

**SHRIMATHI DEVKUNVAR NANALAL BHATT
VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS)**

CHENNAI - 600044.

Re accredited with A+ Grade by NAAC

BACHELOR OF SCIENCE

(Shift – DAY)

Under the faculty of Science

PLANT BIOLOGY AND PLANT BIOTECHNOLOGY



**CHOICE BASED CREDIT SYSTEM
(CBCS) OUTCOME BASED
EDUCATION (OBE)**

(Effective from the Academic Year 2020-21)

CONTENT PAGE

	Page No.
Eligibility for Admission	4
Eligibility for the Award of Degree	4
Duration	4
Course of Study	4
Extension Activities	6
Extra - Curricular & Co - Curricular Activities	7
Attendance	7
Break in Study	9
Transfer of Students and Credits	9
Requirements for Proceeding to Subsequent Semesters	9
Passing Requirements	10
Medium of Instruction and Examinations	10
Submission of Record Note Books for Practical Examinations	10
Classification of Successful Candidates	11
Ranking	11
Grading System	11
Classification & Calculation of GPA and CGPA	12
ESE Revaluation	13
Arrear/ Repeat Examinations	13
Supplementary/ Instant Examinations	13
Concessions for Differently – Abled Students	14
Malpractice	14
Maximum Period for Completion of the Programme to Qualify for a Degree	14

Regulatory Bodies	15
Programme Educational Objectives (PEO)	16
Programme Outcomes (PO)	16
Programme Specific Outcomes (PSO)	17
UG/PG Question Paper Pattern	18
Programme Profile	21
Rubrics for CA Evaluation	22
Assessment for End Semester Examination(Theory/ Practical)	23
Course Framework	24
Course Profile	27
Amendments	31

RULES AND REGULATIONS
DEPARTMENT OF PLANT BIOLOGY AND PLANT
BIOTECHNOLOGY
Revised Syllabus of 2020 – 2021

OBJECTIVES OF THE COURSE:
UG REGULATIONS

1. ELIGIBILITY FOR ADMISSION: (To be filled by respective departments)

2. ELIGIBILITY FOR THE AWARD OF DEGREE:

A candidate shall be eligible for the award of the degree only if she has undergone the prescribed course of the 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:

1. 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.
2. 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 consists of the following

PART –I TAMIL / OTHER LANGUAGES

PART – II ENGLISH

PART – III CORE SUBJECTS, ALLIED SUBJECTS, PROJECT/ ELECTIVES

PART- IV

1) NON- MAJOR ELECTIVES

1. 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).

2. Those who have studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Advanced Tamil comprising of two courses.
 3. Others who do not come under a & b can choose Non-Major elective comprising of two courses.
- 2) Skill based subject (Four) – (2 SOFT SKILLS + 1 skill based elective related to the subject +1 Computing skill)
 - 3) Environmental Studies
 - 4) Value Education – Yoga and Wellness
- PART – V EXTENSION ACTIVITIES (SPORTS/NCC/NSS/ROTARACT)
- PART – VI EXTRA- CURRICULAR AND CO-CURRICULAR ACTIVITIES
(Introduced From 2018 onwards)

RECOMMEDED CREDIT DISTRIBUTION

The Minimum Credit Points for UG (Three Year Program)

Particulars	Credits
1. Part I, II,III – (Language/English/Core/Allied)	119
2. Part IV	20
a. Basic Tamil/Advanced Tamil/ Non-major (I & II Sem.)	4
b. Soft Skill (one paper per semester for 4 semesters)	12
c. EVS (III Semester)	2
d. Value Education (VI Sem.)	2
Total (Part I,II,III,IV)	139
Part V Extension Activities	
a. Sports credit for all, (or)Credits to international, national and state players	1-5
b. NCC,NSS,EDP, Consumer club	1-3
Total (PART I,II,III,IV,V)	140-144

CREDITS-UG(HON)

Particulars	Components	No Of Papers	Credits / Paper	Total Credits
Part I Foundation Course	Language(Tamil/Hindi/Sanskrit)	2	3	6
Part II Foundation Course	English	2	3	6
Part III	Core Major	31	4	124
	Project	1	8	8
Total (PART I,II,III)				144
Part IV	Non-Major Electives/ Basic Tamil.Advanced Tamil	2	2	4
	Soft Skill	4	3	12
	EVS	1	2	2
	Value Education	1	2	2
Total(Part IV)				20
	Internship	3+2	2/4	14
Part V	Co-curricular (Sports)		1	1
	Extra-curricular (NCC, NSS,EDP, consumer club)		1-3	1-3
Total				179

5. EXTENSION ACTIVITIES

A candidate shall be awarded a minimum of 1 Credit for Compulsory Extension Service

which is sports. Students can also enrol for NSS /NCC/ Rotaract. Depending on the level of their performance in the above mention activities including sports they can earn 2 to 5 credits and hence the minimum required credits will vary from 140 – 144.

6. EXTRA – CURRICULAR & CO- CURRICULAR ACTIVITIES

A student shall be awarded a minimum of 1 and a maximum of 2 credits depending on her level of performance in any of the following activities: Fine Arts / EDP / Environ Club / Consumer club / Quiz / Debate.

Students are encouraged to take up MOOC (SWAYAM) courses. On successful completion of these courses, students enrolled will be awarded credits 1/2/3 for each course as prescribed in SWAYAM. Students are trained in Advanced Communication and Presentation Skills for which 2 credits are awarded on successful completion of the course.

All these credits together will be considered as extra credits.

7. ATTENDANCE

CATEGORY-A: ATTENDANCE REQUIREMENT

All candidates must put in 75% and above of attendance for Arts, Science, Commerce courses both UG/PG including MBA/MCA Degree courses for appearing the University Examination. (Theory/Practical)

CATEGORY –B: CONDONATION OF SHORTAGE OF ATTENDANCE

If a candidate fails to put in the minimum attendance (Percentage stipulated), the Principals shall condone the shortage of attendance up to a maximum limit of 10% (i.e. between 65% and above and less than 75%) for all UG/PG courses. (i.e. Arts Science, Commerce, MBA and MCA) after collecting the prescribed fee of RS.250/-each for Theory/Practical examination separately, (Theory Rs.250/- Per semester/Per Candidate: Practical Rs.250/- Per semester/ Per Candidate) towards the condonation of shortage of attendance.

CATEGORY-C: NOT ELIGIBLE FOR CONDONATION OF SHORTAGE OF ATTENDANCE

Candidates who have secured less than 65% but more than 50% of attendance are NOT ELIGIBLE for condonation of shortage of attendance and such candidates will not be permitted to appear for the regular examination, but will be allowed to proceed to the next year/next semester of the course and they may be permitted to take next University

examination by paying the prescribed condonation fee of Rs.250/- each for Theory/Practical separately. Names of such candidates should be forwarded along with their attendance details in the prescribed format mentioning the category(3copies). Degree Wise/Year wise/Branch wise/semester wise/together with the fees collected from them. So as to enable them to get permission from the University and to attend the Theory/Practical examination subsequently without any difficulty.

CATEGORY-D: DETAINED STUDENTS FOR WANT OF ATTENDANCE

Candidate who have put in less than 50% of attendance have to repeat the course (by re-joining) for which they lack attendance without proceeding for II/III year as the case may be. Until they re-join the course and earn the required attendance for that particular semester/year, no candidates shall be permitted to proceed to the next year/next semester of the course under any circumstances. They have to obtain prior permission from the University to re-join the course.

Provided in case of candidates who are admitted form the academic year 2003 -2004 earning less than 50% of attendance in any one of the semesters due to any extraordinary circumstances such as medical ground, such candidates 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 candidates shall have to repeat the semester, which they have missed by re-joining after completion of final semester of the course, by paying the fee for the break of study ad prescribed by the University from time to time.

CATEGORY-E: CONDONATION OF SHORTAGE OF ATTENDANCE FRP MARRIED WOMEN STUDENTS

In respect of married women students undergoing UG/PG course, the minimum attendance for condonation (Theory/Practical) shall be relaxed and prescribed ad 55% instead of 65% if they conceive during their academic career. Medical certificate form the Doctor attached to the Government Hospital (D.G.O) and the prescribed fee of Rs.250%- therefor together with the attendance details shall be forwarded to this off ice to consider the condonation of attendance mentioning the category.

0% Attendance

The candidates who have earned 0% of attendance, have to repeat the course (by re-joining) without proceeding to succeeding semester and they have to obtain prior permission

form the University to re-join the course immediately for which applications issued for the academic year.

8. BREAK IN STUDY

After enrolling into any of the courses offered by the college a student is allowed to be absent continuously for period of FIVE years (Max. Condonable period- from the day of enrolment) after which she forfeits her admission.

A student who wants to continue her study within the condonable break period can rejoin in the same semester in the EXISTING VACANCY after getting the permission from the Principal and subsequently from University of Madras. Such students should also get a letter from the respective Head of the Department stating that she is not repeating any paper which she has already completed in other semesters.

9. TRANSFER OF STUDENTS AND CREDITS:

Transfer from other Autonomous or Non-Autonomous college or from other University is allowed for the same program with same nomenclature provided there is a vacancy in the respective program of study and the student has passed all the examinations under the previous system. **Students with standing arrears are NOT eligible for transfer.**

The marks obtained in the previous system will be converted and grades will be assigned as per the University norms.

Such students **are eligible** for classification.

Such student is NOT eligible for ranking, prizing and medals on qualifying the UG degree.

10. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTERS

- 1) Candidate shall register their names for the First Semester Examination after the admission in the B.Sc., Course.
- 2) Candidates shall be permitted to proceed from the first semester up to the final Semester irrespective of their failure in any of the Semester Examinations subject to the condition that the candidate should register for all arrear subjects of earlier semesters along with current (subject) semester subjects.

11. PASSING REQUIREMENTS

- 1) There shall be no passing minimum for Internal. But 0 also should not be awarded. In case a student absents herself for all the CIA exams and ends in getting 0 in internal in a particular subject, she will be awarded 1 or 2 marks for attendance.
- 2) For all subjects except B.Com Honours (Theory/Practical/Project-Parts I, II, III, IV) the passing requirement is as follows: i) candidate should secure not less than 40% of marks in End Semester Examination (ESE) and not less than 40% in aggregate of the total internal and external marks. For B.Com Honours i) candidate should secure not less than 50% of marks in End Semester Examination (ESE) and not less than 50% in aggregate of the total internal and external marks.
- 3) A candidate who passes in all subjects earning minimum of 140 credits within the maximum period of five years reckoned from the date of admission to the course shall be declared to have qualified for the degree.
- 4) Grading shall be based on overall marks obtained (Internal + External)

12. MEDIUM OF INSTRUCTION AND EXAMINATIONS

The medium of instruction and examinations for the papers of Part I, II & IV shall be the language concerned. For part III subjects other than modern languages, the medium of instruction shall be either Tamil or English and the medium of examinations is in English/Tamil irrespective of the medium of instructions. For modern languages, the medium of instruction and examination will be in the languages concerned.

13. SUBMISSION OF RECORD NOTE BOOKS FOR PRACTICAL EXAMINATIONS

Candidates appearing for practical examinations should submit bonafide Record Note Books prescribed for practical examinations, otherwise the candidates will not be permitted to appear for the practical examinations.

14. CLASSIFICATION OF SUCCESSFUL CANDIDATES

1. A Candidate who qualifies for the Degree and secures CGPA between 9.0 – 10.0 shall be declared to have passed the examination in **FIRST CLASS - EXEMPLARY** provided she has passed the examination in every subject she has registered as well as in the project work in the first appearance.
2. A Candidate who qualifies for the Degree and secures CGPA between 7.5 – 8.9 shall be declared to have passed the examination in **FIRST CLASS WITH DISTINCTION** provided she has passed the examination in every subject he/she has registered as well as in the project work in the first appearance.
3. A candidate who qualifies for the degree as per the regulations for passing requirements and secures CGPA between 6.0 – 7.4 shall be declared to have passed the examination in **FIRST CLASS**
4. A candidate who qualifies for the degree as per the regulations for passing requirements and secures CGPA between 5.0 – 5.9 shall be declared to have passed the examination in **SECOND CLASS**
5. All other successful candidates shall be declared to have passed in **THIRD CLASS**.
6. Only those candidates who have passed all the papers including practical and project work in the first appearance shall be considered for the purpose of **RANKING**.

15. RANKING

- 1) Candidates who pass all the examinations prescribed for the course in the first appearance itself alone are eligible for Ranking / Distinction.
- 2) Provided in the case of candidates who pass all the examinations prescribed for the course with a break in the First Appearance due to lack of attendance are only eligible for classification.

16. GRADING SYSTEM

The term grading system indicates a **SEVEN (7)** point scale of evaluation of the performance of students in terms of marks obtained in the Internal and External Examination, Grade points and letter grade.

Minimum Credits to be earned:

For THREE year UG Programme: Best 140 - 144 Credits (Part I and II:Foundation Courses, Part III Major, Allied, Elective, Part –IV Soft skills and Part V: Extension activities)

Conversion of Marks to Grade Points and Letter Grade

(Performance in a Course / Paper)

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	DESCRIPTION
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
40-49	4.0-4.9	C	Satisfactory
00-39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

17. CLASSIFICATION & CALCULATION OF GPA AND CGPA

For a Semester :

GRADE POINT AVERAGE [GPA]

$$\text{GPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the courses}}{\text{Sum of the credits of the courses in a semester}}$$

For the entire programme:

$$\text{CGPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the courses for entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

CUMULATIVE GRADE POINT AVERAGE [CGPA]

CGPA	GRADE	CLASSIFICATION OF FINAL RESULT
9.5-10.0	O+	First Class - Exemplary *
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction *
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
4.5 and above but below 5.0	C+	Third Class
4.0 and above but below 4.5	C	
0.0 and above but below 4.0	U	Re-appear

*The candidates who have passed in the first appearance and within the prescribed semester of the UG Programme (Major, Allied and Elective courses alone)/PG/M.Phil. are eligible.

18. ESE REVALUATION

A student is eligible to appeal for revaluation of the paper only **if she secures a minimum of 10 in the internal tests (CAT) of that paper** if the internal maximum marks is 25 and **a minimum of 6 in the internal tests (CAT) of that paper** if the internal marks is 15. This has to be done within 10 days from the publication of results. She also has to pay the prescribed fee. The revaluation will be done by an external examiner appointed by the Principal.

19. ARREAR / REPEAT EXAMINATIONS

- 1) A candidate having arrear paper(s) shall have the option to appear along with the regular semester papers.

- 2) Candidates who fail in any of the papers in Part I, II, III & IV of UG degree examinations shall complete the paper concerned within **FIVE (N + 2)** years from the date of admission to the said course.

