Annamalai University

(Accredited with 'A' Grade by NAAC)

Faculty of Science

DEPARTMENT OF BOTANY

M.Sc BOTANY

Programme Code: SBOT51

Regulations, Curriculum and Syllabus
2019

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These rules and regulations shall govern the Five year post graduate studies leading to the award of degree of **Master of Science in Botany** in the Faculty of Science. These academic Regulations shall be called "**Annamalai University, Faculty of Science Five year M.Sc. Botany Regulations 2019**".They shall come into force with effect from the academic year 2019 – 2020.

1. **Definitions and Nomenclature**

1.1 **University** refers to Annamalai University.

1.2 **Department** means any of the academic departments and academic centers at the University.

1.3 **Discipline** refers to the specialization or branch of knowledge taught and researched in higher education. For example, Botany is a discipline in the Natural Sciences, while Economics is a discipline in Social Sciences.

1.4 **Programme** encompasses the combination of courses and/or requirements leading to a Degree. For example, M.Sc.,M.A.

1.5 **Course** is an individual subject in a programme. Each course may consist of Lectures/ Laboratory /Seminar/Project work/viva-voce etc. Each course has a course title and is identified by a course code.

1.6 **Curriculum** encompasses the totality of student experiences that occur during the educational process.

1.7 **Syllabus** is an academic document that contains the complete information about an academic programme and defines responsibilities and outcomes. This includes course information, course objectives, policies, evaluation, grading, learning resources and course calendar.

1.8 **Academic Year** refers to the annual period of sessions of the University that comprises two consecutive semesters.

1.9 **Semester** is a half-year term that lasts for a minimum duration of 90 days.

1.10 **Choice Based Credit System**: A mode of learning in higher education that enables a student to have the freedom to select his/her own choice of elective courses across various disciplines for completing the Degree programme.

1.11 **Core Course** is mandatory and an essential requirement to qualify for the Degree.

1.12 **Elective Course** is a course that a student can choose from a range of alternatives.

1.13 **Value-added Courses** are optional courses that complement the students' knowledge and skills and enhance their employability.

1.14 **Credit** refers to the quantum of course work in terms of number of class hours in a semester required for a programme. The credit value reflects the content and duration of a particular course in the curriculum.

1.15 **Credit Hour** refers to the number of class hours per week required for a course in a

semester. It is used to calculate the credit value of a particular course.

1.16 **Programme Outcomes** (POs) are statements that describe crucial and essential knowledge, skills and attitudes that students are expected to achieve and can reliably manifest at the end of a programme.

1.17 **Programme Specific Outcomes** (PSOs) are statements that list what the graduate of a specific programme should be able to do at the end of the programme.

1.18 **Learning Objectives** are statements that define the expected goal of a course in **Course Objectives**in terms of demonstrable skills or knowledge that will be acquired by a student.

1.19 **Course Outcomes** (COs) are statements that describe what students should be able to achieve/demonstrate at the end of a course. They allow follow-up and measurement of learning objectives.

1.20 **Grade Point Average** (GPA) is the average of the grades acquired in various courses that a student has taken in a semester. The formula for computing GPA is given in section 11.3

1.21 **Cumulative Grade Point Average** (CGPA) is a measure of overall cumulative performance of a student over all the semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters to the sum of the total credits of all courses in all the semesters. is given in section11.4.

1.22 **Letter Grade** is an index of the performance of a student in a particular course. Grades are denoted by the letters S, A, B, C, D, E, RA, and W.

2. **Programme Offered and Eligibility Criteria**:

The Department of Botany offers a M.Sc. in Botany (Five-Year)programme.

A pass in H.S.E. (10+2 level) regular or vocational with Botany/Biology or Vocational course with Agriculture/Plant Protection as one of the courses.

2.1 In the case of SC/ST and Differently-abled candidates, a pass is the minimum qualification for the above Programme.

3. **Reservation Policy:** Admission to the various programmes will be strictly based on the reservation policy of the Government of Tamil Nadu.

4. Programme Duration

4.1 The Five Year Master's Programme consists of five academic years.

4.2 Each academic year is divided into two semesters, the first being from July to November and the second from December to April.

4.3 Each semester will have 90 working days (18 weeks).

5. Programme Structure

5.1 The Five-Year Integrated Programme consists of Language Courses, Core Courses, Allied Courses, Elective Courses, Experiential Learning and Project. Students shall also participate in Extension Activities as part of their curriculum.

5.2 Language Courses

5.2.1 Each student shall take two languages of four courses each, one in each semester for the first two years of the programme.

5.2.1 Language – I shall be Tamil or another language such as Hindi or French.

5.2.2 Language – II shall be English.

5.3 Core courses

5.3.1 These are a set of compulsory courses essential for each programme.

5.3.2 The core courses include both Theory (Core Theory) and Practical (Core Practical) courses.

5.4 Allied Courses

5.4.1 Each student shall take courses in two disciplines allied to the main subject (Allied – I and Allied – II) of the programme in the first four semesters.

5.5 Elective courses

5.5.1 Departmental Electives (DEs) are the Electives that students can choose from a range of Electives offered within the Department.

Interdepartmental Electives (IDEs) are Electives that students can choose from amongst the courses offered by other departments of the same faculty as well as by the departments of other faculties.

5.6 Soft Skills

5.6.1 Soft skills are intended to enable students to acquire attributes that enhance their performance and achieve their goals with complementing hard skills.

5.6.2 Soft skills include communication skills, **computer skills** among others.

5.7 Value Education

5.7.1 All students shall take a course on Value Education that includes human values, sustainable development, gender equity, ethics and human rights.

5.7.2 **Value Education** is categorized as **Non-Credit Compulsory Course.**

5.8 Experiential Learning

5.8.1 Experiential learning provides opportunities to students to connect principles of the discipline with real – life situations, either within the classroom, within the community, or within the work place-based learning outcome that are specifically focused on employability skills.

5.8.2 In-plant training/field trips/internships/industrial visits (as applicable) fall under this category.

5.8.3 Experiential learning is categorized as Non-Credit Compulsory Course

5.9 Extension Activities

5.9.1 It is mandatory for every student to participate in extension activities.

5.9.2 All the students shall enrol under NSS/NCC/YRC/RRC or any other Service organisation in the University.

5.9.3 Students shall put in a minimum attendance of 40 hours in a year duly certified by the Programme Coordinator.

5.9.4 Extension activities shall be conducted outside the class hours

5.9.5 Extension activities are categorized as **Non-Credit Compulsory Course**

5.10 Project

5.10.1 Each student shall undertake a Project and submit a dissertation as per guidelines in the final semester.

5.10.2 The Head of the Department shall assign a Research Supervisor to the student.

5.10.3 The Research Supervisor shall assign a topic for research and monitor the progress of the student periodically.

5.10.4 Students who wish to undertake project work in recognized institutions/industry shall obtain prior permission from the University. The Research Supervisor will be from the host institute.

5.11 Value added Courses (VACs)

5.11.1 Students may also opt to take Value added Courses beyond the minimum credits required for award of the Degree. VACs are outside the normal credit paradigm.

5.11.2 These courses impart employable and life skills.

5.11.3 Each VAC carries 2 credits with 30 hours of instruction. Classes for a VAC are conducted beyond the regular class hours and preferably in the VIII and IX Semester.

5.12 Online Courses

5.12.1 The Heads of Departments shall facilitate enrolment of students in Massive Open Online Courses (MOOCs) platform such as SWAYAM to provide academic flexibility and enhance the academic career of students.

5.12.2 Students who successfully complete a course in the MOOCs platform shall be exempted from one elective course of the programme.

5.13 **Credit Distribution:** The credit distribution is organized as follows:

LIST OF COURSES	CREDITS
Semester I to VI	
Language-I (Tamil or any other Language)	12
Language-II (English)	12
Core Courses	82
Allied-I (1st Year- SEM I & II)	10
Allied-II(2nd Year- SEM III & IV)	10
Electives	09
Soft Skills (Computer Skill)	03
Environmental studies (UGC mandated)	03

Value Education	02*
Experiential learning	02*
Extension activities	01*
Total Credits (Semester I to VI)	**141**
Semester VII to X	
Core Courses	72
Electives (DE)	06
Electives (IDE)	09
Project	06
Constitution of India	02*
Total Credits (Semester VII to X)	**93**
Total Credits (Semester I to X)	**234**

5.9 Credit Assignment

Each course is assigned credits and credit hours on the following basis:

1 Credit is defined as

1 Lecture period of one-hour duration per week over a semester

1 Tutorial period of one-hour duration per week over a semester

1 Practical / Project period of two hours duration per week over a semester

6 Attendance

6.1 Each faculty handling a course shall be responsible for the maintenance of Attendance and Assessment Record for candidates who have registered for the course.

6.2 The Record shall contain details of the students' attendance, marks obtained in the Continuous Internal Assessment (CIA) Tests, Assignments and Seminars. In addition the Record shall also contain the organization of lesson plan of the Course teacher.

6.3 The record shall be submitted to the Head of the Department and Dean once a month for monitoring the attendance and syllabus coverage.

6.4 At the end of the semester, the record shall be placed in safe custody for any future verification.

6.5 The Course teacher shall intimate to the Head of the Department at least seven calendar days before the last instruction day in the semester about the attendance particulars of all students.

