilization and Triple fusion. Structure of Dicot embryo (*Capsella* type).

UNIT III

Anatomy

Classification of tissues - Meristematic and Permanent tissue (Simple and Complex tissue). Primary structure of Dicot Stem and root-Monocot stem and root- Structure of Dicot leaf – Secondary growth in dicot stem

UNIT IV

Plant Physiology

Absorption of water –Osmotic and Non-osmotic – Imbibition and Diffusion – Transpiration – definition and types. Photosynthesis – light reaction, Calvin cycle-Factors affecting photosynthesis - Respiration – Aerobic and Anaerobic. Glycolysis, - Krebs cycle- oxidative phosphorylation

UNIT V

Nitrogen metabolism –Importance of nitrogen – Nitrogen cycle –Ammonification- nitrification- denitrification - A brief study on occurrence and physiological effects of growth hormones -auxins, gibberellins and cytokinins. Photoperiodism

Books for study

Narayanaswamy, R.V. and Rao, K.N. 1976.Outlines of Botany. Viswanathan Printers and Publishers Pvt. Ltd.

Palaniappan, S. 1985, Thavaraviyal Thunaippaadam(Tamil), Mohan Padippagam, Chennai.

Pandey B.P, 1986, Text Book of Botany (College Botany) Vol I and II, S.Chand and co. New Delhi.

Rasool SK and Sekar T (2002). Allied Botany ,Populer Book Hour chennai -15..

Books for reference

Dutta, A.C. 1999. Botany for Degree students, Oxford University Press, Calcutta

Ganguly, A.K., 1971, General Botany, Vol.I, The New Book Stall, Calcutta.

Gangulee, H.C.,Das,K.S and Datta, C., College Botany, 2011Vol.I New Central Book Agency,Kolkatta

Pandey, S.N. &Misra S.P Trivedi P.S. vol I and II 2016 - Text book of Botany. vol I and II Vikas Publishing House Pvt Ltd., New Delhi.

REVISED SYLLABUS

(with effect from the academic year 2020– 2021)

ENVIRONMENTAL STUDIES PROGRAMME

ABILITY ENHANCEMENT COMPULSORY COURSES

(AECC- Environmental Studies)

Subject Code :

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester – II & III

EVS Paper –I

Credits - 2

Hours - 2

Semester : IV

Unit 1: Introduction to Environmental Studies

- Multidisciplinary nature of environmental studies;
- Scope and importance; concept of sustainability and sustainable development.

Unit 2 : Ecosystem (2 lectures)

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: Food chains, food webs and ecological succession, Case studies of the following ecosystem:
 - a) Forest ecosystem
 - b) Grassland ecosystem
 - c) Desert ecosystem
 - d) Aquatic ecosystem (ponds, stream, lakes, rivers, ocean, estuaries)

Unit 3: Natural Resources : Renewable and Non – renewable Resources (6 lectures)

- Land resources and land use change: Land degradation, soil erosion and desertification.
- Deforestation : Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water : Use and over –exploitation of surface and ground water, floods, droughts, conflicts over water (international and inter-state).
- Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4: Biodiversity and Conservation (8 lectures)

- Levels of biological diversity: genetics, species and ecosystem diversity, Biogeographic zones of India: Biodiversity patterns and global biodiversity hot spots
- India as a mega- biodiversity nation, Endangered and endemic species of India.
- Threats to biodiversity : Habitat loss, poaching of wildlife, man- wildlife conflicts, biological invasions; Conservations of biodiversity : In-situ and Ex-situ Conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 5: Environmental Pollution (8 lecturers)

- Environmental pollution: types, causes, effects and controls: Air, Water, soil and noise Pollution.
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste
- Pollution case studies.

Unit 6: Environmental Policies & Practices(8 lecturers)

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act, Air (Prevention & Control of Pollution) Act; Water (Prevention and Control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human Wildlife conflicts in Indian context.

Unit 7: Human Communities and the Environment (7 lectures)

- Human population growth, impacts on environment, human health and welfare.
- Resettlement and rehabilitation of projects affected persons; case studies.
- Disaster management: floods, earthquake, cyclone and landslides.
- Environmental movements : Chipko, Silent Valley, Bishnois of Rajasthan.
- Environmental ethics : Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies(e.g. CNG Vehicles in Delhi)

Unit 8 : Field Work (6 lectures)

- Visit to an area to document environmental assets: river / forest/ flora/ fauna etc.
- Visit to a local polluted site – Urban / Rural/ Industrial/ Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystem- pond, river, Delhi Ridge etc.