20. SUPPLEMENTARY / INSTANT EXAMINATION

- 1) Final year students (UG – III year 6th semester) are **only** eligible to apply for Supplementary / Instant Examination.
- 2) Students who have only one paper as arrear in the final semester are allowed to take up supplementary / instant examination.
- 3) Supplementary / Instant Examination will not be conducted for practical papers and projects.

21. CONCESSIONS FOR DIFFERENTLY-ABLED STUDENTS

- 1) Students who are mentally disabled, learning disability and mental retardation, who are slow learners, who are mentally impaired having learning disorder and seizure disorder and students who are spastic and cerebral palsy the following concessions shall be granted obtaining prior permission from the University
 - a. Part I Foundation course Tamil or any Language can be exempted.
 - b. One-third of the time of paper may be given as extra time in the examination.
 - c. Leniency in overlooking spelling mistakes
- 2) Students who have hearing, speaking impaired
 - a. Part I Foundation course Tamil or any Language can be exempted.
 - b. Part IV Non-Major Elective / Basic Tamil / Advanced Tamil can be exempted.
- 3) Students who are visually challenged
 - a. Exempted from paying examination fees.
 - b. A scribe shall be arranged by the college and the scribe be paid as per the college decision.

22. MALPRACTICE

The College views malpractice of any kind very seriously. The college has a Malpractice committee consisting of four senior staff members. Students found to be directly or indirectly involved in malpractice of any kind during examinations will be subject to penalty of very high proportions.

23. MAXIMUM PERIOD FOR COMPLETION OF THE PROGRAMME TO QUALIFY FOR A DEGREE:

1. A student who for whatever reasons is not able to complete the programme within the normal period (N) or minimum duration prescribed for the programme, may be allowed **TWO** year period beyond the normal period to clear the backlog to be qualified for the degree. (Time span is $N + 2$ years for completion of the programme)
2. In exceptional cases like major accidents and child birth, an extension of **ONE** year be considered beyond maximum span of time that is $N + 2 + 1$. Students qualifying during the extension period are **NOT** eligible for ranking.

24. REGULATORY BODIES

Under autonomy, the college is free to frame its curriculum and conduct examinations. These functions are monitored by the **Board of Studies, Board of Examiners and the Academic Council.**

Board of Studies

Separate Board of studies are constituted for each programme offered by a department. Each Board of Studies will meet at least once a year to design courses, modify syllabi / examination pattern and recommend the same to the Academic Council.

The Board of Studies is composed of:

- ◆ Head of the respective department (Chair person)
- ◆ Two senior staff members of each specialization apart from Chair person.
- ◆ Two subject experts from outside the parent University.
- ◆ One subject experts from within parent University.
- ◆ One representative from Industry / Corporate sector / allied area.
- ◆ One alumnus
- ◆ One student representative from current batch (preferably a meritorious final year student).

The tenure of the external experts is for TWO years.

Board of Examiners

A list of board of examiners is obtained by circulating the details of courses offered by the

college to other colleges and through the list provided by the departments. Single valuation is done for UG courses and double valuation, one Internal and one External, for PG courses.

Academic Council

The Academic Council is composed of:

- ◆ The Principal (Chairman)
- ◆ All heads of the department in the college
- ◆ Four senior teachers of the college representing different categories of teaching
- ◆ Four representatives from the Industry / Corporate sector / allied area relating to placement / Commerce / Law / Education / Medicine / Engineering nominated by the Governing Body
- ◆ Three nominees of the University of Madras
- ◆ A faculty member nominated by the principal (Member Secretary)

The term of the nominated members shall be TWO years.

25. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 : Provides an insight into biology to make scientific queries and enhance the comprehension potential.

PEO 2 : Learn the Scientific knowledge in life science and fundamental metabolism of Plants and Microbes.

PEO 3 : Imparts value orientation study to cope with growing competition for higher studies and employment.

PEO 4 : Acquire practical skills to gather information, assess, create and execute new ideas to develop entrepreneurial skills

PEO 5 : Receive training in pedagogy, research skills and methodology.

26. PROGRAMME OUTCOMES (POs)

PO 1 : Develop sharp cognisance of concepts, apply the domain knowledge with utmost confidence and be assertive at any given opportunity.

PO 2 : Possess deeper understanding of lifeskills to appraise life and draw logical conclusions.

PO 3 : Design and develop solutions for challenging problems of society.

PO 4 : Acquire programme centric thought process facilitating further studies in the respective domain.

PO 5 : Engage in life-long learning to easily adapt to the dynamic environment and obtain clarity and preparedness for field specialization

PO 6 : Self actualise and self regulate, focussing on ethical and moral values to become a compassionate human being.

27. PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1 : Understand the core knowledge of the anatomy, morphology, systematics, genetics, physiology and ecology of marine and terrestrial plants, with particular emphasis on India's unique flora and ecosystems.

PSO 2 : Acquire academic excellence with an aptitude for higher studies, research and so meet competitive exams

PSO 3 : Entrepreneurship skill development

PSO 4 : Scientific knowledge in life science and fundamental metabolism of plants.

PSO 5 : Students will acquire digital skills and integrate the fundamental concepts with modern Tools.

PSO6 : Knowledge about biodiversity exploration, estimation and conservation

Bloom's Category Level	Sections	Marks	Word limit	Total	Meaning of K's
K1,k2	Section A Multiple Choice Questions	15X2=30	Mark the correct choice	75	K 1 & K2 - Understanding Level K 3 - Apply Level K 4 - Analyze Level K 5 – Evaluate Level K 6 – Create Level
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	25	Short answers (500 Words)		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	20	Elaborate answers (approx 1000 Words)		

28. QUESTION PAPER PATTERN:

QUESTION PAPER PATTERN FOR OBE (2020-21 onwards)

Theory UG –Question paper Pattern- Conventional on-paper mode

* 75 marks to be converted as 60 marks.

UG/PG QUESTION PAPER PATTERN FOR OBE

ONLINE ASSESSEMENT (2020 - 2021)

Bloom's Category Level	Sections	Marks	Description of answer	Total	Meaning of K's
INTERNAL SETTING					
K1,K2 ,K3	Section A Multiple Choice Questions 25 Questions *1 Marks (No Choice)	25X1=25	Choose the write option.	50	K 1 & K2 - Understanding Level K 3 - Apply Level K 4 - Analyze Level K 5 – Evaluate Level K 6 – Create Level
EXTERNAL SETTING					
K2,k3, K4,K5, K6	Section B 5 out of 7 Questions *5 Marks	25	Short answers/500 Words		

* 50 marks to be converted as 60 marks.

BLOOM'S CATEGORY LEVEL (ANNEXURE chart)

S.no	K component scale	Verbs for question
I.	K 1& K2 Verbs	Verbs to be used for questioning are “choose, find, identify, indicate, match, name, state, what, when, where, which, who, cite, label, reproduce. define, list, quote, revise, explain, show, sketch, illustrate, interpret, describe, substitute, convert, give example, rephrase

2.	K2 &K3	The questions may contain the verbs such as explain, show, sketch, illustrate, interpret, describe, substitute, convert, examFle, rephrase, apply, relate, solve, classify, predict, compute, prepare
3.	K4	The questions may contain verbs - Apply, relate, solve, classify, predict, compute, prepare.
4.	K5	The questions may contain any of the following verbs : Ascertain, diagnose, distinguish, infer, associate, examine, differentiate, reduce, discriminate, dissect, determine, justify, organize, recommend, solve.
5	K6	The questions may contain any of the following verbs: Appraise, conclude, critique, judge, assess, contrast, deduce, weigh. Compare, criticize, evaluate.

Question paper pattern for Continuous Assessment Test (CAT)

(The online assessment pattern)

U.G/P.G PROGRAMME

SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV

COLLEGE FOR WOMEN

B.Sc DEGREE EXAMINATION, ----- 2020.

----- YEAR - ----- SEMESTER

CAT – I/II/III

Sub Title:

Max. Marks: 50

Sub Code:

Date:

Time: 2hrs.

Question paper Pattern-Two Components: (Max marks=50) - 3hrs

I. Multiple Choice Questions (MCQ) - 20 marks (10x2=20)

II. Google Class Room (GCR) - 30 marks (Structured)

A. Section A: 5 out of 6 – each carries 2 marks (5x2=10)

B. Section B: 4 out of 5 – each carries 5 marks (4x5=20)

- The answers for the questions for QP uploaded in GCR will be as uploads (images of hand written answer sheets converted to .pdf) in Google Class Room.
- The duration for each GCR session (answering and uploading) would be 3 hours (maximum).
- The structured component (30 marks) SHOULD be conducted in GCR as per the CAT schedule.MCQ (10X2=20) CAN be conducted out of schedule also, but should be completed during the CAT examination scheduled.

Note: The GCR question paper and MCQ assessment links to be shared with the COE office for approval and validity on or before the respective allotted dates.

PROGRAMME PROFILE

PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

TOTAL CREDITS: 140

TOTAL TEACHING HRS: 180

PART	COURSE	TITLE OF THE PAPER	CODE	L	T	H	C
I SEMESTER							
I	Tamil/Hindi/ Sanskrit	Tamil - I/Hindi-I/Sanskrit-I	20ULTFC1001/ 20ULHFC1001/ 20ULSFC1001				3
II	English	General English-I	20UGEFC1001				3
III	Core I	Phycology	20UPBCT1001	45	15	4	4
	Core II	Mycology and Lichens	20UPBCT1002	45	15	4	4
	Allied I	Zoology-I	20UPBAP1001	45	15	4	4
IV	Soft skill	Soft Skills – Essentials of Communication Skills	18USSLC1001				3
	EVS	Environmental Studies		15			2
II SEMESTER							

I	Tamil/Hindi/ Sanskrit	Tamil - II/Hindi-II/Sanskrit-II	20ULTFC2001/ 20ULHFC2001/ 20ULSFC2001	90		4	3
II	English	General English-II	20UGEFC2002	90		4	3
III	Core III	General Microbiology and Plant Pathology	20UPBCT2001	45	15	4	4
	Core IV	Bryophytes and Pteridophytes	20UPBCT2002	45	15	4	4
	Allied II	Zoology-II	20UPBAP2001	45	15	4	4
	Core P - I		20UPBCP2001	30		2	2
	Core AP - I		20UPBAP2001	30		2	2
IV	Soft skill	Soft Skills – Essentials of Communication Skills					3
	EVS	Environmental Studies					2
	Yoga and wellness	Yoga and wellness					2
III EMESTER							
I	Tamil/Hindi/ Sanskrit /French	Tamil - III/Hindi-III/Sanskrit-III					3
II	English	General English-III					3
III	Core V	Cell biology and molecular biology		45	15	4	4
	Core VI	Anatomy of angiosperm and embryology		45	15	4	4
	Allied I	General Chemistry - I		60		4	4
IV	NME	NME – Offered to other department students					2
IV SEMESTER							
I	Tamil/Hindi/ Sanskrit /French	Tamil - IV/Hindi-IV/Sanskrit-IV					3
II	English	General English-IV					3
III	Core VII	Gymnosperms, Paleobotany and Evolution		45	15	4	4
	Core VIII	Plant ecology and Environmental Biotechnology		45	15	4	4
	Allied II	General Chemistry-II				4	4
	Core P - II			30		2	2
	Core AP - I	Allied Practical		30		2	2
IV	NME	NME – Offered to other department students					2

V SEMESTER							
	Core IX	Genetics and Plant Breeding		45	15	4	4
	Core X	Taxonomy of Angiosperm and Economic Botany		45	15	4	4
	Core XI	Bioinstrumentation, Bioinformatics and Biostatistics		45	15	4	4
	Core Elective - 1	Herbal Medicine		45	30	5	5
IV		Skill Enhancement course					
		VI SEMESTER					
	Core XII	Plant Physiology, Biochemistry and Biophysics		45	15	4	4
	Core XIII	Plant Biotechnology		45	15	4	4
	Core Elective - II	Horticulture		45	30	5	5
	Core Project	Project					
	Core P III						
	Core P IV						
IV	Skill based Elective	Offered to students of same department SWAYAM – MOOC					

L =Lecture Hrs; T =Tutorial Hrs; H = Hrs per week; C =Credits

RUBRICS FOR CONTINUOUS ASSESSMENT

Assignment	
Seminar	
Field visit	
Participatory Learning	
Group Discussion	
Flipped/Blended Learning	

Assessment Model (from 2020 – 21 onwards)
Under graduation programme
40% Internal 60% External

S.No	Assessment Component	Marks	Weighted %
A.	Theory		
1	INTERNAL ASSESSMENTS		
	Continuous Assessment Test (best two out of three)	2 x 50 = 100	15
2	Quiz/Group Discussion/Seminar/Assignment/Role Play/ Case Study/ Open Book/ snap Test/ Video Presentation/ Review (any three to be considered)	3 x 10 = 30	15
3	MCQ (one test to be conducted online during the semester)	20	05
4	Attendance*	05*	05
5	EXTERNAL ASSESSMENT		
	End semester examinations	75	60
	Grand Total		100
B	Practical		
1	INTERNAL ASSESSMENTS		
	Continuous Assessment Test (best two out of three)	2 x 50 = 100	15
2	Record + Observation	10 +10 = 20	15
3	MCQ (one test to be conducted online during the semester)	20	05
4	Attendance*	5*	05
5	EXTERNAL ASSESSMENT		
	End semester Examinations	60	60
	Grand Total		100

Attendance* - awarding marks for attendance (out of 5)

Attendance below 60% = 0 marks; 61% to 75% = 3 marks; 76% to 90% = 4 marks; above 91% = 5 marks

**DEPARTMENT OF PLANT BIOLOGY AND PLANT
BIOTECHNOLOGY
SDNB VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS)
CHENNAI-600044.
COURSE FRAME WORK
SEMESTER I**

SEM I	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HRS	CREDITS	CA	SE	T
PART - I	20ULTFC1001/ 20ULHFC1001/ 20ULSFC1001	Tamil/Hindi/ Sanskrit	Tamil - I/Hindi-I/Sanskrit-I	60	4	40	60	100
PART - II	20UGEFC1001	English	General English-I	60	4	40	60	100
PART - III	20UPBCT1001	Core I	Phycology	60	4	40	60	100
	20UPBCT1002	Core II	Mycology and Lichens	60	4	40	60	100
	20UPBAP1001	Allied I	Zoology-I	60	4	40	60	100
PART - IV	18USSLC1001	Soft skill	Soft Skills – Essentials of Communication Skills		3			
		EVS	Environmental Studies	15				
			TOTAL					

SEMESTER I

CORE PAPER I - PHYCOLOGY

TOTAL HOURS: 60

SUB CODE:20UPBCT1001

CREDIT: 4

L-T-P: 3 -1 - 2

COURSE OBJECTIVES

1. Learn about the structure, pigmentation, food reserves and methods of reproduction of Algae
2. Know about the commercial cultivation of *Spirulina* and Economic importance of algae
3. Learn to isolate, culture and identification of algae

COURSE OUTCOMES: On completion of the course the students will be able to...