6.6 Each student shall have a minimum of 75% attendance in all the courses of the particular semester failing which he or she will not be permitted to write the End-Semester Examination. The student has to redo the semester in the next year.

6.7 Relaxation of attendance requirement up to 10% may be granted for valid reasons such as illness, representing the University in extracurricular activities and participation in NCC/NSS/YRC/RRC.

7 Mentor-Mentee System

7.1 To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach certain number of students to a member of the faculty who shall function as a Mentor throughout their period of study.

7.2 The Mentors will guide their mentees with the curriculum, monitor their progress, and provide intellectual and emotional support.

7.3 The Mentors shall also help their mentees to choose appropriate electives and value-added courses, apply for scholarships, undertake projects, prepare for competitive examinations such as NET/SET, GATE etc., attend campus interviews and participate in extracurricular activities.

8 Examinations

8.1 The examination system of the University is designed to systematically test the student's progress in class, laboratory and field work through Continuous Internal Assessment (CIA) Tests and End-Semester Examination (ESE).

8.2 There will be two CIA Tests and one ESE in each semester.

8.3 The Question Papers will be framed to test different levels of learning based on Bloom’s taxonomy viz. Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation/Creativity.

8.4 Continuous Internal Assessment Tests

8.4.1 The CIA Tests shall be a combination of a variety of tools such as class tests, assignments and seminars. This requires an element of openness.

8.4.2 The students are to be informed in advance about the assessment procedures.

8.4.3 The question paper will be set by the respective faculty using Blooms Taxanomy.

8.4.4 CIA Tests will be for one- or two-hours duration depending on the quantum of syllabus.

8.4.5 A student cannot repeat the CIA Test-I and CIA Test-II. However, if for any valid reason, the student is unable to attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

8.4.6 For the CIA Tests, the assessment will be done by the Course teacher

8.5 End Semester Examinations (ESE)

8.5.1 The ESEs for the odd semester will be conducted in November and for the even semester in May.

8.5.2 Candidates who failed in any course will be permitted to reappear in failed course in the subsequent examinations.

8.5.3 The ESE will be of three hours duration and will cover the entire syllabus of the course

9 Evaluation

9.1 Marks Distribution

9.1.1 For each course, the Theory, Practical and project shall be evaluated for a maximum of 100 marks.

9.1.2 For the theory courses and Project, CIA Tests will carry 25% and the ESE 75% of the marks.

9.1.3 For the Practical courses, the CIA Tests will carry 40% and the ESE 60% of the marks.

9.2 Assessment of CIA Tests

9.2.1 For the CIA Tests, the assessment will be done by the Course Teacher.

9.2.2 For the Theory Courses, the break-up of marks shall be as follows:

CIA Tests	Marks
Test-I & Test-II	15
Seminar	5
Assignment	5
Total	25

9.2.3 For the Practical Courses (wherever applicable), the break-up of marks shall be as follows:

CIA Tests	Marks
Test-I	15
Test-II	15
Viva-voce and Record	10
Total	40

9.2.4 The M.Sc., students of Botany shall undertake a Botanical Tour during third semester under the guidance of the staff members for field training and plant collection.

9.3 Assessment of End-Semester Examinations

9.3.1 Evaluation for the ESE is done by university examiner (Internal examiner).

9.4 Assessment of Project/Dissertation

9.4.1 The Project Report/Dissertation shall be submitted as per the guidelines.

9.4.2 The Project Work/Dissertation shall carry a maximum of 100 marks.

9.4.3 CIA for Project will consist of a Review of literature survey, experimentation/field work, attendance etc.

9.4.4 The Project Report evaluation and viva-voce will be conducted by a committee

constituted by the Head of the Department.

9.4.5 The Project Evaluation Committee will comprise the Head of the Department, Project Supervisor, and a senior faculty.

9.4.6 The marks shall be distributed as follows:

Continuous Internal Assessment (25 Marks)		End Semester Examination (75 Marks)	
Review-I - 10	Review-II -15	Project / Dissertation Evaluation	Viva-voce
		50	25

9.5 Assessment of Value-added Courses

9.5.1 Assessment of VACs shall be internal. Two CIA Tests shall be conducted by the Department(s) offering VAC.

9.5.2 The grades obtained in VACs will not be included for calculating the GPA/CGPA.

9.6 Passing Minimum

9.6.1 A student is declared to have passed in each course if he/she secures not less than 50% marks in the ESE and not less than 50% marks in aggregate taking CIA and ESE marks together.

9.6.2 The minimum marks for the Project/ Dissertation alone is 50% and passing minimum is the aggregate of Project + CIA + Viva voce is 50%.

9.6.3 A candidate who has not secured a minimum of 50% of marks in a course (CIA + ESE) shall reappear for the course in the next semester/year.

10. Conferment of the Master's Degree

A candidate who has secured a minimum of 50% marks in all courses prescribed in the programme and earned the minimum required credits shall be considered to have passed the Master's Programme.

11. Marks and Grading

11.1 The performance of students in each course is evaluated in terms Grade Point (GP).

11.2 The sum total performance in each semester is rated by Grade Point Average (GPA) while Cumulative Grade Point Average (CGPA) indicates the Average Grade Point obtained for all the courses completed.

11.3 **The GPA** is calculated by the formula

$$GGG = \frac{\sum_{GG\,G}^{G} G_G G_G}{\sum_{GG\,G}^{G} G_G}$$

where, G_G is the Credit earned for the Course G in any semester;

$G_{\acute{G}}$ is the Grade Point obtained by the student for the Course G

G is the number of Courses passedin that semester.

11.4 **CGPA** is the Weighted Average Grade Point of all the Courses passed starting from the first semester to the current semester.

$$GGGG = \frac{\sum_{GG\,G}^{G} \sum_{GG\,G}^{G} G_G G_G}{\sum_{GG\,G}^{G} \sum_{GG\,G}^{G} G_G}$$

Where, G_G is the Credit earned for the Course G in any semester;

$G_{\acute{G}}$ is the Grade Point obtained by the student for the Course G

G is the number of Courses passedin that semester.

G is the number of semester.

11.5 Evaluation :

11.5.1 **Performance of the student for each course will be rated as shown in the Table.**

Range of Marks	Grade Points	Letter Grade
90 and above	10	S
80-89	9	A
70-79	8	B
60-69	7	C
55-59	6	D
50-54	5	E
Less than 50	0	RA
Withdrawn from the examination	0	W

11.5.2 A ten-point rating scale is used for evaluation of the performance of the student to provide overall grade for the Master's Programme.

CGPA	Classification of Final Result
8.25 and above	First Class with Distinction
6.5 and above but below 8.25	First Class
5.0 and above but below 6.5	Second Class
0.0 and above but below 5.0	Re-appear

11.6 **Classification of Results**. The successful candidates are classified as follows:

11.6.1 **First Class with Distinction:** Candidates who have passed all the courses prescribed in the Programme in the first attempt with a CGPA of 8.25and above within the programme duration. Candidates who have withdrawn from the End Semester Examinations are still eligible for First Class with Distinction (See Section

12 for details).

11.6.2 **First Class:** Candidates who have passed all the courses with a CGPA of 6.5and above.

11.6.3 **Second Class:** Candidates who have passed all the courses with a CGPA between 5.0 and less than 6.5.

11.6.4 Candidates who obtain overall highest CGPA in all examinations in the first appearance itself are eligible for **University Rank.**

11.7 **Course-Wise Letter Grades**

11.7.1 The percentage of marks obtained by a candidate in a course will be indicated in a letter grade.

11.7.2 A student is considered to have completed a course successfully and earned the credits if he/she secures an overall letter grade other than RA.

11.7.3 A course successfully completed cannot be repeated for the purpose of improving the Grade Point

11.7.4 A letter grade RA indicates that the candidate shall reappear for that course. The RA Grade once awarded stays in the grade sheet of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidate has appeared for clearance of the arrears.

11.7.5 If a student secures RA grade in the Project Work/Field Work/Practical Work/Dissertation, he/she shall improve it and resubmit if it involves only rewriting/ incorporating the clarifications suggested by the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.

12. Provision for Withdrawal from the End Semester Examination

12.1 The letter grade W indicates that a candidate has withdrawn from the examination.

12.2 A candidate is permitted to withdraw from appearing in the ESE for one course or courses in ANY ONE of the semesters ONLY for exigencies deemed valid by the University authorities.

12.3 Permission for withdrawal from the examination shall be granted only once during the entire duration of the programme.

12.4 Application for withdrawal shall be considered only if the student has registered for the course(s), and fulfilled the requirements for attendance and CIA tests.

12.5 The application for withdrawal shall be made ten days prior to the commencement of the examination and duly approved by the Controller of Examinations. Notwithstanding the mandatory prerequisite of ten days' notice, due consideration will be given under extraordinary circumstances.

12.6 Withdrawal will not be granted for arrear examinations of courses in previous

semesters and for the final semester examinations.

12.7 Candidates who have been granted permission to withdraw from the examination shall reappear for the course(s) when the course(s) are offered next.

12.8 Withdrawal shall not be taken into account as an appearance for the examination when considering the eligibility of the candidate to qualify for First Class with Distinction.