(Equal to 5 Lectures)

Suggested Readings:

1. Carson , R. 2002.Silent Spring, Houghton Mifflin Harcourt.
2. Gadgil , M.,& Guha, R. 1993.This Fissured Land: An Ecological History of India. Univ.of California Press.
3. Gleeson, B. and Low, N.(eds.)1999. Global Ethics and Environment, London, Routledge.
4. Gleick,P.H.1993.Water Crisis. Pacific Institute for Studies in Dev.,Environment & Security. Stockholm Env.Institute, Oxford Univ.Press.
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SEMESTER : V
PART- IV
VALUE EDUCATION

Common for all U.G. & Five Year Integrated Courses

(Effective from the Academic Year 2020-2021)

Subject Code :

External Marks: 75

Internal Marks: 25

Total Marks: 100

Semester – V

Credits - 2

Hours - 2

Objective : Values are socially accepted norms to evaluate objects, persons, and situations that form part and parcel of sociality. A value system is a set of consistent values and measures. Knowledge of the values are inculcated through education. It contributes in forming true human being, who are able to face life and make it meaningful. There are different kinds of values like, ethical or moral values, doctrinal or ideological values, social values and aesthetic values. Values can be defined as broad preferences concerning appropriate courses of action or outcomes. As such, values reflect a person's sense of right and wrong or what "ought" to be. There are representative values like, "Equal rights for all", "Excellence deserves admiration". "People should be treated with respect and dignity". Values tend to influence attitudes and behavior and help to solve common human problems. Values are related to the norms of a culture.

Unit I: Value education-its purpose and significance in the present world – Value system – The role of culture and civilization-Holistic living – Balancing the outer and inner – Body, Mind and Intellectual level- Duties and responsibilities.

Unit II : Salient values for life- Truth, commitment, honesty and integrity, forgiveness and love, empathy and ability to sacrifice, care, unity , and inclusiveness, Self esteem and self confidence, punctuality – Time, task and resource management
– Problem solving and decision making skills- Interpersonal and Intra personal relationship – Team work – Positive and creative thinking

Unit III : Human Rights – Universal Declaration of Human Rights – Human Rights violations – National Integration – Peace and non-violence – Dr. A P J Kalam's ten points for enlightened citizenship – Social Values and Welfare of the citizen – The role of media in value building.

Unit IV: Environment and Ecological balance – interdependence of all beings – living and non-living. The binding of man and nature – Environment conservation and enrichment.

Unit V : Social Evils – Corruption, Cyber crime, Terrorism – Alcoholism, Drug addiction – Dowry – Domestic violence – untouchability – female infanticide – atrocities against women- How to tackle them

Books for Reference:

1. M.G.Chitakra: Education and Human Values, A.P.H.Publishing Corporation, New Delhi, 2003
2. Chakravarthy, S.K. : Values and ethics for Organizations: Theory and Practice, Oxford University Press, New Delhi , 1999.
3. Satchidananda, M.K.: Ethics, Education, Indian Unity and Culture, Ajantha Publications, Delhi, 1991
4. Das, M.S. & Gupta, V.K. : Social Values among Young adults: A changing Scenario, M.D. Publications, New Delhi, 1995
5. Bandiste, D.D.: Humanist Values: A Source Book, B.R. Publishing Corporation, Delhi, 1999
6. Ruhela, S.P. : Human Values and education, Sterling Publications, New Delhi, 1986
7. Kaul, G.N.: Values and Education in Independent Indian, Associated Publishers, Mumbai, 1975
8. NCERT, Education in Values, New Delhi, 1992
9. Swami Budhananda (1983) How to Build Character A Primer : Ramakrishna Mission, New Delhi
- 10.A Cultural Heritage of India (4 Vols.), Bharatiya Vidya Bhavan, Bombay. (Selected Chapters only)
- 11.For Life, For the future : Reserves and Remains – UNESCO Publication
- 12.Values, A Vedanta Kesari Presentation, Sri Ramakrishna Math, Chennai, 1996
- 13.Swami Vivekananda, Youth and Modern India, Ramakrishna Mission, Chennai
- 14.Swami Vivekananda, Call to the Youth for Nation Building, Advaita Ashrama, Calcutta
- 15.Awakening Indians to India, Chinmayananda Mission, 2003