CO No.	CO Statement
CO1	Classify algae based on their characteristics and structures
CO2	Outline the structure, pigmentation, food reserves and methods of reproduction of
CO3	Develop critical understanding of some algal genera and their reproduction.
CO4	Apply the skill of isolation and cultivation of beneficial algae for mass cultivation
CO5	Increase the awareness and appreciation of algae and their economic importance

SYLLABUS

UNIT- 1

15 Hrs

Introduction to Algae, General characters – Habitat, Habit, Pigmentation, Flagellation, Reserve food, Reproduction and Life cycle. Classification of Algae – F.E. Fritsch, 1945.

UNIT- 2

15 Hrs

General characteristic features of Cyanophyceae, Chlorophyceae, Phaeophyceae, Rhodophyceae - Habitat, Habit, Pigmentation, Flagellation, Reserve food, Reproduction and Life cycle.

UNIT- 3

15 Hrs

External and Internal Structure, Vegetative, Asexual and Sexual Reproduction and Life cycle of following genera : *Anabaena*, *Ulva*, *Sargassum*, *Gracilaria*.

UNIT- 4

15 Hrs

Isolation and Culture of algae – Collection, Media preparation, Sterilization, Inoculation, Culture conditions and Maintenance.

UNIT- 5

15Hrs

Algal biofertilizers, SCP, their nutritional value and biomass production; Industrial products: Diatomaceous earth, Alginates, Agar.

TEXT BOOKS:

1. Vashishta, B. R., Sinha, A. K., & Singh, V. P. (2008). Botany for Degree Students: Algae. S. Chand & Company Ltd, New Delhi.
2. Vashishta, B. R. (2010). Botany for degree students Algae. S. Chand and Company Ltd, New Delhi.
3. Sambamurthy, A. V. S. S. (2006). A Textbook of Algae. I. K. International Pvt. Ltd., New Delhi.
4. Tirupathi, B. N., & Kumar, D. (2017). Prospects and Challenges in Algal Biotechnology. Springer; 1st ed.
5. Sharma O. P. (2011). Algae. Tata McGraw Hill Co.

BOOKS FOR REFERENCE:

1. Lee, R. E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
3. Campbell, N. A., Reece, J. B., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky P. V. & Jackson, R. B. (2008). Biology, 8th edition. Pearson Benjamin Cummings, USA.
4. Bux. F., & Chisti, Y. (2016). Algae Biotechnology, Products and Processes. Springer Nature; 1st ed.
5. Dinabandhu Sahoo & Kaushik, B. D. (2012). Algal Biotechnology and Environment. International Publishing House Pvt. Ltd; 1st Edition.

E-LEARNING RESOURCES:

<https://www.toppr.com/guides/biology/plant-kingdom/algae>

<https://www.britannica.com/science/algae/Classification-of-algae>

<https://www.ck12.org/biology/algae-classification/lesson/Classification-of-Plant-like-Protists-Advanced-BIO-ADV>

<https://www.microscopemaster.com/algae.html>

www.agrifarming.in/tag/spirulina-algae-cultivation-in-india

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	1	1	3	1	3
CO2	3	3	2	3	1	3
CO3	3	2	2	2	1	3
CO4	2	3	3	3	2	2
CO5	2	3	3	3	1	2
Average	2.6	2.4	2.2	2.8	1.2	2.6

KEY : Algae, *Anabaena*, *Ulva*, *Sargassum*, algal culture, SCP, Diatomaceous earth and Alginates

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	30	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx1000 Words)	20		

SEMESTER I

CORE PAPER II – MYCOLOGY AND LICHENS

TOTAL HOURS: 60

SUB CODE: 20UPBCT1002

CREDIT:

L-T-P: 3 -1 - 2

COURSE OBJECTIVES

1. Understand the students about diversity of fungi and Lichens
2. Designed to familiarize the industrial microbes
3. Know the economic importance of fungi and mushroom cultivation.

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Develop an understanding about the classification of fungi.
CO2	Develop critical understanding of some fungal genera and their reproduction
CO3	Analyze the various aspects of the fermentation technology and apply for Fermentative production
CO4	Demonstrate skills in laboratory, field and glasshouse work related to mycology and plant pathology.
CO5	Develop an understanding of lichens and appreciate their adaptive strategies.

SYLLABUS

UNIT- 1

15 Hrs

Mycology – Introduction – Systematics of fungi (Alexopoulos) General characteristics: Mode of nutrition, cell wall composition, spore formation, reproduction and uses of following classes: Oomycetes, Ascomycetes, Basidiomycetes.

UNIT- 2

15 Hrs

Morphology, structure, reproduction and life cycle of following genera: *Albugo*, *Aspergillus* and *Peziza*.

UNIT- 3

15 Hrs

Economic importance of fungi: Citric acid production by *Aspergillus niger*. Antibiotics- Penicillin; Enzymes from microbes and their application- Amylase, Proteases.

UNIT- 4

15 Hrs

Mushroom cultivation: Oyster mushroom - nutritional value, method of cultivation: spawn production, substrate preparation, Oyster mushroom bag preparation, maintenance, harvesting and control of pests and pathogens.

UNIT- 5

15 Hrs

Lichens: Occurrence; General characteristics: Growth forms and range of thallus organization; Nature of associations of algal and fungal partners, types, structure and reproduction of Lichens. Morphology, taxonomy, reproduction and uses of *Usnea*. Economic importance of lichen.

TEXT BOOKS:

1. Webster, J., & Weber, R. (2007). Introduction to Fungi. 3rd edition. Cambridge University Press, Cambridge.
2. Sethi, I. K., & Walia, S. K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
3. Sharma, P. D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.
4. Sambamurthy, A. V. S. S. (2006). A Textbook of Plant Pathology. I. K. International Pvt. Ltd., New Delhi.
5. Pandey, B. P. (2001). College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.

BOOKS FOR REFERENCE:

1. Ulloa, M., Hanlin, R.T. (2000). Illustrated Dictionary of Mycology. APS Press, St. Paul, MN.
2. Watling, Roy. (2003). *Fungi*. Smithsonian Institution Press,
3. Miller, O. & Miller, H. (2006). *North American Mushrooms*. Globe Pequot Press, Guilford, CT.
4. Alexopoulos, C. J. (1971). *Introductory Mycology* – John Wiley and Sons Inc. New York, London.
5. Kumar, H. D. & Singh, H. N. (1982). *A text Book on Algae*, Affiliated East West Press Pvt. Ltd. New Delh

E-LEARNING RESOURCES

1. <http://mycology.cornell.edu/>
2. <https://testguide.adhb.govt.nz/EGuide/?elv=2&cgl=1809&sd=3>
3. <https://mycology.adelaide.edu.au/>
4. <https://mycology.adelaide.edu.au/reference-centre/>
5. <https://www.emlab.com/resources/fungal-library/references/>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	1	1	3	1	3
CO2	3	1	2	2	1	3
CO3	2	3	3	3	2	2
CO4	3	3	3	3	2	2
CO5	3	1	1	2	1	3
Average	3	1.8	2	2.6	1.4	2.6

KEY : *Albugo, Aspergillus, Peziza, Mushroom, citric acid and lichen*

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	30		
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx 1000 Words)	20		

DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**SDNB VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS)****CHENNAI-600044.****COURSE FRAME WORK****SEMESTER II**

SEM II	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HRS	CRE DITS	CA	SE	T
PART - I	20ULTFC2002/ 20ULHFC2002/ 20ULSFC2002	Tamil/Hindi/ Sanskrit	Tamil - I/Hindi- I/Sanskrit-I					
PART - II	20UGEFC2002	English	General English-II					
PART - III	20UPBCT2003	Core II	General Microbiology and Plant Pathology	60	4	40	60	100
	20UPBCT2004	Core III	Bryophytes and Pteridophytes	60	4	40	60	100
	20UPBAP2002	Allied II	Allied Zoology - II	60	4	40	60	100
PART - IV	20UPBCP2001	Core Practical I	Core Practical - I	30	2			
	20UPBAP2001	Allied Practical I	Allied Zoology - I	30	2			
	18USSLC2002	Soft skill	Soft Skills – Essentials of Communication Skills		3			
		EVS	Environmental Studies	15	2			
			TOTAL					

SEMESTER II

CORE PAPER III – GENERAL MICROBIOLOGY AND PLANT PATHOLOGY

TOTAL HOURS: 60
CREDIT: 4

SUB CODE: 20UPBCT2003
L-T-P: 3 -1 -2

COURSE OBJECTIVES

1. Understand the structure, nutrition and reproduction of bacteria, types of virus and their structure and reproduction.
2. Develop knowledge on methods of studying microbes and applied aspects of microbiology on milk, food, beverages, antibiotics and enzymes.
3. Deals with the role of microbes in plant diseases.

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Learn about classification, characteristics, ultra structure of Prokaryotic and Eukaryotic microbes.
CO2	Develop understanding on the concept of microbial nutrition and respiration
CO3	Develop critical understanding of Bacteria and their reproduction.
CO4	Increase the awareness and appreciation of algae and their economic importance
CO5	Know about organisms and causal factor responsible for plant diseases & methods of studying plant diseases

SYLLABUS

UNIT- 1

15 Hrs

Introduction, Major group of Microbes (Protists, Cyanobacteria, Fungi, and Viruses). Bacteriophages – Structure and reproduction of T₄ Bacteriophage (lytic cycle and lysogenic cycle).

UNIT- 2

15 Hrs

Ultra-structure of Bacteria, types, Flagellation, Nutritional types – Autotrophs and Heterotrophs. Respiration – aerobic and anaerobic.

UNIT- 3

15 Hrs

Bacterial reproduction & sexuality: Asexual – Fission, Budding and Endospores. Sexual – Transformation, Transduction & Conjugation.

UNIT- 4

15 Hrs

Economic importance of Bacteria: Role in decay & decomposition, soil fertility (Nitrogen cycle), role in molecular biology, milk industry and role in the field of medicine

UNIT- 5

15 Hrs

Study of causal organisms and symptoms of a) Red rot of Sugarcane b) Tikka of Ground-nut c) Bacterial blight of Rice d) Citrus canker e) *Fusarium* wilt of Cotton f) Tobacco Mosaic Virus (TMV).

TEXT BOOKS:

1. Pandey, B. P. (2001). College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
2. Pandey, B. P. (2007). Botany for Degree Students: Diversity of Microbes, Cryptogams, Cell Biology and Genetics. S. Chand & Company Ltd, New Delhi.
3. Thakur, A. K. & Bassi., S. K. (2008). A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.
4. Tortora, G. J., Funke, B. R., Case, C. L. (2008). Microbiology: An Introduction, 8th edn. Benjamin Cummings.
5. Prescott, L., Harley, J. P., & Klein D. A. (2008). Microbiology, 7th edn. Wm C. Brown -

McGraw Hill, Dubuque, IA.

BOOKS FOR REFERENCE:

1. Whitman, W. B. (2015). *Bergey's Manual of Systematics of Archaea and Bacteria*. John Wiley and Sons.
2. Campbell, N. A., Reece, J. B., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky P. V. & Jackson, R. B. (2008). *Biology*, 8th edition. Pearson Benjamin Cummings, USA..
4. Pelczar, M. J. (2001). *Microbiology*, 5th edition, Tata McGraw-Hill Co, New Delhi.
5. Rangaswami G and Mahadevan A.2003. *Diseases of crop plants in India*. Prentice Hall of India Pvt. Ltd.

E-LEARNING RESOURCES

1. <https://microbiologyonline.org/>
2. <https://uwyo.libguides.com/c.php?g=97838&p=633430>
3. <https://jcm.asm.org/>
4. <https://open.umn.edu/opentextbooks/textbooks/microbiology>
5. <http://www.bionewsonline.com/pub/pub1.htm>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	1	3
CO2	3	2	2	3	1	3
CO3	3	2	2	3	1	3
CO4	2	3	3	2	2	2
CO5	3	3	1	2	2	3
Average	2.8	2.4	2	2.6	1.4	2.8

KEY : Bacteria, Fungi, Virus, Citrus canker, Diseases, Bacteriophage.

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	30	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx 1000 Words)	20		

SEMESTER II

CORE PAPER IV – : BRYOPHYTES AND PTERIDOPHYTES

TOTAL HOURS: 60
CREDIT: 4

SUB CODE: 20UPBCT2004
L-T-P: 3 -1 - 2

COURSE OBJECTIVES

1. To understand the diversity and their distribution
2. To know the importance of Bryophytes and Pteridophytes
3. To understand the evolution of plants

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Learn about the general characters and economic importance of Bryophytes which make to understand Reimer's classification.
CO2	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes.

CO3	Analyze the the general characters and economic importance of Pteridophytes.
CO4	Know about the stelar evolution in Pteridophytes, heterospory and origin of seed habit.
CO5	Develop critical understanding on morphology, anatomy and reproduction of Pteridophytes.

YLL
ABUS

UNIT – 1

Bryophytes

15 Hrs

General characters: Introduction – non vascular cryptogams – Characteristic features – Habitat of Bryophytes – Lifecycles, classification of Bryophytes (Reimer, 1954); Economic importance of Bryophytes.

UNIT - 2

15 Hrs

Study of the morphology, anatomy and reproductive structures of the following: a. *Marchantia*, b. *Polytrichum* (no developmental studies)

UNIT - 3

Pteridophytes

15 Hrs

General characters : Introduction – vascular cryptogams – Characteristic features – Habitat of Pteridophytes – Lifecycle, classification (Reimer, 1954). Economic importance of Pteridophytes.

UNIT - 4

15 Hrs

Stelar evolution : Protostele – Haplostele, Actinostele, Plectostele; Siphonostele – Ectophloic Siphonostele, , Dictyostele, Amphiphloic Siphonostele; Eustele. Apogamy and Apospory. Homospory and Heterospory.

UNIT - 5

15 Hrs

Study of the morphology, anatomy and reproductive structures of the following : a) *Lycopodium* b) *Dicranopteris* and c) *Marsilea* (no developmental studies)

TEXT BOOKS:

1. Pandey, B. P. (2006). College Botany, Vol. II: Pteridophyta, Gymnosperms and Paleobotany. S. Chand & Company Ltd, New Delhi.
2. Pandey, B. P. (2007). Botany for Degree Students: Diversity of Microbes,

Cryptogams, Cell Biology and Genetics. S. Chand & Company Ltd, New Delhi.

3. Thakur, A. K., & S. K. Bassi. (2008). A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.
4. Vashishta, P. C., Sinha, A. K., & Anil Kumar. (2006). Botany - Pteridophyta (Vascular Cryptogams). S. Chand & Company Ltd, New Delhi.
5. Vashishta, B. R., Sinha, A. K., & Singh, V. P. 2008. Botany for Degree Students: Algae. S. Chand & Company Ltd, New Delhi.