13. **Academic misconduct:** Any action that results in an unfair academic advantage/interference with the functioning of the academic community constitutes academic misconduct. This includes but is not limited to cheating, plagiarism, altering academic documents, fabrication/falsification of data, submitting the work of another student, interfering with other students' work, removing/defacing library or computer resources, stealing other students' notes/assignments, and electronically interfering with other students'/University's intellectual property. Since many of these acts may be committed unintentionally due to lack of awareness, students shall be sensitized on issues of academic integrity and ethics.

14. **Transitory Regulations:** Wherever there has been a change of syllabi, examinations based on the existing syllabus will be conducted for two consecutive years after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that, the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendation of the Head of the Department concerned.

15. Notwithstanding anything contained in the above pages as Rules and Regulations governing the Five-Year Master's Programmes at Annamalai University, the Syndicate is vested with the powers to revise them from time to time on the recommendations of the Academic Council.

Annamalai University

Department of Botany

M.Sc. Botany (Five Year) Programme

Programme Code: SBOT51

Curricula and Scheme of Examination

(For students admitted from the academic year 2019-2020)

Course Code	Course Title	Hours/ Week			C	Marks		
		L	T	P		CIA	ESE	Total
Semester-I								
19ITAMC11	Language-I: Course 1 Tamil /French/Hindi	3	0		3	25	75	100
19IENGC12	Language–II: Course 1 English Through Literature-I Prose	3	0		3	25	75	100
19IENSC13	Environmental Studies	3	0		3	25	75	100
19IBOTC14	Core 1: Microbiology and Plant Pathology	4	0		4	25	75	100
19IZOOA01	Allied-I: Zoology –I	4	0		4	25	75	100
	Elective 1: Department Elective	3	0		3	25	75	100
					20			
Semester-II								
19ITAMC21	Language-I: Course 2Tamil /French/Hindi	3	0		3	25	75	100
19IENGC22	Language– II: Course 2 English Through Literature-II Poetry	3	0		3	25	75	100
19ICISC23	Core 2: Soft Skill: Computer Applications - I	3	0		3	25	75	100
19IBOTC24	Core 3: Algae, Fungi and Lichens	4	0		4	25	75	100
19IBOTP25	Core 4: Practical–I	0	0	6	5	40	60	100
19IZOOA02	Allied- I: Zoology –II	4	0		4	25	75	100
19IZOOAP1	Allied Practical- I: Zoology			6	2	40	60	100
					24			
Semester-III								
19ITAMC31	Language-I: Course 3 Tamil /French/Hindi	3	0		3	25	75	100
19IENGC32	Language–II: Course 3 English Through Literature-III Drama	3	0		3	25	75	100
19IBOTC33	Core 5: Bryophytes and Pteridophytes	4	0		4	25	75	100
19IBOTP34	Core 6: Practical–II	0	0	6	5	40	60	100
19ICHEA01	Allied- II: Chemistry - I Course 1	4	0		4	25	75	100
	Elective 2: Department Elective	3	0		3	25	75	100
					22			

Semester-IV								
19ITAMC41	Language–I: Course 4 Tamil /French/Hindi	3	0		3	25	75	100
19IENGC42	Language–II: Course 4English Through Literature-IV Short story	3	0		3	25	75	100
19IBOTC43	Core 7: Gymnosperms and Palaeobotany	4	0		4	25	75	100
19IBOTC44	Core 8: Morphology of Angiosperms	5	0		5	25	75	100
19IBOTP45	Core 9: Practical-III	0	0	6	5	40	60	100
19ICHEA02	Allied-II: Chemistry - II Course 2	4	0	0	4	25	75	100
19ICHEP01	Allied Practical-II Chemistry	0	0	6	2	40	60	100
19IBOTC46	Core 10: Extension Activity	0	0	2	1*	25	75	100
					26			
Semester-V								
19IBOTC51	Core 11: Anatomy and Embryology of Angiosperms	5	0		5	25	75	100
19IBOTC52	Core 12: Taxonomy of Angiosperms, Economic Botany and Evolution	5	0		5	25	75	100
19IBOTC53	Core 13: Biological Techniques	4	0		4	25	75	100
19IBOTP54	Core 14: Practical- IV	0	0	12	6	40	60	100
19IBOTV55	Core 15: Value Education	2	0		2*	25	75	100
	Elective 3: Department Elective	3	0		3	25	75	100
					23			
Semester-VI								
19IBOTC61	Core 16: Cytology, Genetics and Plant Breeding	4	0		5	25	75	100
19IBOTC62	Core 17: Plant Physiology and Biochemistry	5	0		5	25	75	100
19IBOTC63	Core 18: Ecology and Biodiversity	5	0		5	25	75	100
19IBOTC64	Core 19: Molecular Biology, Genetic Engineering and Biotechnology	4	0		5	25	75	100
19IBOTP65	Core 20: Practical-V	0	0	12	6	40	60	100
19IBOTC66*	Core 21: Experiential Learning	0	4	0	2*	25	75	100
					26			
Semester-VII								
19IBOTC71	Core 22: Plant Diversity – I(Algae and Bryophytes)	4	0		4	25	75	100
19IBOTC72	Core 23: Fungi, Lichens and Plant Pathology	4	0		4	25	75	100
19IBOTC73	Core 24: Microbiology	4	0		4	25	75	100

19IBOTP74	Core 25: Practical-VI	0	0	12	6	40	60	100
	Elective 4: Interdepartmental Elective	3	0		3	25	75	100
					21			
Semester-VIII								
19IBOTC81	Core 26: Plant Diversity - II (Pteridophytes, Gymnosperms and Palaeobotany)	4	0		4	25	75	100
19IBOTC82	Core 27: Anatomy, Embryology of Angiosperms and Morphogenesis	4	0		4	25	75	100
19IBOTC83	Core 28: Cell Biology, Genetics and Plant Breeding	4	0		4	25	75	100
19IBOTP84	Core 29: Practical-VII	0	0	12	6	40	60	100
	Elective 5: Department Elective	3	0		3	25	75	100
	Elective 6: Interdepartmental Elective	3	0		3	25	75	100
					24			
Semester-IX								
19IBOTC91	Core 30: Taxonomy of Angiosperms and Economic Botany	4	0		4	25	75	100
19IBOTC92	Core 31: Biochemistry and Molecular Biology	4	0		4	25	75	100
19IBOTC93	Core 32: Biological Techniques and Research Methodology	4	0		4	25	75	100
19IBOTC94	Core 33: Plant Bio-technology and Genetic Engineering	4	0		4	25	75	100
19IBOTP95	Core 34: Practical-VIII		0	12	6	40	60	100
	Elective 7: Department Elective	3	0		3	25	75	100
	Elective 8: Interdepartmental Elective	3			3	25	75	100
19IPSC090	Constitution of India* (additional non credit - compulsory course)	2*			2*	25	75	100
					28			
Semester-X								
19IBOTCX1	Core 35: Plant Physiology	4	0		4	25	75	100
19IBOTCX2	Core 36: Environmental Biology and Evolution	4	0		4	25	75	100
19IBOTPX3	Core 37: Practical-IX	0	0	12	6	40	60	100
19IBOTDX5	Project (Dissertation &Viva-voce)	0	6	0	6	25	75	100
					20			
	Total Credits				**234**			

L- Lectures; T-Tutorials; P- Practical; C- Credits; CIA- Continuous Internal Assessment; ESE- End-Semester Examination

Note:

1. Students shall take both Department Electives (DEs) and Interdepartmental Electives (IDEs) from a range of choices available. The details of interdepartmental electives are given in the **"Handbook of Interdepartmental Electives- PG Programmes"** and listed in the University website.
2. Students may opt for any Value-Added Courses listed in the University website. The details of Value-Added Courses are given in the **"Handbook of Value-Added Courses"** and listed in the University website.
3. Guidance/Discussion with students on course specific **experiential learning** through the application of theory and academic content to real-world experiences, either within the classroom, within the community, or within the work place, which advances program or course -based learning outcome that are specifically focused on employability skills.

DEPARTMENT ELECTIVE COURSES (DE)

S. No.	Course Code	Course Title	Hours/ week			C	Marks		
			L	T	P		CIA	ESE	Total
1.	19IBOTE16	Mushroom Cultivation	3	0	0	3	25	75	100
2.	19IBOTE17	Herbal Science	3	0	0	3	25	75	100
3.	19IBOTE36	Floriculture	3	0	0	3	25	75	100
4.	19IBOTE37	Pomology	3	0	0	3	25	75	100
5.	19IBOTE56	Bio-fertilizer	3	0	0	3	25	75	100
6.	19IBOTE57	Micro Propagation	3	0	0	3	25	75	100
7.	19IBOTE85	Herbarium Keeping	3	0	0	3	25	75	100
8.	19IBOTE86	Forest Technology	3	0	0	3	25	75	100
9.	19IBOTE95	Applied Botany	3	0	0	3	25	75	100
10.	19IBOTE96	Bioprospecting of Medicinal and Aromatic Plants	3	0	0	3	25	75	100

ALLIED COURSES OFFERED TO OTHER DEPARTMENTS

S. No.	Course Code	Course Title	Hours/ week			C	Marks		
			L	T	P		CIA	ESE	Total
1.	19IBOTA01	Allied –I: Botany I: Plant Diversity, Anatomy and Embryology	4	0	0	4	25	75	100
2.	19IBOTA02	Allied Botany II: Taxonomy, Physiology, Ecology and Biotechnology	4	0	0	4	25	75	100
3.	19IBOTAP1	Allied Practical I: Botany	0	0	6	3	40	60	100

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[Question Paper Pattern - INTERNAL TESTS I & II (CIA)]

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc : Five Year Integrated **Semester: All**

Time: 2 Hrs **Max.Marks:50**

Part-A (Level-K1) **Marks: (6x2=12)**

(Answer ALL of the questions)

1. Define /Choose/ Relate……
2. What / Why / How?
3. Multiple Choices a. b. c. d.
4. Multiple Choices a. b. c. d.
5. Match the following i - a ii - b iii - c iv - d v - …..
6. Match the following i - a ii - b iii - c iv - d v - …..