BOOKS FOR REFERENCE:

1. Raven, P. H., Johnson, G. B., Losos, J. B., Singer, S. R. (2005). Biology. Tata McGraw Hill, New Delhi.
2. Vanderpoorten, A. & Goffinet, B. (2009). Introduction to Bryophytes. Cambridge University Press, Cambridge.
1. Vashishta, P. C., Sinha, A. K., & Anil Kumar. (2006). Botany for Degree Students: Gymnosperms. S. Chand & Company Ltd, New Delhi
2. Ganguli, H. G., Das, S. K., & Dutta, C. (2011). College Botany. Vol –I and II. New Central Book Agency, Calcutta.
5. Pandey, B. P. (2010). College Botany. Vol. III. S. Chand and Company Ltd, New Delhi.

E-LEARNING RESOURCES

1. <https://www.easybiologyclass.com/botany-bryophyta-free-online-classes-lecture-notes-references-study-materials/>
2. <https://study.com/academy/lesson/bryophytes-history-habitat-facts.html>
3. <https://study.com/academy/lesson/bryophytes-history-habitat-facts.html>
4. <http://www.biologyreference.com/Po-Re/Pteridophytes.html>
5. <http://www.theplantlist.org/browse/P/>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	3	2	3
CO2	3	2	2	2	3	3
CO3	3	2	1	2	2	3
CO4	2	2	1	3	3	2
CO5	3	2	2	2	3	3
Average	2.8	2.2	1.6	2.4	2.6	2.8

KEY : Cryptogams, *Marchantia*, *Marsilea*, *Dicranopteris*, stelar evolution

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Questions	Choice Mark the correct choice	30	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx 1000 Words)	20		

SEMESTER II

CORE PRACTICAL I – ALGOLOGY, MYCOLOGY AND LICHEN, GENERAL

MICROBIOLOGY AND PLANT PATHOLOGY, BRYOPHYTES AND PTERIDOPHYTES

TOTAL HOURS: 30

SUB CODE: 20UPBCP2001

CREDIT: 2

L-T-P: 3 -1 - 2

COURSE OBJECTIVES

1. Learn to isolate, culture and identification of algae
2. To understand the diversity and their distribution
3. Understand the students about diversity of fungi and Lichens

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Develop the technical skill to observe the internal structure of algae
CO2	Create skill to identify the Gram positive and Gram negative bacteria
CO3	Develop the technical skill to observe and classify the internal structure of Bryophytes
CO4	Develop the technical skill to observe and classify the internal structure of Pteridophytes
CO5	Understand the structure of disease causing organism

SYLLABUS

ALGOLOGY

Microscopic observation of vegetative and reproductive structures of *Anabaena*, *Ulva*, *Sargassum*, *Gracilaria* through temporary preparation and permanent slides.

Demonstration of Algal biofertilizers preparation, Single cell protein (SCP), Diatomaceous earth, Alginates and Agar.

Demonstration of Isolation, Media preparation and culture of algae

MYCOLOGY AND LICHENS

Aspergillus : Study of asexual stage from temporary mounts.

Albugo : Study of symptoms of plants infected with *Albugo*; asexual phase study through section/temporary mounts and sexual structures through permanent slides.

Peziza : Sectioning through ascocarp

Oyster : Specimens of full grown mushroom: sectioning of gills of oyster

Demonstration of different types of lichens (crustose, foliose and fruticose) on different substrates and its uses.

GENERAL MICROBIOLOGY AND PLANT PATHOLOGY

Preparation of bacterial smear & fixation of suspension

Gram staining of bacteria

Hanging drop mount method

Demonstration of tools (Inoculation loop, spirit lamp), instruments (Autoclave, Inoculation chamber, Quebec colony counter and medium used to culture bacteria.

Identification of Root nodules, Bacteriophage, cavity slide, antibiotics through photographs, models and specimens.

BRYOPHYTES AND PTERIDOPHYTES

Sectioning, Microscopic observation and identification of *Marchantia* thallus, *Marchantia* gemma cup, *Polytrichum* sporocarp, *Lycopodium* stem, *Dicranopteris* leaf through sori, *Marsilea* rhizome and sporocarp.

TEXT BOOKS:

1. Thakur, A. K., & Bassi, S. K. (2008). A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.
2. Tortora, G. J., Funke, B. R., & Case, C. L. (2008). Microbiology: An Introduction, 8th edn. Benjamin Cummings.
3. Vashishta, B. R., Sinha, A. K., & Singh., V. P. (2008). Botany for Degree Students: Algae. S. Chand & Company Ltd, New Delhi.
4. Sharma, P. D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.
5. Tirupathi, B. N., & Kumar, D. 2017. Prospects and Challenges in Algal Biotechnology. Springer; 1st ed.

BOOKS FOR REFERENCE:

1. Sahoo, D., & Kaushik, B.D. (2012). Algal Biotechnology and Environment. International Publishing House Pvt. Ltd; 1st Edition.
2. Vanderpoorten, A., & Goffinet, B. (2009). Introduction to Bryophytes. Cambridge University Press, Cambridge.
3. Alexopoulos, C. J. (1971). Introductory Mycology – John Wiley and Sons Inc. New York, London.
4. Raven, P. H., Johnson, G. B., Losos, J. B., & Singer, S. R. (2005). Biology. Tata McGraw Hill, New Delhi.
3. Vanderpoorten, A., & Goffinet, B. (2009). Introduction to Bryophytes. Cambridge University Press, Cambridge.

-LEARNING RESOURCES

1. <https://mycology.adelaide.edu.au/reference-centre/>
2. <https://www.emlab.com/resources/fungal-library/references/>
3. <http://www.biologyreference.com/Po-Re/Pteridophytes.html>
4. <http://www.theplantlist.org/browse/P/>
5. <https://uwyo.libguides.com/c.php?g=97838&p=633430>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	3	3	3
CO2	3	3	2	3	3	3
CO3	3	3	2	3	3	3
CO4	2	2	3	2	2	2
CO5	3	2	1	2	2	3
Average	2.8	2.6	2	2.6	2.6	2.8

KEY : Gram staining, *Sargassum*, *Peziza*, *Ulva*, *Marchantia*.

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Chart, Microscopic observation, Specimens, Spotters, PPT and field study.

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

MAIN PRACTICAL -1

TIME: 3 hrs

Maximum: 60 marks

Theory : 50 marks

Record : 10 marks

1. Cut transverse sections of **A, B, C** and **D**. Stain and mount in glycerine. Draw labelled sketches. Identify giving reasons. Submit the slide for valuation.
(4X5 =20 marks)
2. Make suitable stained preparation of specimen **E** and submit the slide for valuation. Write down the aim, procedure & result of the same.
(1X5 =5 marks)
3. Write notes on **F**
(1X5 = 5 marks)
4. Name the genus, group & morphology of the parts of **G, H, I & J**. Diagrams not necessary

(4X5 = 20 marks)

KEY FOR EXAMINERS

1. A - Algal specimen (*Sargassum leaf, Gracilaria thallus and cystocarp Ulva thallus*)
B - Fungal specimen (*Albugo, Peziza*)
C – Bryophytes (*Marchantia,*)
D- Pteridophytes(*Lycopodium, Dicranopteris, Marsilea*)
2. E – Gram staining
3. F – Microbiology spotter (Curd, Cheese, Antibiotic, Cavity slide)
4. G - Alga (Macroforms of *Sargassum* thallus with air bladder, *Gracilaria* thallus and cystocarp, *Ulva* thallus)
H – Plant pathology (Citrus canker, Rice blast)
I – Bryophytes (Macroforms of *Marchantia* gemma cup, *Marchantia* Antheridiophore, *Marchantia* Archegoniophore, *Polytrichum* thallus with capsule)
J - Pteridophytes (Macroforms of *Lycopodium* strobilus, *Dicranopteris* sporophyll with sorus and *Marsilea* Rhizome)

Distribution of marks:

1. Slide- 2; Identification - 1; Diagrams- 1; Reasons - 1 (4 X 5= 20 marks)
2. Slide- 2; Identification -1; Procedure-2 (1X5= 5 marks)
3. Identification -1; Notes -4 (1X5= 5 marks)
4. Genus- 1; group -2; morphology- 2 (4X5= 20 marks)

DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**SDNB VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS)****CHENNAI-600044.****COURSE FRAME WORK****SEMESTER III**

SEM III	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HRS	CREDITS	CA	SE	T
PART - I	20ULTFC3003/ 20ULHFC3003/ 20ULSFC3003	Tamil/Hindi/ Sanskrit	Tamil - I/Hindi- I/Sanskrit-I					
PART - II	20UGEFC3003	English	General English-II					
PART - III	20UPBCT3005	Core V	Cell Biology and Molecular Biology	60	4	40	60	100
	20UPBCT3006	Core VI	Anatomy of Angiosperms and Embryology	60	4	40	60	100
	20UPBAP3003	Allied III	Allied Chemistry - I	60	4	40	60	100
PART - IV		NME	NME – Offered to other department students		2	50		
			TOTAL					

SEMESTER III

CORE PAPER V – CELL BIOLOGY AND MOLECULAR BIOLOGY

TOTAL HOURS:60

SUB CODE: 20UPBCT3005

CREDIT:4

L-T-P: 3 -1 - 2

COURSE OBJECTIVES

- To study the structure and function of basic components of prokaryotic and eukaryotic cells, cell membranes and cell wall
- To study the structure and function of cell organelles
- To appreciate the cellular components underlying mitotic cell division.
- To understand the structure and function of DNA, RNA.
- To appreciate the central dogma of life, protein synthesis and mutation

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Study the structure and function of basic components of prokaryotic and eukaryotic cells, cell membranes and cell wall
CO2	Study the structure and function of cell organelles
CO3	Understand the cellular components underlying mitotic cell division.
CO4	To study the structure and function of DNA, RNA.
CO5	To analyse the concept of genetic code with protein synthesis and mutation

SYLLABUS

Cell Biology

UNIT - 1

15 Hrs

Introduction, Cell organization Prokaryotic and Eukaryotic, Ultrastructure and functions of Cell Wall (Middle lamella, Primary wall, Secondary wall)

UNIT - 2

15 Hrs

Occurrence, structure, function and origin of plasma membrane, Endoplasmic reticulum, Golgi bodies, Lysosomes, Ribosomes, Mitochondria, Plastids-Chloroplast and Nucleus.

UNIT - 3

15 Hrs

Microtubules, Cytoskeleton (microfilament), flagella, cilia, microbodies (Glyoxysomes, Peroxisomes, Sphaerosomes), vacuole. Non-living cell inclusions.

Molecular Biology

UNIT - 4

15 Hrs

Gene regulation in prokaryotes-*lac-operon* and *tryp-operon* as bio-synthetic system. Auoregulation and feedback inhibition.

UNIT - 5

15 Hrs

Genetic engineering - aims of Genetic Engineering, Techniques of Gene Manipulation, PCR, Recombinant DNA Technology, Outlines of cloning vectors: plasmids, cosmids.

TEXT BOOKS:

1. Aparna Bhattacharya. (2009). Molecular Biology. Rajat Publications.
2. Gerald Karp. (2013). Cell Biology. Wiley publication.
3. Prakash, S. L. (2013). Cell and Molecular Biology. MJP Publishers.
4. Jacobs, M. (2016). Cell and Molecular Biology. CBS Publishers.

- Gupta, P. K. (2017). Biomolecules and Cell biology. Rastogi Publications

BOOKS FOR REFERENCE:

- Devasena, T. (2012). Cell Biology. Oxford University Press.
- Rastogi, V. B. (2016). Principles of Molecular Biology. Medtech.
- Rastogi, S. C. (2018). Cell and Molecular Biology. New Age International Pvt. Ltd.

E-LEARNING RESOURCES

- <http://www.jove.com/>
- <http://www.biology-pages.info/>
- <https://www.mcb.harvard.edu/mcb/home/>
- <http://learn.genetics.utah.edu/>
- <https://libguides.gvsu.edu/cmb>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	1	3
CO2	3	2	2	3	1	3
CO3	3	2	2	3	1	3
CO4	2	3	3	2	2	2
CO5	3	3	1	2	2	3
Average	2.8	2.4	2	2.6	1.4	2.8

KEY : Prokaroyes, Eukaryotes, Ribosomes, Plasmids, Cosmids, Gene Manipulation, PCR

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	30		
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx 1000 Words)	20		

SEMESTER III

CORE PAPER VI – ANATOMY OF ANGIOSPERM AND EMBRYOLOGY

TOTAL HOURS: 60
CREDIT:4

SUB CODE: 20UPBCT3006
L-T-P: 3 -1 - 2

COURSE OBJECTIVES

1. To know the anatomical structure of Angiospermic plant
2. To identify woods of commercial importance
3. Understand the development of Embryo.

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Describes the structure of root, shoot and nodal types of dicot plants.
CO2	Discuss the types of leaves and explains various kinds of stomata in Dicot and Monocot
CO3	Illustrates the structure of anther. Discuss the various types of microsporogenesis
CO4	Illustrates the structural types of Ovule and discuss the development of megaspore.
CO5	Explains the development of Monocot and Dicot embryo

SYLLABUS

UNIT- 1

15 Hrs

Anatomy

Study of Primary characters of Dicot stem, Monocot stem and Root. Secondary growth in dicot stem and root, Nodal types of dicot plants - Uni, tri, multi lacunar.

UNIT- 2

15 Hrs

Anomalous secondary growth in *Nyctanthes*, *Boerhaavia* and *Dracaena*. Anatomy of leaf – Dicot and Monocot, Isobilateral and Dorsiventral; Microscopic studies on the distribution, structure, types and functions of stomata (dicots and monocots).

UNIT- 3

15 Hrs

Embryology

Development of anther- Tapetum – Glandular and Amoeboid; Microsporogenesis - Microspore mother cell – Successive type and Simultaneous type; Types of microspore tetrads – Tetrahedral, Isobilateral, Decussate and T-shaped; Microsporangium – male gametophyte.

UNIT- 4

15 Hrs

Development of ovule- megasporogenesis-female gametophyte- *Polygonum*, *Allium* and *Peperomia* types.

UNIT- 5

15Hrs

Endosperm-types, development and function. Embryogeny-development of embryos in dicot and monocot.

TEXT BOOKS:

1. Pandey, B. P. (2010). College Botany. Vol. III. S. Chand and Company Ltd, New Delhi.
2. Cutler, D. F., Botha, T., & Stevenson, D. W. (2008). Plant Anatomy: An Applied Approach
3. Katherine Esau. (2011). Anatomy of seed plants. John Wiley and Sons. U.S.A.
4. Singh, V., Pandey, P. C., & Jain, D. K. (2018). A Text Book of Botany. Anatomy and Embryology of Angiosperms. Rastogi Publications.
5. Sharma, H. P. (2009). Plant Embryology, Classical and Experimental. Alpha Science.