Part-B (Level-K2)

Marks: (3x5=15)

(Answer any THREE of the questions)

7. Explain…..
8. Describe…..
9. Select……
10. Compare

Part-C (Level-K3/ Level-K4)

Marks: (2x7=14)

(Answer any TWO of the questions)

11. Apply….
12. Calculate….
13. Categorize…

Part-D (Level-K5/ Level-K6)

Marks: (1x9=9)

(Answer any ONE of the questions)

14. Discuss….
15. Summarize….

ANNAMALAI UNIVERSITY
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[End Semester Examinations]
(Based onRevised Bloom's Taxonomy)

Programme: M.Sc., : Five Year Integrated PG Year: I/II Semester:
Time: 3 Hrs Max.Marks:100

Part-A (Level-K1)

Marks: (15x2=30)

(Answer ALLof the questions)

1. Define……
2. What …….?
3. Choose/Relate……
4. How ……?
5. Why ……?
6. Find……
7. Spell out……
8. Multiple Choices a. b. c. d.
9. Multiple Choices a. b. c. d.
10. Multiple Choices a. b. c. d.
11. Multiple Choices a. b. c. d.
12. Match the following i - a ii - b iii - c iv - d v - …..
13. Match the following i - a ii - b iii - c iv - d v - …..
14. Match the following i - a ii - b iii - c iv - d v - …..
15. Match the following i - a ii - b iii - c iv - d v - …..

Part-B (Level-K2)

Marks: (5x5=25)

(Answer any FIVE of the questions)

16. Explain…..
17. Describe…..
18. Select……
19. Classify….
20. Compare….
21. Interpret…

Part-C (Level-K3/ Level-K4)

Marks: (5x7=35)

(Answer any FIVE of the questions)

22. Apply….
23. Show…..
24. Solve….
25. Calculate….
26. Categorize…
27. Distinguish….
28. Test for…..

Part-D (Level-K5)

Marks: (1x10=10)

(Answer any ONE of the questions)

29. Discuss….
30. Summarize….

ANNAMALAI UNIVERSITY
Department of Botany
[End Semester Examinations]
(Based onRevised Bloom's Taxonomy)

Programme: M.Sc., : Five Year Integrated PG Year: III Semester:
Time: 3 Hrs Max.Marks:100

Part-A (Level-K1)
***(Answer ALL of the questions*)** **Marks: (10x2=20)**

1. Define……
2. What …….?
3. Multiple Choices a. b. c. d.
4. Multiple Choices a. b. c. d.
5. Multiple Choices a. b. c. d.
6. Multiple Choices a. b. c. d.
7. Match the following i - a ii- b iii- civ - d v - …..
8. Match the following i - a ii- b iii- civ - d v - …..
9. Match the following i - a ii- b iii- civ - d v - …..
10. Match the following i - a ii- b iii- c iv - d v - …..

Part-B (Level-K2)
(Answer any FIVE ofthe questions) **Marks: (5x3=15)**

11. Explain…..
12. Describe…..
13. Select……
14. Classify….
15. Compare….
16. Outline ….

Part-C (Level-K3/Level-K4)

Marks: (9x5=45)

(Answer any NINE of the questions)

17. Apply….
18. Prepare….
19. Show…..
20. Solve….
21. Illustrate…..
22. Sketch….
23. Infer….
24. Categorize…
25. Analyze…
26. Distinguish….
27. Take part in…

Part-D (Level-K5/Level-K6)

Marks: (2x10=20)

(Answer any TWO of the questions)

28. Discuss….
29. Summarize….
30. Design….

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Department of Botany

[End Semester Examinations]

(Based onRevised Bloom's Taxonomy)

Programme: M.Sc.,: Five Year Integrated PG Year: IV Semester:

Time: 3 Hrs **Max.Marks:100**

Part-A (Level-K1/ Level-K2)

Marks: (10x2=20)

(Answer ALL of the questions)

1. Define……
2. Multiple Choices a. b. c. d.
3. Multiple Choices a. b. c. d.
4. Match the following i - a ii- b iii- c iv –d v - …..
5. Match the following i - a ii- b iii- c iv –d v - …..
6. Explain…….
7. Select…..
8. Describe……
9. Classify….
10. Elucidate….

Part-B (Level-K3/ Level-K4)

Marks: (8x5=40)

(Answer any EIGHT of the questions)

11. Prepare…..
12. Solve…..
13. Apply……
14. Show…..
15. Categorize…
16. Analyze…
17. Distinguish….
18. Infer….
19. Compare….
20. Compute

Part-C (Level-K5)

Marks: (3x10=30)

(Answer any THREE of the questions)

21. Discuss…
22. Summarize….
23. Evaluate…..
24. Disprove….

Part-D (Level-K6)*

Marks: (1x10=10)

(Answer any ONE of the questions)

25. Design….
26. Develop…

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All PG in the Faculties of Arts / Sci. / M. Sci. / Ind. Lan. / Edn. / Fine Arts. [2019-20]
[End Semester Examinations]

(Based onRevised Bloom's Taxonomy)

Programme: M.Sc., : Five Year Integrated PG Year:V Semester:

Time: 3 Hrs **Max.Marks:100**

Part-A (Level-K1/ Level-K2)

(Answer ALL of thequestions) **Marks: (10x2=20)**

1. Define……
2. Multiple Choices a. b. c. d.
3. Multiple Choices a. b. c. d.
4. Match the following i - a ii- b iii- c iv –d v - …..
5. Match the following i - a ii- b iii- c iv –d v - …..
6. Explain…….
7. Select…..
8. Describe…..
9. Classify….
10. Elucidate….

Part-B (Level-K3/ Level-K4)

(Answer any SIX of the questions) **Marks: (6x5=30)**

11. Apply……
12. Show…..
13. Prepare
14. Make use of….
15. Categorize…
16. Analyze…
17. Distinguish….
18. Simplify…..

Part-C (Level-K5)

(Answer any THREE of the questions) **Marks: (3x10=30)**

19. Discuss…
20. Recommend with
21. Evaluate…..
22. Justify….
23. Optimize…

Part-D (Level-K6)

(Answer any TWO of the questions) **Marks: (2x10=20)**

24. Design….
25. Formulate …
26. Modify…..

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[End Semester Examinations]

Bloom's Taxonomy - Questions Conforming to Levels K1 to K6

I Year(Five Year PG)				II Year (Five Year PG)				III Year(Five Year PG)			
Level	Part	Questions & Marks	Total Marks	Level	Part	Questions & Marks	Total Marks	Level	Part	Questions & Marks	Total Marks
K1	A	15 x 2	30	K1	A	15 x 2	30	K1	A	10 x 2	20
K2	B	5 x 5	25	K2	B	5 x 5	25	K2	B	5 x 3	15
K3	C	3 x 7	21	K3	C	3 x 7	21	K3	C	5 x 5	25
K4		2 x 7	14	K4		2 x 7	14	K4		4 x 5	20
K5	D	1 x 10	10	K5	D	1 x 10	10	K5	D	1 x 10	10
			100				100	K6		1 x 10	10
											100

IV Year (Five Year PG) I Year (Two/Three year PG)/				V Year (Five Year PG) II/IIIYear (Two/Three Year PG) /			
Level	Part	Questions & Marks	Total Marks	Level	Part	Questions & Marks	Total Marks
K1	A	5 x 2	10	K1	A	5 x 2	10
K2		5 x 2	10	K2		5 x 2	10
K3	B	4 x5	20	K3	B	2 x 5	10
K4		4 x5	20	K4		4 x 5	20
K5	C	3 x 10	30	K5	C	3 x10	30
K6	D	1 x 10	10	K6	D	2x 10	20
			100				100

PROGRAMME OUTCOMES (POs)

After the successful completion of the M.ScBotany (5 year) Degree Programme, the graduates will be able to:

PO1:	Domain knowledge: Demonstrate knowledge of basic concepts, principles and applications of the specific science discipline.
PO2:	Resource Utilisation. Cultivate the skills to acquire and use appropriate learning resources including library, e-learning resources, ICT tools to enhance knowledge-base and stay abreast of recent developments.
PO3:	Analytical and Technical Skills: Ability to handle/use appropriate tools/techniques/equipment with an understanding of the standard operating procedures, safety aspects/limitations.
PO4:	Critical thinking and Problem solving: Identify and critically analyse pertinent problems in the relevant discipline using appropriate tools and techniques as well as approaches to arrive at viable conclusions/solutions.
PO5:	Project Management: Demonstrate knowledge and scientific understanding to identify research problems, design experiments, use appropriate methodologies, analyse and interpret data and provide solutions. Exhibit organisational skills and the ability to manage time and resources.
PO6:	Individual and team work: Exhibit the potential to effectively accomplish tasks independently and as a member or leader in diverse teams, and in multidisciplinary settings.
PO7:	Effective Communication: Communicate effectively in spoken and written form as well as through electronic media with the scientific community as well as with society at large. Demonstrate the ability to write dissertations, reports, make effective presentations and documentation.
PO8:	Environment and Society: Analyse the impact of scientific and technological advances on the environment and society and the need for sustainable development.
PO9:	Ethics: Commitment to professional ethics and responsibilities.
PO10:	Life-long learning: Ability to engage in life-long learning in the context of the rapid developments in the discipline.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