BOOKS FOR REFERENCE:

1. Beck, C. B. (2010). An Introduction to Plant Structure and Development: Plant Anatomy for the Twenty-First Century. Cambridge University Press.
2. Sinha, S. K. (2014). A Text Book of Plant Anatomy. Centrum Press.
3. Grewal, R. C. (2008). Plant Anatomy. Campus Books International.
4. Singh, V., & Abhishek, A. (2019). Plant Embryology and Experimental Biology. Educational Publishers and Distributors.
5. Batygina, T. B. (2002). Embryology of Flowering Plants: Terminology and Concepts, Vol.I. Generative Organs of Flower. CRC Press.

E-LEARNING RESOURCES

1. <https://www.biologydiscussion.com/plants/anatomical-structure-of-plants-with-diagram/6450>
2. <https://www.easybiologyclass.com/plant-anatomy-online-tutorials-lecture-notes-study-materials/>
3. <https://science.umd.edu/classroom/bsci124/lec4.html>
4. <https://www.aplustopper.com/plus-one-botany-notes-chapter-4/>
5. <https://www.biologydiscussion.com/angiosperm/angiosperms-fertilization-embryology-and-seed-with-diagrams/13572>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	3	3
CO2	3	2	2	2	3	3
CO3	3	2	2	2	3	3
CO4	2	3	3	3	2	2
CO5	3	3	3	1	3	3
Average	2.8	2.4	2.4	2	2.8	2.8

KEY : *Albugo, Aspergillus, Peziza*, Mushroom, citric acid and lichen

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	30	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx1000 Words)	20		

DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**SDNB VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS)****CHENNAI-600044.****COURSE FRAMEWORK****SEMESTER IV**

SEM III	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HRS	CREDITS	CA	SE	T
PART - I	20ULTFC4004/ 20ULHFC4004/ 20ULSFC4004	Tamil/Hindi/ Sanskrit	Tamil - IV/Hindi- IV/Sanskrit-IV					
PART - II	20UGEFC4004	English	General English-IV					
PART - III	20UPBCT4006	Core VII	Gymnosperms, Paleobotany and Evolution	60	4	40	60	100
	20UPBCT4007	Core VIII	Ecology and Environmental Biotechnology	60	4	40	60	100
	20UPBAP4004	Allied IV	Allied Chemistry - II	60	4	40	60	100
PART - IV		NME	NME – Offered to other department students		2	50		
			TOTAL					

SEMESTER IV

CORE PAPER VII – GYMNOSPERMS, PALEOBOTANY AND EVOLUTION

TOTAL HOURS: 60
CREDIT: 4

SUB CODE: 20UPBCT4007
L-T-P: 3-1-2

COURSE OBJECTIVES

1. To study the classification, characteristics and life cycle of Gymnosperms
2. To study the process of fossilization
3. To study the basics of evolution

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Understand the characteristics of Gymnosperms and their classification
CO2	Illustrate the reproductive characters of important genus of gymnosperm
CO3	Describe the types of fossils
CO4	Interpret the evolutionary sequence with the knowledge of the geological time scale
CO5	Analysis of evolution, variation and chemosynthetic theory

SYLLABUS

UNIT- 1

15 Hrs

Gymnosperms

General characteristics of Gymnosperm. Classification of Gymnosperms (Pilger and Melchior, 1954).

UNIT- 2

15 Hrs

Detailed study of morphology, structure and reproduction in *Cycas* and *Gnetum* (no developmental studies).

UNIT- 3

15 Hrs

Paleobotany

Fossils and ideal conditions for fossilization, kinds of fossils- Compressions, impressions, coal ball, casts, molds, petrification, pseudofossil.

UNIT- 4

15 Hrs

Importance of paleobotany, Dr.Birbal Sahani. Geological time scale. Brief study of the following fossils -*Medullosa* and *Williamsonia sewardiana*, *Pentoxylon*

UNIT- 3

15 Hrs

Evolution

Origin of life- Chemosynthetic theory on the origin of life. Variation in nature - Analysis of variation, source of variation (mutation, recombination, Adaptation & selection)

TEXT BOOKS:

1. Chamberlain, C.J. (2000). Gymnosperms. C B S Publishers and Distributors
2. Sharma, O.P., & Dixit, S. (2002).Gymnosperms. Pragti Prakashan
3. Bhatnagar, S. P., & Moitra, A. (2005). Gymnosperms. New Age Interactive (P) Ltd.
4. Sambamurty, A. V. S. S. (2005). A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. Today & Tomorrow's Printers and Publishers
5. Kaur I. D., & Uniyal P. L. (2019). Text Book of Gymnosperms.New Delhi, Delhi: Daya

BOOKS FOR REFERENCE:

1. Stewart, W. N., Stewart, W. N., Stewart, W. M., & Rothwell, G. W. (1993). *Paleobotany and the evolution of plants*. Cambridge University Press.
2. Shukla, A. C., & Misra, S. P. (1975). *Essentials of paleobotany*. Vikas.
3. Pandey, B. P. (2006). *College Botany, Vol. II: Pteridophyta, Gymnosperms and Paleobotany*. S. Chand & Company Ltd, New Delhi.
4. Vasishtha, P. C., Sinha, A. K., & Kumar, A. (2006). *Botany for Degree Students: Gymnosperms*. S Chand.
5. Sporne, K. R. (1965). *The morphology of gymnosperms*. Hutchinson Univ. Library, London, UK.

E-LEARNING RESOURCES

1. <https://www.biologydiscussion.com/gymnosperm/gymnosperm-classification-and-economic-importance/5726>
2. <https://www.biologydiscussion.com/essay/gymnosperms/essay-on-the-life-cycle-of-gnetum-class-gnetopsida-gymnosperms-botany/76855>
3. <https://www.biologydiscussion.com/fossils/fossils-definition-and-its-study-biology/73890>
4. <https://www.biologydiscussion.com/gymnosperm/williamsonia-occurrence-external-features-and-reproduction-bennettitales/22132>
5. <https://www.biologydiscussion.com/biology/origin-of-life-4-theories-evolutionary-biology/56249#:~:text=This%20theory%20was%20given%20by,were%20formed%20from%20inorganic%20constituents>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	2	3	3	2	2
CO2	2	2	3	3	2	2
CO3	2	2	3	3	2	2
CO4	3	3	2	2	3	3
CO5	3	1	3	3	3	1
Average	2.4	2	2.8	2.8	2.4	2

KEY : *Cycas, Gnetum, Dr.Birbal Sahani, Medullosa, Williamsonia sewardiana, Pentoxylon*

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	30	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx1000 Words)	20		

SEMESTER IV

CORE PAPER VIII – PLANT ECOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY

TOTAL HOURS: 60
CREDIT: 4

SUB CODE: 20UPBCT4008
L-T-P: 3-1-2

COURSE OBJECTIVES

1. Understanding the interactions of organisms with one another within the physical and chemical environment. Understand plants' associations and adaptations.
2. Critically analyze the sustainable utilization of land, water, forest and energy resources.
3. Discover botanical regions and vegetation types of India.

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Understand the environmental factors that influence vegetations
CO2	Analyze the plant adaptations and succession types
CO3	Discuss the principles of Phytogeography
CO4	Recognize the importance of soil erosion and forest conservation
CO5	Explain the Biofuel,bioremediation and Biosorption

SYLLABUS

UNIT– 1

15 Hrs

Scope and various branches of ecology. Environmental factors and their influence on vegetation. Climatic factors, Edaphic factor, Biotic factor & Topographic factor.

UNIT– 2

15 Hrs

Community dynamics: Plant Succession: Types-stages, Hydrosere, Xerosere Adaptations in Xerophytes, Hydrophytes, Mesophytes, Halophytes, mesophytes, Halophytes and Epiphytes.

UNIT– 3

15 Hrs

Basic principles of Phytogeography: Vegetational types of India-Tropical rain forest, mangrove vegetation, Scrub jungle, deciduous forest and grasslands.

UNIT– 4

15 Hrs

Conservation Ecology: Soil erosion and conservation (*In situ* an *ex-situ*), Afforestation, Social forestry, Agroforestry, seed banks, culture collection. A brief account of National and international agencies of conservation – IUCN, WWF.

UNIT– 5

15 Hrs

A brief note on the following: Biomass and Biofuel (Biogas-Characteristics, production, selection of feed stock, methanogen, uses of biogas), sewage treatment, Bioremediation, Biomining, Biosorption.

TEXT BOOKS:

1. Verma, V. (2011). Plant Ecology, Ane Books Pvt. Ltd, New Delhi.
2. Odum, E., & Barrett, G.W. (2017). Fundamentals of Ecology, 5thed., Cengage Learning India Pvt Ltd, New Delhi
3. Singh, J. S., Singh, S. P., and Gupta, S.R. (2017). Ecology, Environmental Science and Conservation, S. Chand (G/L) & Company Ltd.
4. Pranav Kumar. (2017). Fundamentals of Ecology and Environment, 2nd ed., Pathfinder Publications.
5. Sharma, P D. (2019). Plant Ecology and Phytogeography, 1st Ed., Rastogi Publications.

BOOKS FOR REFERENCE:

1. Rana, S. V. S. (2013). *Essentials of ecology and environmental science*. PHI Learning Pvt. Ltd..
2. E. J. Kormondy. (2017). *Concepts of Ecology*. Fourth edition. Pearson Education
3. Sharma, P. D., & Sharma, P. D. (2012). *Ecology and environment*. Rastogi Publications.
4. Schulze, E.-D., Beck, E., Buchmann, N., Clemens, S., Müller-Hohenstein, K., Scherer-Lorenzen, M. (2019). *Plant Ecology*. Springer-Verlag Berlin Heidelberg
5. Ricklefs, R. (2018). *Ecology: The Economy of Nature*. WH Freeman

E-LEARNING RESOURCES

1. <https://www.futurelearn.com/subjects/nature-and-environment-courses/ecology>
2. <https://www.coursera.org/courses?query=ecology&page=1>
3. <https://nabt.org/Resource-Links-Ecology-Environment>
4. <https://www.commonsense.org/education/top-picks/excellent-ecology-and-environmental-science-apps-games-and-websites>
5. <https://www.britishecologicalsociety.org/learning-and-resources/learning-resources/>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	3	2
CO2	3	2	2	2	3	2
CO3	3	2	2	2	3	2
CO4	2	3	3	3	2	3
CO5	3	3	3	1	3	3
Average	2.8	2.4	2.4	2	2.8	2.4

KEY : Xerophytes, Hydrophytes, Mesophytes, sewage treatment, Bioremediation, Biomining, Biosorption.

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	30		
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx1000 Words)	20		

SEMESTER IV

CORE PRACTICAL II – CELL BIOLOGY AND MOLECULAR BIOLOGY, ANATOMY OF ANGIOSPERMS, PALEOBOTANY AND EVOLUTION, GYMNOSPERMS, PALEOBOTANY AND EVOLUTION AND ECOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY

TOTAL HOURS: 30
CREDIT: 2

SUB CODE: 20UPBCP2001
L-T-P: 3 -1 - 2

COURSE OBJECTIVES

1. To study the mitosis and structural and functional aspects of various tissue systems and organs of dicots and monocots.
2. To understand the internal structure of Gymnosperms
3. To understand the structure of cells in relation to the functional aspects and Understand the cellular components underlying cell division

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Discuss the structure and functions of the meristematic, primary & complex tissues.
CO2	Distinguish between normal and anomalous secondary growth. Discuss the development of the endosperm and embryo
CO3	To understand the internal structure of Gymnosperms
CO4	To understand about internal structure of fossils
CO5	Understand the cell organelles through electron micrographs and Identify the cellular components underlying cell division and phytogeographical region

SYLLABUS

Cell Biology and Molecular Biology

Observation of Models and Charts of the following organelles and structures : Eukaryotic cell, Prokaryotic cell, Golgi apparatus, Mitochondria, Chloroplast, Ribosomes, mRNA, tRNA and DNA.

Anatomy of Angiosperms

Preparation of thin sections to observe the internal structure of the following : Dicot stem, Monocot stem, Monocot root, Anomalous structure of *Dracena*, *Nyctanthus* and *Boerhavia*.

Paleobotany

Observation of Permanent slides *Lepidodendron* and *Calamites* stem.

Gymnosperm

Preparation of thin sections to observe the internal structure of the following : *Cycas*-corolloid, *Cycas* root, *Cycas* leaflet, *Cycas* rachis and *Gnetum* stem. Observation of Permanent preserved specimens of *Cycas* -rachis with leaflet, microsporophyll, megasporophyll, *Gnetum* twig, male strobilus, female strobilus.

Plant Ecology

Preparation of thin sections to observe the internal structure of the following : *Hydrilla* stem, *Tridax* stem, *Tridax* stem, Transverse section of *Nerium* leaf. Identification of Phytogeographical regions of India.

TEXT BOOKS

1. Lohar, P. S. (2013). Cell and Molecular Biology. MJP Publishers.
2. Jacobs, M. (2016). Cell and Molecular Biology. CBS Publishers.
3. Esau, K. (2011). Anatomy of Seed Plants. John Wiley and Sons. U.S.A.
4. Singh, V., Pande, V.C., & Jain, D.K. (2018). A Text Book of Botany. Anatomy and Embryology of Angiosperms. Rastogi Publications.
5. Sharma, P. D. (2019). Plant Ecology and Phytogeography. 1st Ed., Rastogi Publications.

REFERENCE BOOKS

1. Singh, V., Pande, V.C., & Jain, D.K. (2018). A Text Book of Botany. Anatomy and Embryology of Angiosperms. Rastogi Publications.
2. Sharma, H. P. (2009). Plant Embryology, Classical and Experimental. Alpha Science.
3. Sharma, P. D. (2017). Ecology and Environment, Rastogi Publications,
4. Sharma, P. D. (2011). Ecology and Environment, Rastogi Publications,.
5. Srivatsava, H. N. (2005). Gymnosperms. Pradeep publications.

E – LEARNING RESOURCES

1. <https://www.ou.edu/cas/botany-micro/www-vl/>
2. <http://www1.biologie.uni-hamburg.de/b-online/e00/default.htm>
3. <https://www.padasalai.net/2018/10/12th-bio-botany-practical-manual-study.html>
4. <https://byjus.com/tn-board/tamil-nadu-board-class-11-botany-practical/>
5. <https://www.nature.com/articles/137515d0>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	3	3	2	3	2
CO2	2	3	3	2	3	2
CO3	2	3	3	2	3	2

CO4	3	2	2	3	2	3
CO5	3	3	3	3	3	3
Average	2.4	2.8	2.8	2.4	2.8	2.4

KEY : *Hydrilla, Tridax, Cycas, Gnetum, Gymnosperms, Angiosperms, Dracena,.*

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Microscopic observation, Chart, Seminar, PPT and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

TIME: 3 hrs

Maximum: 60 marks

Theory : 50 marks

Record : 10 marks

1. Prepare a squash of material **A**. Submit slide for valuation. Draw diagram of any two stages.

(1 x 5 = 5)

2. Cut the transverse section of **B, C & D**. Stain & mount in glycerin. Draw labeled sketches. Identify giving reasons. Submit slides for valuation

(3x5=15)

3. Name the genus, group & morphology of the parts of **E**. Diagrams not necessary

(1 x 5 =5)

4. Write notes on **F, G & H**.

(3 x 5 = 15)

5. Mark the phytogeographical regions of India **I**.

(1 x 5 = 5)

6. Write notes on **J**

(1 x 5 = 5)

Key to Examiner

1. A. Squash (Mitosis - Onion root tip)
2. B. Anatomy (*Boerhavia*, *Dracena*, *Nyctanthus*)
C. Gymnosperm (*Cycas* - coralloid root, leaflet, rachis, *Gnetum* - stem)
D. Ecology (*Hydrilla*, *Tridax*, *Nerium* leaf)
3. E. Gymnosperms Macroforms - (*Cycas*- rachis with leaflet, Microsporophyll, Megasporophyll, *Gnetum*- twig, Male strobilus, Female strobilus)
4. F. Embryology (Pollinium, Anther development, Female gametophyte)
G. Anatomy (Monocot stem, Dicot stem, *Boerhavia*, *Dracena*, *Nyctanthus*)
H. Cell Biology (Choloroplast, Mitochondria, Nucleus, Plasma membrane, Golgi complex, Polyribosomes and Endoplasmic reticulum, Molecular biology (DNA, tRNA))
5. I. Phytogeographical regions
6. J. Paleobotany (*Lepidodendron*, *Calamites*)

Distribution of Marks:

1. Slide - 2, Diagram -2, Notes-1
2. Slide -2, Notes-2, Diagram -1
3. Genus -1, Group -2, Morphology -2
4. Identification-2, Notes-3
5. India map – 5
6. Identification-2, Notes-3

DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**SDNB VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS)****CHENNAI-600044.****COURSE FRAME WORK****SEMESTER V**

SEM III	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HRS	CREDITS	CA	SE	T
PART - III	20UPBCT5009	Core IX	Genetics and Plant Breeding	60	4	40	60	100
	20UPBCT5010	Core X	Taxonomy and Economic Botany	60	4	40	60	100
	20UPBCT5011	Core XI	Bioinstrumentation, Bioinformatics and Biostatistics	60	4	40	60	100
	20UPBCE5001	Elective - I	Herbal Medicine	75	5	40	60	100
PART - IV		Skill Enhancement course			3	50		

SEMESTER V
CORE PAPER IX – GENETICS AND PLANT BREEDING

TOTAL HOURS: 60

SUB CODE: 20UPBCT5009

CREDIT: 4

L-T-P: 3 -1 - 2

COURSE OBJECTIVES

1. To enable the students to understand the transfer of hereditary characters
2. To gain knowledge on Mendel's ratios and deviation.
3. To know the significance of blood groups, linkage and crossing over, the conventional methods of plant breeding, role of hybridization, mutation, and polyploidy in plant breeding.

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Understand, apply and evaluate the laws of Mendel in classical genetics, deviations from Mendelian ratios and the different types of gene interactions.
CO2	Understand sex determination in plants and apply the concepts of cytoplasmic, nuclear and sex-linked inheritance
CO3	Understand and analyse linkage, crossing over, chromosome mapping, mutations and syndromes
CO4	Evaluate the significance and applications of DNA finger printing, gene therapy, DNA library and Hardy Weinberg law.
CO5	Remember, analyse and apply the principle involved in conventional methods of plant breeding, polyploidy, and the organizations involved in plant improvement.

SYLLABUS

UNIT– 1

15 Hrs

Genetics:

Mendelian genetics - Monohybrid , Dihybrid, Testcross and Backcross Ratio. Deviations allelic & Nonallelic, Gene interactions. Polygenic Inheritance and Pseudoalleles.

UNIT– 2

15 Hrs

Sex determination in Plants, Cytoplasmic Inheritance (eg. Male sterility in Corn), Extra Nuclear Inheritance - Plastid Inheritance in *Mirabilis*. Sex Linked Inheritance - Colour Blindness, Hemophilia, Hypertrichosis.

UNIT– 3

15 Hrs

Multiple alleles, Chromosome theory of Inheritance. Linkage, Crossing over, Chromosome Mapping, Mutation–Gene and Chromosomal. Polyploidy - Euploidy, Aneuploidy – Syndromes - Klinefelter's, Down's and Turner's Syndrome. Mutagenic agents and its Significance.

UNIT– 4

15 Hrs

DNA finger printing, germplasm storage, gene therapy, DNA probe, genomic library. Population genetics-Hardy Weinberg principle.

UNIT– 5

15 Hrs

Plant Breeding

Mass selection and Pure line selection, Heterosis and hybrid seed production, Male sterility, types and its use in plant breeding. Polyploidy breeding application of auto and allopolyploids in plant breeding; limitations. Mutation breeding - types: chemical mutagens, radiation, transposons; handling and release of mutagenic varieties.

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	2	3	3	2	2
CO2	2	2	3	3	2	2
CO3	2	2	3	3	2	2
CO4	3	3	2	2	3	3
CO5	3	1	3	3	3	3
Average	2.4	2	2.8	2.8	2.4	2.4

KEY : Monohybrid , Dihybrid, Hemophilia, Hypertrichosis, Hardy Weinberg principle

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	30	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx 1000 Words)	20		

TEXT BOOKS:

1. Pierce, B. A. (2019). Genetics - A Conceptual Approach. 6th edition. W.H. Freeman and Co. NY.
2. Clug, W. S., Cummings, M.R., Spencer, C.A., & Palladino, M.A . (2016). Genetics. 10th edition. Pearson Education India.
3. Snustad, P. J., & Simmons., M. J. (2015). 7th edition. Wiley.
4. Singh, B. D. (2014). Fundamentals of Genetics. Kalyani Publishers.
5. Verma, P. S., & Agarwal, V. K. (2010). Genetics. S.Chand.

REFERENCE BOOKS

1. Krebs, J.E., Goldstein, E.S., & Kilpatrick, S.T. (2017). Lewin's Genes XII. Jones and Bartlett Publishers Inc.
2. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. 10th edition.
3. W. H. Freeman and Co., U.S.A. 3. Gupta, P.K. (2018) Genetics. 5th Edition, Rastogi Publications, Meeru
4. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. 9th edition. Benjamin Cummings, U.S.A.
5. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. 5th edition. John Wiley & Sons Inc., India.

E – LEARNING RESOURCES

1. <https://www.jax.org/education-and-learning/high-school-students-and-undergraduates/teaching-the-genome-generation/stem-learning-resources>
2. <https://www.easybiologyclass.com/category/genetics/>
3. <https://www.edx.org/learn/genetics>
4. <https://www.commonsense.org/education/top-picks/great-heredity-and-genetics-games-and-websites>
5. <https://byjus.com/tn-board/tamil-nadu-board-class-11-botany-practical/>

SEMESTER V

CORE PAPER X – TAXONOMY OF ANGIOSPERMS & ECONOMIC BOTANY

TOTAL HOURS:60

SUB CODE: 20UPBCT5010

CREDIT:

L-T-P:

COURSE OBJECTIVES

1. Identify flowering plants.
2. Analyze the Nomenclature and classification of flowering plants.
3. Observe technical terms in Angiosperms.

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Interpret the Nomenclature systems and to identify the plants
CO2	Understand the Principle and classification of angiosperms
CO3	Understand the Technical terms used in morphology of plants
CO4	Understand and analyze the Floral taxonomy of angiosperms
CO5	Understand the Economic uses of plants

SYLLABUS

UNIT- 1

15 Hrs

Taxonomy and its importance, Herbarium techniques. Author citation, binomial nomenclature, I.C.B.N. and Taxonomic hierarchy.

UNIT- 2

15 Hrs

Categories of classification – Artificial (Linnaeus), Formal (Bentham & Hooker), Modern (Cronquist) & Overview of APG-III only outline classification needed – Merits and Demerits.

UNIT- 3

15 Hrs

A detailed study of the range of characters of the following families and the economic importance in these families. Dicotyledons – *Annonaceae*, *Rutaceae*, *Leguminosae*, *Cucurbitaceae*, *Asteraceae*, *Asclepiadaceae* & *Apocynaceae*.

UNIT- 4

15 Hrs

A detailed study of the range of characters of the following families and the economic importance of these families. Monocotyledons - *Euphorbiaceae*, *Amaranthaceae*. Monocotyledonae - *Orchidaceae* & *Poaceae*.

Food plants –cultivation and milling of cereals – rice, sugar- cultivation, harvesting and extraction. Fibre-types extraction and use of cotton (*Gossypium*). Beverages – harvesting and preparation of coffee and tea. Rubber –extraction and processing of *Hevea braziliensis*.

TEXT BOOKS:

1. RashtraVardhana. (2009). Economic Botany. 1st Ed., Sarup Book Publishers Pvt. Ltd., NewDelhi.
2. Simpson, M. G. (2011). Plant Systematics. 2nd ed., Academic Press, New York, .
3. Pandey, B. P. (2013). Taxonomy of Angiospherms, S. Chand Publishing.
4. Sharma, O. (2017). Plant taxonomy, 2nd Ed. McGraw Hill Education.
5. Sambamurty, A.V. S. S. (2019). Taxonomy of Angiosperms. Dreamtech Press.

BOOKS FOR REFERENCE:

1. Davis, P. H., & Heywood, V. H. (1963). Principles of angiosperm taxonomy.
2. Rana, T. S. (2014). Plant Taxonomy and Biosystematics: Classical and Modern Methods New India Publishing Agency.
3. Singh, G. (2019). *Plant systematics: an integrated approach*. CRC Press.
4. Singh V., Pande P. C., & Jain, D. K. (2018). Economic botany, 3rd Revised Ed.,Rastogi Publications.
5. Singh,G. 2020. Plant Systematics. 4th ed., CBS Publishers & Distributors.

E-LEARNING RESOURCES

1. https://www.researchgate.net/publication/272151018_Taxonomy_of_E-Learning_Challenges_and_an_Insight_to_Blended_Learning
2. https://ce.uci.edu/pdfs/instructor/blooms_taxonomy.pdf
3. <http://higherelearning.com/understanding-blooms-taxonomy-e-learning-new-resources>
4. https://www.teachee.com/home?source=yeahmobi-gg-onlineeducation&query_computed=1
5. <https://www.niallmcnulty.com/2017/11/blooms-digital-taxonomy/>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	3	3
CO2	3	2	2	2	3	3
CO3	3	2	2	2	3	3
CO4	2	3	3	3	2	2
CO5	3	3	3	1	3	2
Average	2.8	2.4	2.4	2	2.8	2.6

KEY : Euphorbiaceae, Amaranthaceae. Monocotyledonae - Orchidaceae & Poaceae

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	30	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx 1000 Words)	20		

SEMESTER V

CORE PAPER XI – BIOINSTRUMENTATION, BIOINFORMATICS AND BIOSTATISTICS

TOTAL HOURS: 60

SUB CODE: 20UPBCT6011

CREDIT:

L-T-P: 3 -1 - 2

COURSE OBJECTIVES

1. To understand the botanical techniques, working principles and applications of biological instruments.
2. Learn the Microscopic biological preparations
3. Digitize and Analyze the biological data

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Remember, understand and apply the instrumentation of microscopy and micrometry
CO2	Apply the skill of the botanical techniques, microtomy, Fixative and staining for preparing permanent and temporary slides.
CO3	Understand and apply the working principles, Dialysis and applications of Colorimeter, pH meter centrifuge and chromatography
CO4	Describe the bio informatics basics and it's application in biology
CO5	Calculate the mean, median, mode, standard deviation and Chi-Square Test.

SYLLABUS

UNIT- 1

15 Hrs

Microscopy – Basic principles and functions of light, Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM).

UNIT- 2

15 Hrs

Microscopic preparations: Preparation of Whole Mount, and Maceration – Fixatives (FAA & Carnoy's fluid), Stains (Haematoxylin & Toluidine blue) Microtomy : Working procedure - Preparation of wax block, Sectioning, Dehydration and Staining methods.

UNIT- 3

15 Hrs

Basic principles and applications of Spectrophotometer, pH meter, Centrifuge (Table top Centrifuge and Ultracentrifuge). chromatography - Basic principles –Types of chromatography (Paper Chromatography, Gas Chromatography and Thin Layer Chromatography).

UNIT- 4

15 Hrs

Bioinformatics: Introduction to Bio-informatics; NCBI-Entrez, DDBJ, Swiss prot., Prosite; Basics of proteomics & genomics; Sequence analyses.

UNIT- 5

15 Hrs

Measures of Central Tendency : Mean – Median – Mode, Measures of Dispersion: Quartile Deviation – Mean Deviation – Standard Deviation ; Test of significance : Chi-Square Test.

TEXT BOOKS:

1. Machve, K. K. (2007). A text book of Bio – Instrumentation. Manglam Publishers & Distributors, Delhi.
- 2 Alam Khan. I. (2005). Elementary Bioinformatics. 1st Edn. Adithya Art Printers.
- 3 .Sharma, V., Munjal, A., & Shankar, A. (2008). A text book of Bioinformatics. 1st edn.. Rastogi Publications, Meerut.
4. Ignacimuthu, SJ 2008 Basic Bioinformatics Narosa Publishing House, New Delhi
5. Satguru Prasad. 1992. Fundamentals of Biostatistics. Emkay publications, New Delhi.

BOOKS FOR REFERENCE:

1. Keith Wilson & John Walker, 1994. Practical Biochemistry Principles & Techniques. Rekha Printers Pvt. Ltd. New Delhi.
2. Avinash U., Kakoli U. and Nirmalendu N. 1998. Biophysical Chemistry. Himalaya Publishing House, Mumbai.
3. Mehrotra.P, Kumund Sarin, Swapna.K.Srivastava. 2005 The New hand Book of Bioinformatics, 1st edn. Vikas Publishing House Pvt. Ltd. Noida, Uttar Pradesh. India
4. Rastogi,R.C. Mendiratta,N. Rastogi,P 2010 Bioinformatics-Methods and applications Genomics, proteomics and Drug discovery, 3rd edn. PHI learning private ltd, New Delhi.
5. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.