At the end of the programme, the student will be able to

PSO1	Understand the basic principles of Life forms for the scientific phenomena of Plant Science
PSO2	Understand the enumeration and description of the natural phenomena
PSO3	Appreciate the knowledge on the various branches of Botany (Plant Morphology, Anatomy, Embryology and Physiology)
PSO4	Comprehend the importance of conservation of plant resources
PSO5	Understand the various applications of plants to human welfare

Semester	19ITAMC11: Language – I : Course 1 Tamil	L	T	P	C
I	நவீனஇலீ கியீ ீ நாடகீ ீ	3	0	0	3

கீ றலீ நேரீ கீ

LO1	தமிழில்தோல்றியநவன்இலல்கியல்கல்றில்ல்அறில் கல்செல்தல். நவன்இலல்கியல்கல்றில்தவரையறை
LO2	தோல்றல்பன்னணல்நவன்இலல்கியவகைகல்–உரைநடை - ல்ல்கவன்தை -
LO3	செல்தில்தால்–நாடகல்போல்றவல்றில் வரலால்றைவன்ல்ல்தல்.

கீ றீ வெளீ பரீ

இீ தீ பாட்ீ ீ வீ மாணவீ கீ

CO 1	நவன்இலல்கியல்கல்நாடகஇலல்கியல்கல்றில்தறிதலைல்பெல்வததோல்தமில்இலல்கியல்களன்நல்சியைல்ல்ல்கொல்வல்
CO 2	தல்காலஇலல்கியல்கல்எல்வால்சல் கல்தைஎல்ல்ல்கால்ல்கில்றனஎல்பதைவல்ளல்கிகொல்வல்
CO 3	நவன்இலல்கியல்களன்வழிவால்வல்பல்கல்ல்ல்களைஅறில்ல்வால்ல்கையன்பல்ல்பல்ல்வால்கல்

அலீ - 1 சீ கதை

1. ல்ல்மைல்பன்தல் - பால்வல் ணல்பன்ளை
2. .கி.ராஜநாராயணல் - கதல்
3. ல்.அழகில்சாமி - ராஜாவல்தில்ல்கிறால்
4. கல் மணன்ணசேகரல் - உயன்ல்தல் ணன்
5. மேலால் மைபொல்ல் ல்சாமி - தேசியமயன்

அலீ – 2ீ ீ கவீ தை

1. பாரதியால் - ல்ல்மைல்பெல்
2. பாரதிதாசல் - தமில்உணல்
3. உவமைல்கவஞல்ல்ரதா - தமிழில்பெயல்ல்ல்கல் (ல்றைல் கல்)

4. தேவதேவல் - ல்கல்டல் (அல் தல்மால்திரமேவெளாய்யல்டல்)

5. அறில்மதி - நல்ல்ல்காலல் (ல் தல் 20- கவன்தைகல்மல்ல்ல்)

6. மில்ரா - ஹைல் எல்தோழி

(ல் தல் 20- கவன்தைகல்மல்ல்ல்)

அலீ - 3 ீ தினீ

1. ல்.செல்வரால் - பொல்ல்கால்ல்திரை

அலீ - 4 நாடகீ

1. இல்ல்லால் - ஒளவை

அலீ - 5 ஜீ காலஇலீ கியவரலரீ

ஐரோல்யல்வல்கை–நவன்இலல்கியல்கல்அறில் கல்- ல்ல்ல்கவன்தை - சில்கதை–ல்தினல்ஆகியவல்றில்தோல்றல் ல்வளல்ச்சில்ல்–இலல்கியல் ல்னோல்கல்–செல்தில்தால்வல்கை - நாடகல்–தோல்றல் ல்வளல்ச்சில்ல்.

பாட் ீ கீ

1. ல்ல்மைல்யன்தல்,(2015),பால்வல் ணல்பன்ளை,(ஐல்தால்பதில்ல்),நில்செல் சல்ல்ல்ஹல்ல் , செல்னை
2. கி.ராஜநாராயணல், (2015),கதல்,(ஏழால்பதில்ல்),அல்னல்வெளாய்யல்,தல் சால் ல்
3. ல்.அழகில்சாமி, (2012),ராஜாவல்தில்ல்கிறால்ல் தல்பதில்ல்), காலல்ல்வல்பதில்யகல், நாகல்கோயன்
4. கல் மணன்ணசேகரல்,(1997),உயன்ல்தல் ணன்ல் தல்பதில்ல்) தாமரைல்செல்வல்தில்யகல், செல்னை
5. மேலால் மைபொல்ல் ல்சாமி,(1997),தேசியமயன்,(ல் தல்பதில்ல்), வானதிபதில்யகல், செல்னை
6. பாரதியால்(2017),பாரதியால்கவன்தைகல்,(இரல் டால்பதில்ல்),நில்செல் சல்ல்ல்ஹல்ல் , செல்னை
7. பாரதிதாசல்,(2016),பாரதிதாசல்கவன்தைகல்,(ஏழால்பதில்ல்),மணல்வாசகல்யதில்யகல், செல்னை
8. உவமைல்கவஞ்ஞல்ர்தா,(2010),ல்றைல் கல்(ல் தல்பதில்ல்),ல்வாதிபதில்யகல்,அல்பல்ல் ல், செல்னை,

9. தேவதேவல்,(2016),அல் தல்மால்திரமேவெளைல்யல்டல்,(ல் தல்பதில்ல்), நில் செல்சல் ல்ல்ஹல்ல் , செல்னை
10. அறில்மதி, (2005),நல்ல்ல்காலல், (எல்டால்பதில்ல்),கவன்ராபதில்பகல், செல்னை,
11. மில்ரா, (1990), மில்ராகவன்தைகல், (ல் தல்பதில்ல்),சாரல்வெளைல்பல், செல்னை
12. ல்.செல்வராால் (2014), பொல்ல்கால்ல்திரை, (ல் தல்பதில்ல்), நில் செல்சல் ல்ல் ஹல்ல் , செல்னை
13. இல்ல்லால் (2015), ஒளவை, (ஐத்தால்பதில்ல்), அகரல்பதில்பகல், தல்சால் ல்
14. ச.வே.ல்ல்பன்மணல்பல், (2015), தமில் இலல்கிய வரலால், (ஏழால்பதில்ல்), மணல்வாசகல்பதில்பகல், செல்னை
15. சோ.நா. கல்தசாமி, (2004), தமில் இலல்கிய வரலால், (ல் தல்பதில்ல்), மணல்வாசகல் பதில்பகல், செல்னை

பரீ வை ீ கீ :

1. வல்லிகல் ணல், (2008), ல்ல்ல்கவன்தையல்ல் தோல்றல் ல் வளல்ல்சில்ல், (ல் தல்பதில்ல்), பால்நிலையல்,செல்னை
2. க. கைலாசபதி (2010), தமில்நாவல் இலல்கியல், (மல்பதில்ல்) ல்மரல் பதில்பகல், வடபழனல்செல்னை
3. கால்ல்திகேல்சிவதல்பன்(2013),தமிழில்சில்கதைதோல்றல் ல்வளல்ல்சில்ல்,(ல் தல்பதில்ல்),நில் செல்சல், ல்ல்தகநிலையல்,செல்னை- 98,
4. ஆல். அழகல்பல், (2011), தமில்நாடகல்தோல்றல் ல்வளல்ல்சில்ல், (ல் தல்பதில்ல்), பால்நிலையல், செல்னை,
5. ல்சல்திவேல்,(2010),இல்பதால்ல் ல்றால் ல்ல்தமில்உரைநடை மணல்வாசகல் பதில்பகல், சிதல்பரல்-2010

Outcome mapping

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3	3	2										3	2	3	3	3
CO2	3	3	2										2	2	2	3	3
CO3	3	2	2											2			3

Semester	19IFREC11: Language I French-I	L	T	P	C
I		3	0	0	3

Learning Objective (LO):

LO1	Greet People
LO2	Introduce oneself (Basic 1)
LO3	Identify the things and the persons; spell a word
LO4	Ask about the day, the time and the date
LO5	Asking excuse

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Greet people appropriately, ask how they are, tell them how I am and ask how others are
CO2	Obtain another different culture, the sound of the French language, certain words in French, some famous French symbols/landmarks.
CO3	Understand basic classroom instructions
CO4	Can use different forms of address to speak to friends, teachers and people I do not know, using formal and informal modes of address and language.
CO5	Understand when the teacher is speaking to one or more persons in class and understand simple commands (mostly passive, receptive languagewith some active, productive language) and polite language. I can recognise'tu' and 'vous' forms and help phrases such as ***'Pardon', 's'ilvousplaît','excusez-moi', 'merci'.***

Unit I
Aborderquelqu'un; Dire son nom
Identifier une langue, la nationalité et le nombre.
Identifier les choses et les personnes

Unit II
Remplirune fiche de renseignements.
Découvrir la carte postale, un message sur internet et le blog très simples.
Les pays francophones ; Les lieux de la ville
Dire si on comprend ;Saluer ; Prendre congé
Dire s'excuser ; Affirmer et nier ; Epeler son nom

Unit III
L'espacefrancophone ;Découvrir la France et les pays francophones
Exprimersesgouts ; Identifier les professions

Demander quelque chose à quelqu'un

Unit IV
Comprendre un article de presse sur un portrait d'unepersonne.
Première approche de la sociétéfrançaise (noms, âges, origines, lieux d'habitation)
Parler des loisirs ; Faire un projet

Unit V
Proposer-accepter ou refuser une proposition
Demander une explication
Ecrire les cartes et messages d'invitation, d'acceptationou de refus.
Découvrir la carte de France et les connaissances.

Books for study:

1. J. Girardet et J. Pecheur,(2012)**Echo A1** - méthode de français**,** Paris**:** Langers,

Reference Books / Supplementary Reading:
1. Marie-Noelle Cocton et Emilie Pommier, (2015)**Saison A1** - méthode de français, Les Editions Didier, Paris
2. Angels Campa, Claude Mestreit, Julio Murillo et ManuelTost,(2001)**FORUM** – Méthodede français, HACHETTE LIVRE
3. Mauger Bleu, **Le Cours de langue et de la civilisation française**, - Méthode de français, Paris
4. Michele Boulares et Jean-Louis Frerot,(1997)**GrammmaireProgressive du Français avec 400 exerices**, CLE International,

COs	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PSO 1	PSO2	PS O3	PS O4	PS O5
CO1	-	2	3	2	2	3	2	3	3	3	3	3	-	-	-
CO2	3	-	2	-	3	-	2	2	-	3	-	-	-	-	-
CO3	3	2	-	-	2	3	-	2	3	-	-	-	2	-	-
CO4	3	3	3	3	3	-	3	-	2	2	2	-	-	2	-
CO5	-	-	3	3	3	3	3	2	2	2	2	-	-	-	3

Semester	**19IHINC11: Language I Hindi-I**	L	T	P	C
I		3	0	0	3

Learning Objectives:

- To know the Hindi terms for various professions.
- To gain knowledge of poem and prose

- ❖ To help the student to learn the importance of the moral, spiritual and human values
- ❖ To study short stories and imbibe morals
- ❖ To know about national leaders

Unit - I: Introduction

Mathruvandana(poem) ,peshwar,chalo bazaar chalo, ahimsa kivijay

Unit - II:Poem ,Prose

Balwanbano, **,**Gandhijikeasheram me chor,

Unit - III:vani ka theer ,Bharth, daku se mahatma.

Unit - IV:chandhini,samaykipabandhi, vitamin.

Unit - V: Rajiv Gandhi, titiali(poem),Bangalore.

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations. Understanding on Hindi drama basis and concepts and nibandh.

Text Books

1. Adharshahindi reader I-DBHPsabha-Chennai.17.
2. ParichyaDBHPS **,**Trichi 17.

Supplementary Reading

1. Naveen Hindi Patamala: Part - I , D.B.H.P. Sabha, Chennai - 600 017.
2. Hindi prachar vahini.1,DHBS,sabha Chennai 17.

Course Outcomes

At the end of the course, the student will be able to:

CO1: Understand the basic structure of poems.

CO2: Knowledge on various common hindi words.

CO3: Describe the basic concepts of moral stories.

CO4: Apply the concepts of in life.

CO5: Analyzethedifference between prose and poem.

Outcome Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	-	2	3	2	2	3	2	3	3	3	3	3	-	-	-
CO2	3	-	2	-	3	-	2	2	-	3	-	-	-	-	-

CO3	3	2	-	-	2	3	-	2	3	-	-	-	2	-	-
CO4	3	3	3	3	3	-	3	-	2	2	2	-	-	2	-
CO5	-	-	3	3	3	3	3	2	2	2	2	-	-	-	3

Semester	19IENGC12: Language–II: Course -1	L	T	P	C
I	English Through Literature I: Prose	3	0	0	3

Learning Objective (LO):

LO1	Develop the Language ability of the students
LO2	Enable students to understand the passage, to read fluently, to enrich their vocabulary, and to enjoy reading and writing
LO3	Make the students proficient in the four language skills
LO4	Make the students read with correct pronunciation, stress, intonation, pause, and articulation of voice.
LO5	Develop their inquiry skills

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Obtain competency in communication, both in written and oral skills
CO2	Acquire fluency in English language
CO3	Become knowledgeable about construction of sentence structures
CO4	Develop English vocabulary to use the English language effectively
CO5	Exhibit prophecy in the four communication skills

Unit I

Stephen Leacock "With the Photographer"

Winston S. Churchill "Examinations"

Grammar: Parts of Speech: Nouns, Verbs, Adjectives, and Adverbs

Unit II

G.B. Shaw "Spoken English and Broken English"

M.K. Gandhi "Voluntary Poverty"

Grammar: Articles

Unit III

Robert Lynd	"On Forgetting"
Virginia Woolf	"Professions for Woman"
Grammar:	Pronouns

Unit IV

A. G. Gardiner	"On Umbrella Morals"
R.K. Narayan	"A Snake in the Grass"
Grammar:	Prepositions

Unit V

Martin Luther King (Jr.)	"I Have a Dream"
George Orwell	"The Sporting Spirit"
Grammar:	Conjunctions & Interjections

Text Book:

1. Ayyappa Raja, S T. Deivasigamani. N. SaravanaPrabhakar, B .Karthikeyan. *English through Literature: Prose, Chidambharam, Manibharathi Publishers, 2010.*
2. David Green: *Contemporary English Grammar: Structures and Composition*, Macmillan, 2012.

OUTCOME MAPPING

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1				3			3	3		3			3	3			3
CO2				3			3	3		3			3	3			3
CO3	3			2			2	2		2			2	2			3
CO4	3			3			3	3		3			3	3			3
CO5	2			2			2	2		2			2	2			2

Semester	**19IENSC13:Environmental Studies**	L	T	P	C
I		3	0	0	3

Learning Objective (LO):

LO1	To introduce the learners to the ecosystem and to create environmental awareness
LO2	To create pollution free environment andprotecting the natural resources

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Appreciate the need for maintaining ecological equilibrium
CO2	Perceive the roots of environmental damages
CO3	Cultivate sensitivity to the magnitude and consequences of environmental damage
CO4	Insights into the need for sustainable development
CO5	Cultivating sustainable life-styles

Unit- 1 The Environmental System

The Services Provided by the Environmental System

Ecosystems: Food Chains, Food Webs, Ecological Pyramids

Biochemical Cycles: Hydrological Cycle, Carbon Cycle.

Unit- 2 Environmental Damage- Pollution

Sources and impact of

Air Pollution

Water Pollution

Land Pollution

Municipal Solid Waste

Noise Pollution

Unit- 3 Resource Depletion

Importance of Forests: Causes and Consequences of Deforestation.

Bio Diversity: Meaning and Importance-Reasons and Consequences ofBiodiversity Decline

Consequences of Overdrawing Water Resources.

Unit- 4 Global Climate Change

The Science of Climate Change-The Green House Effect

Sources and Impact of Climate Change

Coping with Climate Change

Unit- 5 Sustainable Development

Concepts and Definition of Sustainable Development (BrundtlandCommission Definition)

Poverty, Population Growth and Environmental Damage

Policies for Sustainable Development

Text Books :

1. ErachBharucha. *Environmental Studies*. New Delhi: UGC, 2004.
2. Asthana,D.K& Asthana M,(2016).*A Text book of Environmental Studies* S.Chandan Company New Delhi

Reference Books / Supplementary reading:

1. Kumarasam, K. A.Alagappa Moses and M.Vasanthy. (2004). *Environmental Studies.* Trichy: Bharathidasan University Pub.,
2. Rajamannar, (2004). *Environmental Studies*. Trichy: EVR College Pub.,
3. Kalavathy S. (2004). *Environmental Studies. (Ed)*. Trichy: Bishop Heber College Pub.
4. Richard Wright and Dorothy F Boorse, (2010). *Environmental Science: Toward a Sustainable Future*. New Delhi: Prentice-Hall India

Outcome Mapping

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1		3					3	2	2	3					3	2	3
CO2		3					2	2	2	3					3	2	3
CO3		3					2	2	2	3					3	2	3

Semester	19IBOTC14: Core 1: Microbiology and Plant Pathology	L	T	P	C
I		4	0	0	4

Learning Objective (LO):

LO1	To acquire the knowledge on micro organisms
LO2	To know about the plant pathogens

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand classification, characterization, structure of various Microorganisms
CO2	Understand the culture methods of Microorganism
CO3	Appreciate the genetic makeup of Microorganisms
CO4	Comprehend the plant pathogens and control measures
CO5	Analyze the nature of Plant disease and their symptoms

Unit – 1

Introduction to microbiology-Scopes of microbiology – The concept of microbial species – Significance of study of microorganisms – Classification of microorganisms - Five kingdom classification – Eight kingdom classification –Three domain classification.

Unit – 2

Methods in microbiology: Microbial cultures – Physical methods –Chemical methods and Biological methods. Microbial growth – Culture media – Characterization of a medium – Types of Media and Microscopy.