E-LEARNING RESOURCES

1. <https://www.biologydiscussion.com/microscope/microscopy-and-properties-of-microscope/5826>
2. <https://www.biologydiscussion.com/plants/plant-tissue-culture/tools-and-techniques-used-for-plant-tissue-culture/11613>
3. <https://www.biologydiscussion.com/botany/practicals-botany/study-notes-on-microtome-sections/57074>
4. <https://www.biologydiscussion.com/biochemistry/chromatography-techniques/chromatography-basics-principles-and-theories/12682>
5. <https://byjus.com/tn-board/tamil-nadu-board-class-11-botany-practical/>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	3	3
CO2	3	2	2	2	3	3
CO3	3	2	2	2	3	3
CO4	2	3	3	3	2	2
CO5	3	3	3	1	3	3
Average	2.8	2.4	2.4	2	2.8	2.8

KEY : TEM, SEM, Maceration, TLC.GC, Chi square test

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	30	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx1000 Words)	20		

SEMESTER V

CORE ELECTIVE I – HERBAL MEDICINE

TOTAL HOURS: 75
CREDIT: 5

SUB CODE: 20UPBCE5001
L-T-P: 3 -2 - 0

COURSE OBJECTIVES

1. Understand the basic principles of Indian system of medicine.
2. To learn the home remedies for common ailments and body care by natural means, preparation of herbal medicines.
3. Learn some of the medicinal plants

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Understand, apply and analyze the importance of Indian system of medicine and Explain the alternate herbal remedies for common ailments.
CO2	Understand and discuss the Classification of natural drugs
CO3	Understand, apply and evaluate the herbal preparations
CO4	Describe the systematic position & medicinal value of plants
CO5	- Understand , discuss and Detect the adulteration of the crude drug from medicinal value of plants

SYLLABUS

UNIT- 1

15 Hrs

Importance of herbal drugs in Indian system of medicine (Ayurveda, Siddha, Unani, Homeopathy) and Aromatherapy, Pharmacological terms – Antidote, Antipyretic, Antiseptic, Antitumor, Cardiotonic, Carminative, Diuretic, Laxative, Narcotic, Refrangent.

UNIT- 2

15 Hrs

Classification of natural drugs-Morphological, Taxonomical, Therapeutical and chemical (Alkaloids, Glycosides, Lipids, Volatile oil, Tannins, Vitamins, Resins and Carbohydrates).

UNIT- 3

15 Hrs

Herbal preparations (one example for each) Lehium, Suranam, Kashayam & Thailam. Collection & processing of crude drugs for marketing.

UNIT- 4

15 Hrs

Study of systematic position & medicinal value of plants -Root- *Rauwolfia serpentina* & *Withania somnifera* Rhizome- *Curcuma longa* & *Zingiber officinale*, Bark- *Cinchona calisaya* & *Cinnamomum zeylanicum* Whole plant- *Azadirachta indica* & *Phyllanthus amarus*

UNIT- 5

15Hrs

Study of systematic position & medicinal value of plants - Leaf- *Aloe vera* & *Ocimum sanctum* Flower- *Crocus sativus* & *Hibiscus rosa-sinensis* Fruit- *Coriandrum sativum* & *Embllica officinalis* Seed- *Ricinus communis* & *Trigonella foenum-graecum*

TEXT BOOKS:

1. Girija Khanna.1986. Herbal Remedies –Vikas Publishing house Ltd, New Delhi.
2. Roseline, A. 2011. Phamacognosy. MJP Publishers, Chennai.
3. Saharan, Moond, Chouhan and Gupta. 2008. Principles of Pharmacognosy Agrobios, Jodhpur India.
4. Kokate C.K., Purohit, A.P and Gokhale, S.B 2014. Pharmacognosy (49thed.). Nirali Publications, Mumbai.
5. Nigel C. Veitch, Michael Smith, 2013. Herbal Medicines Fourth edition. Pharmaceutical Press.

BOOKS FOR REFERENCE:

1. Phillip, K. (1994). Everyday Aromatherapy – Brock Hampton press, Italy.
2. Kurian, A., & Asha Sankar, M.(2007). Medicinal Plants. New India Publishing Agency.
3. Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (1998). Pharmacognosy. Nirali Prakashan, Pune.
4. Warriar, P.K, Nambiar, V.P.K., & Ramakutty. (1993). Indian Medicinal Plants. Orient Longman Ltd, Chennai.
5. Evans, W.C. (2008). Trease and Evans Pharmacognosy (15th ed.). Saunders- An imprint of Elsevier, Philadelphia.

E-LEARNING RESOURCES

1. <https://www.biologydiscussion.com/medicinal-plants/13-main-medicinal-plants-with-its-uses/34918>
2. <https://www.biologydiscussion.com/herbal-drugs/modern-methods-of-herbal-drugs-extraction/25348>
3. <https://www.biologydiscussion.com/essay/essay-on-drugs-definition-classification-and-moral-implication/5389>
4. <https://www.biologydiscussion.com/essay/medicinal-plants-essay/essay-on-medicinal-plants-sources-and-drugs-botany/74615>
5. <https://www.biologydiscussion.com/plants/plant-tissue-culture/tools-and-techniques-used-for-plant-tissue-culture/11613>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	2	2	3
CO2	3	3	2	2	2	3
CO3	3	3	2	2	2	3
CO4	2	2	3	3	3	2
CO5	3	3	3	3	1	3
Average	2.8	2.8	2.4	2.4	2	2.8

KEY : Cardiogenic, Carminative, Diuretic, Laxative, *Azadirachta indica* & *Phyllanthus Amarus*, Lehium, Suranam, Kashayam & Thailam.

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	30	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx 1000 Words)	20		

DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

SDNB VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI-600044.

COURSE FRAME WORK

SEMESTER VI

SEM III	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HR S	CR ED IT S	C A	SE	T
PART - III	20UPBCT6012	Core IX	Plant Physiology, Biochemistry and Biophysics	60	4	40	60	100
	20UPBCT6013	Core X	Plant Biotechnology	60	4	40	60	100
	20UPBCE5001	Elective - II	Horticulture	75	5	40	60	100
	20UPBAP6003	Core Practical - III	Practical - III	30	2	40	60	100
	20UPBAP6004	Core Practical - IV	Practical - IV	30	2	40	60	100
	20UPBER6001	Core Project	Project - I	75	5	40	60	100
PART - IV		Skill based Elective – Offered to students of same department SWAYAM – MOOC			3	50		

SEMESTER VI

CORE PAPER XII - PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS

TOTAL HOURS: 60

SUB CODE: 20UPBCE6012

CREDIT: 4

L-T-P: 3 -1 - 2

COURSE OBJECTIVES

1. To understand the basis of photosynthesis and respiration in plants
2. To obtain knowledge on plant-water relationships
3. To study the cycles of metabolism
4. To understand the structure and functions of biomolecules

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Enable the students to learn the fundamentals of photosynthesis and photorespiration in plants.
CO2	Understand the physiology of respiration in plants.
CO3	Create the knowledge on the processes involved in cycling of nitrogen in plants and atmosphere.
CO4	Understand the significance of enzymes and coenzymes in plants.
CO5	Impart knowledge on laws of Thermodynamics, bioenergetics and bioluminescence.

SYLLABUS

UNIT– 1

15 Hrs

Photosynthesis - Photophosphorylation (Cyclic & Noncyclic). Pigment system-Red drop & Emersons Enhancement effect. Quantasomes. Light energy : Chlorophyll, absorption spectrum, action spectrum, Fluorescence, Phosphorescence, Quantum Yield, Quantum requirement. Dark reaction –Calvin cycle (C3 cycle), Hatch-Slack pathway (C4 cycle). Differences between C3 & C4 plants. Blackmans law of limiting factor. Photorespiration - C2 cycle.

UNIT– 2

15 Hrs

Respiration -:Aerobic and anaerobic – Glycolysis ,Krebs cycle-Mitochondria-electron transport system, oxidative phosphorylation, respiratory quotient. Pasteurs effect.

UNIT– 3

15 Hrs

Nitrogen Metabolism: Importance of nitrogen in plant life, conversion of nitrate to ammonia by plants - Nitrogen fixation -Abiological and biological - nitrogen fixing organisms, legume – *Rhizobium* – symbiosis - synthesis of amino acids - reductive and transamination. Growth Hormones – Plant growth regulators (auxins, gibberellins, cytokinins, ethylene and abscisic acid)- Practical applications.

UNIT– 4

15 Hrs

Enzymes : Nomenclature & Classification - Chemistry of Enzymes – Properties of Enzymes - Mechanism of Enzyme action - Factors affecting enzyme activity. Michaelis constant. Coenzymes: Introduction, salient features of coenzymes, mechanism of coenzyme action and Classification of coenzymes (NAD, FAD,CoA, ATP and TPP).

UNIT– 5

15Hrs

Law of Thermodynamics - Enthalpy - Entropy - Free energy - Bioenergetics-ATP Formation and breakdown in living system – Mitochondria. Bioluminescence.

TEXT BOOKS:

1. Arumugam, N., & Kumaresan, V. (2016). Plant Physiology and Biophysics. Saras Publication.
2. Jain, V. K. (2017). Fundamentals of Plant Physiology. 19th edition. S. Chand.
3. Trivedi, P. C., Atreya, A., & Pathak, K. (2006). Plant Physiology, Biochemistry and Biotechnology. Indus Valley Publications, Jaipur.
4. Srivastava, H. S., & Shankar, N. (2005). Plant Physiology and Biochemistry. Rastogi Publications.
5. Banerjee, P. K. (2010). Introduction to Biophysics. S. Chand.

BOOKS FOR REFERENCE:

1. Noggle, G. R., & Fritz, G. J. (1983). Introductory Plant Physiology, 2nd edition. Prentice Hall.
2. Taiz, L., & Zeiger, E. (2010). Plant Physiology. Sinauer Associate Inc.
3. Ranjan, R., Prasad, V., & Purohit, S. S. (2008). Plant Hormones. Action and Application. Agrobios.
4. Satyanarayana, U. (2019). Biochemistry. 5th edition. Generic Publisher.
5. Glazer, R. (2012). Biophysics. An Introduction. Springer.

E-LEARNING RESOURCES

1. <https://academic.oup.com/pcp>
2. <https://academic.oup.com/plphys>
3. <https://www.easybiologyclass.com/plant-physiology-free-lecture-notes-online-tutorials-lecture-notes-ppts-mcqs/>
4. <http://www.esalq.usp.br/lepse/imgs/conteudo/Plant-Physiology-by-Vince-Ordog.pdf>
5. <https://www.ou.edu/cas/botany-micro/www-vl/>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	3	3
CO2	3	2	2	2	3	3
CO3	3	2	2	2	3	3
CO4	2	3	3	3	2	2
CO5	3	3	3	1	3	3
Average	2.8	2.4	2.4	2	2.8	2.8

KEY : *Albugo, Aspergillus, Peziza*, Mushroom, citric acid and lichen

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	20	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx 1000 Words)	20		

SEMESTER V
CORE PAPER XIII – PLANT BIOTECHNOLOGY

TOTAL HOURS: 60
CREDIT: 4

SUB CODE: 20UPBCE6013
L-T-P: 3 -1 - 2

COURSE OBJECTIVES

1. Understand the various techniques involved in plant tissue culture
2. Learn the basic principle about organ culture, fermentation technology
3. Create knowledge on genetic manipulation of eukaryotic cells.

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Understand preparation of tissue culture medium and basics of tissue culture techniques.
CO2	Understand plant protoplast isolation and fusion for the generation of hybrid varieties.
CO3	Analyse the intricacies of techniques involved in the culture of various plant organs.
CO4	Evaluate the significance and applications of fermentation technology and mass cultivation of biofertilizers.
CO5	Know the principle involved in generating custom made plants producing secondary metabolites and to understand the significance in converting C3 plants to C4 transgenics.

SYLLABUS

UNIT- 1

15 Hrs

Introduction to Biotechnology – Definiton and Scope. Plant cell and Tissue culture – Totipotency, Nutrient medium, MS Medium, Sterilization, Inoculation and Maintenance of culture.

UNIT- 2

15 Hrs

Protoplast isolation, purification and regeneration. Protoplast fusion - Somatic hybrids, Somoclonal embryos, Synthetic seeds

UNIT- 3

15 Hrs

Organ culture – Micropropagation – Root and Shoot culture and its uses. Basic Structure & Culture of anther, pollen, ovule & Embryo.

UNIT- 4

15 Hrs

Fermentation technology: Introduction, Microbial growth, Types of cultures – Batch culture, Continuous culture, Fermentor designs and operations. Biofuel - Ethanol production and its applications. Bacterial SCP, Bacterial Biofertilizers - Mass cultivation of *Rhizobium*, *Azotobacter*, *Azospirillum*.

UNIT- 5

15Hrs

Genetic manipulation of eukaryotic cells. Alkaloid production, Vaccine productions, Luminescent plants, Protein Sweetener, Conversion of **Photosystems C₃ to C₄**.

TEXT BOOKS:

1. Nirmala, C. B., Rajalakshmi, G., & Chandra Karthick. (2014). Plant Biotechnology. MJP Publishers.
2. Kumerasan, V. (2005). Biotechnology. Saras publications.
3. Singh, B. S., & Singh M. P. (2007). Plant Biotechnology. Sathish Serial Publishing House.
4. Ranjan, K.(2017). Fundamentals of Plant Biochemistry and Biotechnology. Kalyan Publishers.
5. Kuila, A., & Sharma, V. (2018). Principles and Applications of Fermentation Technology. Scrivener Publishing.

BOOKS FOR REFERENCE:

1. Christou, P., & Klee, H. (2004). Handbook of Plant Biotechnology, Volume I. John Wiley and Sons.
2. Dheer Singh. (2017). Fermentation Technology. Om Publications.
3. Singh, B. D. (2015). Plant Biotechnology. Kalyani Publishers.
4. Chawla, H.S. (2009). Introduction to Plant Biotechnology. CRC Press.
5. Neal Stewart, Jr., C. (2008). Plant Biotechnology and Genetics. Principles, Techniques and Applications. John Wiley and Sons.

E-LEARNING RESOURCES

1. <http://www.plant.uoguelph.ca/riskcomm>
2. <http://project.bio.iastate.edu/>
3. <http://www.bio-scope.org/>
4. <http://www.biotech-info.net/>
5. <http://geneinfo.hightide.net.au/>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	2	2	3	3	2
CO3	3	2	2	3	3	2
CO4	2	3	3	2	2	3
CO5	3	3	1	2	3	3
Average	2.8	2.4	2	2.6	2.8	2.4

KEY : *Albugo, Aspergillus, Peziza*, Mushroom, citric acid and lichen

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	20	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx 1000 Words)	20		

SEMESTER V

CORE ELECTIVE II – HORTICULTURE

TOTAL HOURS: 75

SUB CODE: 20UPBCE6013

CREDIT: 5

L-T-P: 3 -2 -0

COURSE OBJECTIVES

1. To impart skill oriented knowledge and fundamental aspects of horticulture.
2. To learn the horticulture techniques and To develop skill in flower arrangement
3. To know the methods of plant propagation methods and to develop skill in green house

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Acquire knowledge about the fundamental aspects of horticulture and To learn the principles of garden design
CO2	To understand the garden components and importance of green house and its construction.
CO3	Understand the basic techniques involved in gardening Apply the techniques in bonsai production and cut flower cultivation . Skilled in various flower arrangement techniques . Employ the techniques terrace gardening
CO4	Promote the cultivation of horticultural plants through various propagation methods
CO5	To learn the hybridisation techniques and methods of crop improvement

SYLLABUS

UNIT- 1

15 Hrs

Horticulture: Significance -branches in horticulture - basic principles of landscape gardening - a brief knowledge of annuals, biennials and perennials with reference to ornamental gardens.