Unit – 3

Virus: Morphology of Virus, Classification of Virus, Transmission of Virus- Virus-vector relationships - Structure of TMV and Bacteria phage: Bacteriophage replication – Lytic and lysogenic cycles. General account on mycoplasma

Unit – 4

Bacteria: Outline of bacterial classification – Bergey's manual of determinative bacteriology. Ultrastructure- Gram positive and gram negative bacteria, flagellation, nutrition, cell division, reproduction and genetic recombination- transformation, transduction and Conjugation. Economic importance of bacteria.

Plant Pathology

Unit - 5

History of Plant Pathology – Methods of studying plant disease – Koch's postulates – Symptoms of Plant Disease – Symptoms Causative organisms and control of the following disease:- Tikka disease (Groundnut), Smuts (Sorghum), Citrus canker- Little leaf of Brinjal, Bunchy top of Banana, Principles of plant disease control.

Text Books :

1. Dubey, R.C and D.K.Maheswari.(2015). *A Textbook of Microbiology* (6th Edition) – McGraw Hill College, Dimension
2. Dasgupta, M.K.(2004). *Principles of Plant Pathology*. Allied publishers Ltd., New Delhi
3. SambamurthyA.V.S.S.(2006). *A Textbook of Plant Pathology*.I.K. Internatl.Pvt.Ltd., New Delhi

Reference Books / Supplementary reading:

1. Abigall, A, Salyers, Dixie D. Whitt, (2013). *Microbiology-Diversity, Disease and the Environment*. Panima Distributors, Meerut.
2. Rangaswami, G.A.Mahadevan, (2006). *Diseases of Crop plants in India*. Prentice Hall Pvt., Ltd., New Delhi
3. Singh, R.S, (2015). *Plant Diseases.* Oxford & IBH publishing Co.Pvt.Ltd., New Delhi

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	2	2	3		

CO2	3	3	3		2			2		3			3		2
CO3	3	3								3			3		
CO4	3		3					2		3			3		
CO5	3									3			3		2

Semester	19IZOA15: ALLIED ZOOLOGY - I ANIMAL DIVERSITY - I	L	T	P	C
I		3	0	0	3

Learning Objective (LO):

LO1	To lean the principles of animal taxonomy
LO2	To learn the classification of animals upto orders
LO3	To learn the salient features and various systems of different phyla

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify a fauna based on morphological character
CO2	Identify poisonous and non- poisonous snakes, and extinct fauna
CO3	Distinguish primitive mammals
CO4	Understand origin of chordates

UNIT- 1.

Principles of classification-salient features and classification upto orders in non-chordates. Protozoa- Type study Entamoeba. Porifera and coelenterata-Type Sycon sponge, Obelia

UNIT- 2

Platyhelminthes and Nemathelminthes-Type study – Planaria- parasitic adaptations. Ascaris-Annelida –Salient features-Type study-Earthworm,.

UNIT- 3

Arthropoda-Salient features-Cockroach- Molluscs-Salient features Type study-Fresh water mussel- torsion in mollusca- Echinodermata-Salient features Asterias-Echinoderm larvae-their siginificance.

UNIT- 4

Orgin and salient features of chordates. Agnatha - salient features-Type study-affinities Fishes- parental care, respiratory organs, migration. Amphibians- Salient features -parental care

UNIT- 5

Reptiles-Salient features, extinct reptiles, poisonous snakes of India. Birds-salient features flightless birds - adaptive radiation. Mammals. salient features brief account of monotremes, marsupials - Dentition in mammals.

PRACTICALS

1. Examination of paramecium, amoeba, euglena.
2. Study of sycon, hylonema and spongilla from slides and specimens
3. Slides and specimens of hydra, obelia, aurelia, sea-anemone, 4. Slides and specimens of Fasciola and Taenia
5. Slides and specimens of ascaris
6. Cockroach – demonstration of digestive system and mounting of mounth parts
7. Prawn- demonistration and mounts: Mounts of Radula, ctenidium
8. Echinoderm -specimen study.
9. Amphibia- museum specimens.
10. Reptiles- museum specimens.
11 Aves-mounts and museum specimens.
12. Mammals- museum specimens

TEXT BOOKS:

1. EkambaranathaAyyar.M,(1973). *A Manual of Zoology –Part –I, Invertebrata*,S.Viswanathan (Printers and Publishers)Pvt.Ltd.Madras.
2. Jordon, E.L and P.S .Verma ,(1985).*Invertebrate Zoology*. S.Chand and Co. Ltd.New Delhi
3. EkambaranathaAyyar.M, (1973). *A Manual of Zoology Part II .Chordata,* S.Viswanathan Printers and publishers, Pvt.Ltd.,Madras
4. Young.J.Z, (1988). *The Life of Vertebrates*. Oxford at the clarendon press,London
5. Adam Sedgwick, (1960). *A students Text Book of Zoology Vol.III*. General BookDepot, Allahabad

REFERENCE BOOKS

1) Arumugam, N. (2014). *Animal diversity Volume -1 – Invertebrata*. Saras Publication, Nagercoil, Tamil Nadu.
2) Arumugam, N. (2014). *Animal diversity Volume -2 – Chordata*. Saras Publication,Nagercoil, Tamil Nadu..
3) Barrington E.J.W. (2012).*Invertebrate structure and function.* Affiliated East West Press Pvt. Ltd., New Delhi.

4) Richard C. Brusca, Wendy Moore and Stephen M. Shuster. (2016). *Invertebrates*. OUP, USA.
5) George C Kent and Robert K. Carr. (2015). *Comparative Anatomy of the Vertebrates*. McGraw Hill.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	19ITAMC21:LANGUAGE – I Course 2: TAMIL பீ திஇலீ கியீ ீ சீ றிலீ கியீ ீ	L	T	P	C
II		3	0	0	3

கீ றலீ நேரீ கீ

LO1	தமில்வ்பத்திஇலக்கியல்களைல்ல்சில்றிலக்கியல்களைல்ல்அறில் கல்செல்தல். பத்திஇலக்கியத்தில்செல்வாக்கு
LO2	தோல்றல்வளக்சி–பால்பால்
LO3	தமிழில்தனக்குதல்மையைஉணக்கியபால்ல்போல்றவல்றைவரலால்ல்டல்வக்கு ல்ல்தல்.

கல்றல்வெளக்குயால்

இத்தல்பாடல் ல்வக்குமாணவல்கல்

CO1	பத்திஇலக்கியல்களால்தமில்மொழிஅடைத்தசிறக்கிதல்மையானநெகில்ல்தல்மைஅ றிந்தில்வ்பல்
CO2	பத்திஇலக்கியல்களல்கு றல்பல்டதல்ல்வல்களக்கு வழிவால்வபல்நெறில் றைகளைவ்பல் ல்பல்வல்
CO3	பத்திஇலக்கியல்களல்கு றல்பல்டக்கல்ல்ல்க்களைசல் கமல்ல்ல்உலகஅமைதியைநிலை நால்டவ்யல்பல்ல்வல்

அலீ -1 பீ திஇலீ கியீ

1. தில்ஞானசல்பத்தல்	-	தில்நல்ளால் - பல்சைவல்பதிகல் (ல் தல் 5 பாடல்கல்)
2. தில்ல் லல்		தில்மல்திரல் (உடல்பன்னைனல் ல்னை, யாவல்ல்மால்,ஒல்றேல்லல் ல், உல்ளல்பெல்ல்கோயன்ல், ஆல்ல்ல்னைனல்தொடல்ல்ல்பாடல்கல்)
3. சிவவால்கியல்		அறில்நிலை (5 பாடல்கல்)

அலீ –2 பீ திஇலீ கியீ

1. ஆல் டால்	-	தில்ல்பாவை (ல் தல் 5 பாடல்கல்)
2. வல்ளலால்	-	தில்வல்ல்பா–பன்ளைல்சில்வன்ல் ணல்பல்

அலீ –3 பீ திஇலீ கியீ

1.தேல்பாவணல்	-	ல்ழவன்ல்வதைல்படலல்
2.சீறால்ல்ராணல்	-	மால் ல்ல்ல்பன்ணைநில்றபடலல்

அலீ –4 சீ றிலீ கியீ

1. ல்ல்றாலல்ல்றவல் சி	-	மலைவளல் (வானரல்கல்... பாடல்ல் தல்)
2. ல் ல்ல் டல்பல்ல்	-	நால்ல்வளல்

அலீ -5 இலீ கியவரலரீ

பல்திசில்றிலல்கியவரலால்- இடைல்காலத்தமிழகல்ல்ழல்–சைவ வைண சமயல்களன்ல் செல்வால்ல் – சமணபெளத்தசமய இலல்கியல்கல்– கிறில்ல்வஇல்லால்இலல்கியல்கல்– நாயல்கல்காலச்சில்றிலல்கியல்கல்தோல்றபன்ல்னணல்சில்றிலல்கியவகை.

(மாணவீ கீ அறீ ீ கெரீ வதீ ீ மீ ீ – தீ ீ கானபீ திஅீ ல)

இலல்கியல்களைல்ல் அவை தொடல்வான இலல்கியவரலால்றைல்ல் இணைல்ல்பல்ல்தல். பல்திஇலல்கியவளல்ச்சியன்ல்தமில்ல்பல் வல்களன்ல் ஏல்பல்டவளல்ச்சியைல் ல்ல்ல்கால்ல்தல். மனன்ல் மனல்தைபல் பல்ல்தல்ல், சல் கஅமைதியை நிலைநால்டல்ல், உலகநல்லிணல்கல்காணல்ல்பல்திஇலல்கியல்பயல்பல்மால்றைவன்ல்ல்தல்.