UNIT- 2

15 Hrs

Garden components: Lawn – hedges –edges – rockery – topiary - Lilly pond and green house

UNIT- 3

15 Hrs

Types of pots and containers - potting media - potting on, repotting – Manure. Indoor garden: Potted plants - Terrarium, hanging basket, bonsai culture. Cut flowers – preservation - vase life - flower arrangement – fresh – Ikebana.

UNIT- 4

15 Hrs

Propagation: Cutting – layering – grafting – transplanting - Bulbs, corm, seedlings, tubers and large trees. After care of plants - pruning, mulching, staking and weeding.

UNIT- 5

15Hrs

Plant breeding – Methods of Crop improvement – Selection (Pure line, mass, clonal) Hybridization. Introduction and acclimatization and Mutation breeding.

TEXT BOOKS:

1. Rajan, S. and Baby, L. M., (2007). Propagation of Horticultural Crops. New India Publ. Agency
2. Bansil, P. C. (2008). Horticulture in India. CBS Publishers and Distributors, NewDelhi.
3. Peter, K.V. (Ed.). (2008). Basic of Horticulture. New India Publ. Agency.
4. Kumar, N. (2010). Introduction to Horticulture Oxford &IBH Publishing Co.Pvt.Ltd,New Delhi.
5. Kumaresan, V. (2014). Horticulture Saras Publications, Nagercoil.

BOOKS FOR REFERENCE:

1. Christopher, E. P. (2001). Introductory Horticulture, Biotech Books, NewDelhi.
2. Acquaah ,G. 2002. Horticulture principles and practices. 2nd Ed – Pearson Education(Singapore) Pvt. Ltd
3. Ashman, M.A. and Puri. G. 2002. Essential soil science. Blackwell publishing.
4. Bhattacharjee .S.K. 2006 Horticulture,Biotechnology and post harvest technology, Pointer publishers, Jaipur.
5. Rajan,S.and B.L.Markose, 2007 Propagation of horticultural crops. Pitam Pura, NewDelhi

E-LEARNING RESOURCES

1. <https://www.biologydiscussion.com/essay/gardening/essay-on-landscape-gardening-horticulture/61612>
2. <https://ww.biologydiscussion.com/floriculture/hedges-classification-and-maintenance-horticulture/61570>
3. <https://www.britannica.com/topic/bonsai-horticulture>
4. <https://www.biologydiscussion.com/plants/vegetative-propagation/vegetative-propagation-methods-botany/34172>
5. <https://www.biologydiscussion.com/crops/improvement/crop-improvement-selection-methods-withdiagram/17663#:~:text=Selection%20Method%20for%20Crop%20Improvement%3A&text=It%20can%20be%20defined%20as,crop%20improvement%20among%20the%20cultivators.>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	3	2	3
CO2	3	3	2	3	2	3
CO3	3	3	2	3	2	3
CO4	2	2	3	2	3	2
CO5	2	3	3	3	3	2
Average	2.6	2.8	2.4	2.8	2.4	2.6

KEY : Lawn, hedges, edges, rockery, topia, - pruning, mulching, staking and weeding

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Map Study, Seminar, PPT, Assignment and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,k2	Section A Multiple Choice Questions	Mark the correct choice	20	75	
K2,k3,k4	Section B 5 out of 7 Questions *5 Marks	Short answers (500 Words)	25		
K3, K4,k5,k6	Section C 2 Out of 5 Questions *10 Marks	Elaborate answers (approx 1000 Words)	20		

SEMESTER VI

CORE PRACTICAL II – GENETICS AND PLANT BREEDING, TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY, BIOINSTRUMENTATION, BIOINFORMATICS AND BIOSTATISTICS

TOTAL HOURS: 30

SUB CODE: 20UPBCP6003

CREDIT: 2

L-T-P: : 0 – 0 - 2

COURSE OBJECTIVES

1. Collection, identification and preparation of herbarium
2. To apply common bio-instrumentstechniques involved in plants
3. To solve the genetic and biostatistics problems

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Identify the plants using Taxonomically
CO2	To observe Economic importance
CO3	Interpret the Genetic problems
CO4	Apply common statistical tools to derive inference
CO5	Analyze Bio-instruments and hybridization techniques involved in plants

SYLLABUS

Cell Biology and Molecular Biology

Observation of Models and Charts of the following organelles and structures :
Eukaryotic cell, Prokaryotic cell, Golgi apparatus, Mitochondria, Chloroplast, Ribosomes, mRNA, tRNA and DNA.

Anatomy of Angiosperms

Preparation of thin sections to observe the internal structure of the following :
Dicot stem, Monocot stem, Monocot root, Anomalous structure of *Dracena*,
Nyctanthus and *Boerhavia*.

Paleobotany

Observation of Permanent slides Lepidodendron and Calamites stem.

Gymnosperm

Preparation of thin sections to observe the internal structure of the following :
Cycas-corolloid, *Cycas* root, *Cycas* leaflet, *Cycas* rachis and *Gnetum* stem.
Observation of Permanent preserved specimens of *Cycas* -rachis with leaflet,
microsporophyll, megasporophyll, *Gnetum* twig, male strobilus, female strobilus.

Plant Ecology

Preparation of thin sections to observe the internal structure of the following :
Hydrilla stem, Tridax stem, Tridax stem, Transverse section of Nerium leaf.
Identification of Phytogeographical regions of India.

TEXT BOOKS

1. Sundara Rajan, S. (2003). Practical Manual of Angiosperm Taxonomy, Anmol Publications.
2. Vikas Pali. (2016). Practical Handbook of Genetics. Kalyani Publishers .
3. Pooja Tiwari, Pallavi Pandey. (2017). A Practical Guide for Basic Bioinformatics and Biostatistics, 1st ed. Notion Press.
4. Debarati Das. (2017). Essential Practical Handbook of Cell Biology & Genetics, Biometry & Microbiology, A Laboratory Manual. Academic Publishers.
5. Mendel Suchmacher and Mauro Geller, Practical Biostatistics: A Step-by-Step Approach for Evidence-Based Medicine, 2021.

6. Practical Biostatistics: A Step-by-Step Approach for Evidence-Based Medicine Paperback – Import, 1 June 2021 by Mendel Suchmacher (Author), Mauro Geller (Author)

REFERENCE BOOKS

1. Pullaiah, T., Textbook of Biosystematics: Theory and Practicals, Regency Publications, ISBN-13: 978-8189233815, 2010.
2. Debarati Das, Essential Practical Handbook of Cell Biology & Genetics, Biometry & Microbiology A Laboratory Manual, Academic Publishers, ISBN-13: 978-9383420599, 2017.
3. Singh G., Plant Systematics Theory and Practice 3Ed. Oxford & IBH Publishing Co Pvt.Ltd. ISBN-13: 978-8120417632, 2019.
4. Sinha, R.K., Practical Taxonomy of Angiosperms, 2nd ed., I K International Publishing, ISBN-13: 978-9386768520, 2020
5. Ashok Bendre, Rastogi Publications C.B.C.S.: B.Sc 2nd Year Practical botany, 2018.

E – LEARNING RESOURCES

1. <https://www.elearninglearning.com/taxonomy/>
2. <https://www.classcentral.com/course/swayam-economic-botany-plant-resource-utilization-14022>
3. <http://www.fao.org/in-action/plant-breeding/resources/e-learning/en/>
4. <https://bms.ucsf.edu/resources-learning-biostatistics>
5. https://clas.ucdenver.edu/working-remotely/sites/default/files/attached-files/facilitating_online_teaching.pdf

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	3	3	2	3	2
CO2	2	3	3	2	3	2
CO3	2	3	3	2	3	2
CO4	3	2	2	3	2	3
CO5	3	3	3	3	3	3
Average	2.4	2.8	2.8	2.4	2.8	2.4

KEY : *Hydrilla, Tridax, Cycas, Gnetum, Gymnosperms, Angiosperms, Dracena.*

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Microscopic observation, Chart, Seminar, PPT and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

MAIN PRACTICAL -III

Maximum marks: 60

Practical: 40
Record: 10
Herbarium: 10

1. Assign the specimen **A** to the respective family giving Reasons. Draw diagram. (10 marks)
2. Solve the genetic problem **B**. (10 marks)
3. Biostatistical problem covered in the theory **C**. (5marks)
4. Construct the chromosome map with the data provided-**D**. (5 marks)
5. Prepare a stained maceration of **E**. (1x4=4 marks)
6. Write the genus, species, morphology of the useful parts and the family of **F**. (1×3=3)
7. Write notes on **G**. (1×3=3)

KEY FOR EXAMINERS

1. A - Taxonomy (Annonaceae, Rutaceae, Asteraceae, Apocynaceae, Asclepiadaceae, Fabaceae)
2. B - Genetics
3. C - Biostatistics
4. D - Chromosome mapping
5. E - Maceration
6. F – Economic Botany (*Oryza sativa*, *Camellia sinensis*, *Coffea Arabica*
Heveabraziliensis, *Saccharum officinarum*, *Gossypiumhirsutum*)
7. G – Bioinstrumentation (Centrifuge, TEM, SEM, Spectrophotometer, pH meter, Colorimeter)

Distribution of Marks

1. Diagram -4, Reason-4, slide – 2
2. Genetic Problem-5.
3. Biostatistical problem-5
4. Chromosome Mapping-5
5. Slide-1, Identification -1, Diagram-1, Notes-1
6. Family-½, Genus-½, Species-1, Useful part-1
7. Identification-1, , Notes-2

SEMESTER VI

CORE PRACTICAL VI – PLANT PHYSIOLOGY, BIOCHEMISTRY, BIOPHYSICS AND PLANT BIOTECHNOLOGY

TOTAL HOURS: 30
CREDIT: 2

SUB CODE: 20UPBCP6003
L-T-P: 0 – 0 - 2

COURSE OBJECTIVES

1. Appreciate the metabolism of plants
2. Understand the plant tissue culture techniques
3. Understand the microbial techniques

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Understand the photosynthetic system of plants
CO2	Learn the respiratory process of plants
CO3	Understand the techniques involved in plant tissue culture
CO4	Learn the mass cultivation of Biofertilizers
CO5	Learn the sterilization techniques

SYLLABUS

Plant Physiology, Biochemistry and Biophysics

The following are the Experiments to be performed and recorded by students : Absorption spectrum of chlorophyll a, b and total chlorophyll (net), Absorption spectrum of carotenoid, Absorption spectrum of anthocyanin, Extraction of pigments in flower petals, Study of rate of photosynthesis under different light intensities, Study of rate of photosynthesis under different wave lengths (red and blue) of light, Separation of chlorophyll by paper chromatography, Separation of amino acids by paper chromatography, Activity of enzyme catalase, Activity of enzyme amylase, Activity of enzyme dehydrogenase,

Demonstration of RQ using respirometer and Respiroscope for fermentation.

Plant Biotechnology

Isolation of Ovule from *Tridax*,

Demonstration of spotters MS- medium, Explants', callus culture, Root nodules, Biofertilizer.

TEXT BOOKS

1. Jain, J.L., Jain, S. & Jain, N. (2008). Fundamentals of Biochemistry. S. Chand & Company Ltd., New Delhi.
2. Lewin, B. (2001). Genes V. Oxford University Press., Oxford.
3. Lewin, B. (2002). Genes VII. Oxford University Press., Oxford.
4. Pandey, B. P. (2007). Botany for Degree Students: Plant Physiology, Biochemistry, Biotechnology, Ecology and Utilization of Plants. S. Chand & Company Ltd., New Delhi
5. Taiz, L. & Zeiger. E. (1998). Plant Physiology (2nd Ed.). Sinauer Associates, Inc., Publishers, Massachusetts, USA.

REFERENCE BOOKS

1. Kalyan Kumar, De. (2004). An Introduction to Plant Tissue Culture. New Central Book Agency. Pvt.Ltd. Howrah.
2. Kumaresan, V. (2001). Biotechnology .Saras Publication, Nagercoil, TamilNadu
3. Ganguli, H. G. , Das, K.S., & Dutta, C. (2011). College Botany. Vol –I and II. New Central Book Agency, Calcutta.
4. Sharma, P. D. (2010). Microbiology. Rastogi Publications, Meerut.
5. Jain.V. K. (2017). Fundamentals of Plant Physiology. Chand & Company, New Delhi

E – LEARNING RESOURCES

1. <https://www.classcentral.com/course/swayam-plant-physiology-and-metabolism-17732>
2. <https://biolympiads.com/plant-physiology-and-anatomy-links/>
3. <https://byjus.com/biology/plant-physiology/>
4. <http://www.access-excellence.org/Lc/ST/st2bgplant.html>
5. <http://aggie-horticulture.tamu.edu/tisscult/biotech/biotech.html>

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	3	3	2	3	2
CO2	2	3	3	2	3	2
CO3	2	3	3	2	3	2
CO4	3	2	2	3	2	3
CO5	3	3	3	3	3	3
Average	2.4	2.8	2.8	2.4	2.8	2.4

KEY : Photosynthesis, Respiration, Tissue culture, Biofertilizer

PEDAGOGY (TEACHING METHODOLOGY)

Lecture, Microscopic observation, Chart, Seminar, PPT and field study

QUESTION PAPER PATTERN END SEMESTER EXAMINATION:

MAIN PRACTICAL IV

Maximum marks: 60

Practical : 50

Record : 10

1. Outline the procedure, apparatus and materials required for investigating the physiological Problem **A** assigned. Set up the experiment. Tabulate the data observed. Leave the set up for valuation. (1x10 = 10 marks)
2. Outline the procedure, apparatus and materials required for investigating the biochemical Test **B**. Leave the set up for valuation. (1x10 = 10 marks)
3. Set an experiment to prove the activity of **C**. (1x5 = 5 marks)
4. Isolate Ovule from the given flower, mount it and submit **D**. (1x5 = 5 marks)
5. Comment on **E, F, G and H** (4x5 = 20 marks)

Key for Examiners

1. A –Physiology
2. B - Biochemistry
3. C - Physiology (spotters)
4. D-Biotechnology (Ovule isolation)
5. E, F, G, and H – Biotechnology (MS- medium, Explants', callus culture, Root nodules, Biofertilizer)

Distribution of marks

1. Requirement-2, Procedure-3, Setup-3 & Result- 2
2. Requirement-2, Procedure-3, Setup-3 & Result- 2
3. Notes-5
4. Identification -1, Procedure – 2, slide - 2
5. Identification. -2, Notes-3