பாட ீ கீ :

1. ச.வே.ல்ப்பன்மணவ்ல்(ப.ஆ), (2010),பல்னவ்தில்ல் றைகல் ல் ல்றால்பதில்வ்,மணவ்ாசகவ்தில்யகல், செல்னை
2. ச.வே.ல்ப்பன்மணவ்ல்(ப.ஆ), (2000),நாலாயவ்ரத்தில்யபன்ப்பத்தல்கல்(இரல் டால் பதில்வ், ல் ல்லைநிலையல்,செல்னை-17
3. ..... (1996) சில்தவ்ாடல்கல், இரல் டால்பதில்வ்,மணவ்ாசகவ்தில்யகல், செல்னை
4. வல்ளலாரத்தில்வல்ல்பா,, அல் ணாமலைல் பல்கலைல்கழகல் பதில்வ் அல் ணாமலைநகல்
5. வநம்மால் னவ்ல்(2010), தேல்பாவணைல்(ல் தல்பதில்வ்,பால்நிலையல்,செல்னை– 8
6. உமல்ல்வ்லவல்(2004), சீறாவ்ராணல்,(ல் தல்பதில்வ், நேல் னல்பதில்யகல், செல்னை
7. தில்ல் டராசல்பல்கவன்ராயல்(2014), ல்ல்றாலல்ல்றவல் சி,(இரல் டால்பதில்வ், பாவைபதில்யகல், செல்னை
8. ..... (2015), ல் ல்ல் டல்பல்ல் , (மல்பதில்வ், பால்நிலையல்,செல்னை -108 , –

பரீ வை ீ கீ

1. ந.வ.சயராமல், (1968),சில்றிலல்கியல்செல்வல், (ல் தல்பதில்வ், மணவ்ாசகவ்தில்யகல், செல்னை.
2. ந.வ.சயராமல், (1980), பல்ல் இலல்கியல், (ல் தல்பதில்வ், மணவ்ாசகவ்தில்யகல், செல்னை.
3. கோ.கேசவல், (1981), பல்ல் இலல்கியல்ஒல்சல் கவன்ல்பால்வை, (ல் தல்பதில்வ், அல்னல்வெளன்ல், தல்சால் ல்
4. ச.வே.ல்ப்பன்மணவ்ல், (2010),தமில்இலல்கியவரலால், (ஏழால்பதில்வ், மணவ்ாசகவ்தில்யகல், செல்னை.
5. சோ.நா.கல்தசாமி, தமில்இலல்கியவரலால், மணவ்ாசகவ்தில்யகல், செல்ன

Outcome Mapping

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3	3	2										3	2	3	3	3
CO2	3	3	2										2	2	2	3	3
CO3	3	2	2											2			3

Semester	19IFREC21: Language- I: Course -2	L	T	P	C
II	French-II	3	0	0	3

Learning Objective (LO):

LO1	By introducing the course, it is intended to:
LO2	Talk about their family members
LO3	Engage a simple conversation about family members.
LO4	Talk about your likes and dislikes
LO5	Fill in a simple form

Course Outcomes (CO):

At the end of the course, the student will be able to:

CO1	**Understand simple texts providing personal details of others.**
CO2	State how many people are in my family and who they are, using vocabulary including family members, possessive adjectives and negatives such as 'je n'ai pas de frères/sœurs'.
CO3	Write a short text to inform others of my likes and dislikes and provide reasons. Ask others about their likes and dislikes, showing that I appreciate diverse viewpoints and personalities e.g. 'Quelest ton … favori/préféré?'
CO4	Understand in filling up a simple form.
CO5	Write a short introduction about myself, providing personal details and use simple connectors, such as *'et' , 'mais' and 'aussi'.*

Unit I

Demander /donner des précisions sur le temps
Demander / indiquer l'heure et la date
Demander / dire ce qu'on a fait
Féliciter

Unit II

Comprendre et écrire un journal personnel en français.
Comprendre l'agenda de quelqu'un
Les rythmes de vie en France
Evaluez-vous

Unit III

Evasion en français par l'Internet, la télévision, la radio et la presse.
Découvrir la France dans votre pays

Unit IV

Les voyages et les transports

Comparer les choses ; Montrer ; Indiquer une appartenance

Demander / donner une explication

Unit V

Voyager en France ; Situations pratiques relatives au voyage.

Parler d'un repas.

Situations pratiques à l'hôtel et au restaurant

Les habitudes des Français sur un repas.

TextBook:

1. J. Girardet et J. Pecheur, (2012), ***Echo A1*** - méthode de français**,** Langers, Paris

Supplementary Readings:

1. Marie-Noelle Cocton et Emilie Pommier, (2015), ***Saison A1*** - méthode de français, Les Editions Didier, Paris.
2. Angels Campa, Claude Mestreit, Julio Murillo et ManuelTost, (2001), ***FORUM***– Méthode de français, HACHETTE LIVRE, Paris.
3. Mauger Bleu, (2014), ***Le Cours de langue et de la civilisation française***, - Méthode de français, Hachette, Paris
4. Michele Boulares et Jean-Louis Frerot, (1997), ***GrammmaireProgressive du Français avec 400 exerices***, CLE International, Paris.

OUTCOME MAPPING :

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PS O3	PS O4	PS O5
CO1	-	2	3	2	2	3	2	3	3	3	3	3	-	-	-
CO2	3	-	2	-	3	-	2	2	-	3	-	-	-	-	-
CO3	3	2	-	-	2	3	-	2	3	-	-	-	2	-	-
CO4	3	3	3	3	3	-	3	-	2	2	2	-	-	2	-
CO5	-	-	3	3	3	3	3	2	2	2	2	-	-	-	3

Semester	**19IHINC21: Language I Course 2: Hindi-II**	L	T	P	C
II		3	0	0	3

Learning Objectives:

- To know the life of National leaders.
- To introduce the Gandhijji's thought.
- To understand the concepts of teaching and learning from Dr.Sarvapalli Radhakrishnan's life.

Unit - I: Introduction

man ki shakti dena ,prathighnapalan, hamaraRajchinga,adhbhudmaya..

Unit - II:Poem ,Prose

sarvapalliradhakrishnan,amedkar, mahaveer, sadakkeniyam,sanghi ka phal(poem),

Unit - III:Stories.

Tyog ka such,bhavansabkaekhai,chirjivan ka jharna, , lob ka parinam.

Unit - IV:dadhakimoorkatha, kuthekipoonchandebarabardhana.

Unit - V:bakri do ghav kha gayi, ,Dhankimagima,

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Text Books

1.Naveen Hindi Patamala: Part - II D.B.H.P. Sabha, Chennai - 600 017.
2. Manohar Kahaniyam , Part – II D.B.H.P. Sabha, Chennai - 600 017.

Supplementary Reading

1.Naveen Hindi Patamala: Part - I , D.B.H.P. Sabha, Chennai - 600 017.
2.Hindipracharbodhini-DHBS, Chennai 17

Course Outcomes

At the end of the course, the student will be able to:

CO1:	Understand the basic structure of poem and prose.
CO2:	Classify and compare various poems.
CO3:	Describe the basic concepts of moral stories.
CO4:	Apply the teachings of various national leaders.
CO5:	Understand the spirit of spirituality.

Outcome Mapping

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5
CO1	-	3	3	2	2	3	2	3	3	3	3	3	-	-	-
CO2	3	-	3	-	3	-	2	2	-	3	-	-	-	-	-
CO3	3	3	-	-	2	3	-	2	3	-	-	-	2	-	-
CO4	3	3	3	3	3	-	3	-	2	2	2	-	-	2	-
CO5	-	-	3	3	3	3	3	2	2	2	2	-	-	-	3

Semester	19IENGC22: Language –II : Course 2: English Through Literature II: Poetry	L	T	P	C
II		3	0	0	3

Learning Objective (LO):

LO1	Develop the ability of the learner to comprehend and appreciate poems in English
LO2	Enhance the competence of the learner in using the English language
LO3	Improve the interest of the learner in human values and perceptions
LO4	Enable students to study and analyze the use of language in poetry
LO5	Provide learners with the theoretical and practical understanding of grammar

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Become competent in communication, both in written and oral skills
CO2	Gain fluency in English language
CO3	Attain knowledge about construction of sentence structures
CO4	Acquire the vocabulary to use the English language effectively
CO5	Acquire the aesthetic sense for appreciating poetry

Unit I

William Shakespeare	"Sonnet 116"
William Blake	"Lamb"
Robert Burns	"A Red, Red Rose"
Grammar	Finite& Non-finiteverbs

Unit II

PB Shelley	"To Wordsworth"
John Keats	"Sonnet to Sleep"
Thomas Hardy	"Neutral Tones"
Grammar	Strong and Weak Verbs, Auxiliaries and Modals

Unit III

Robert Frost	"Stopping By Woods on a Snowy Evening"

Wilfred Owen	“Anthem for Doomed Youth”
Emily Dickinson	“A Narrow Fellow in the Grass”
Grammar	Transitive, Intransitive Verbs, Active and Passive Voice

Unit IV

Sri Aurobindo	“The Tiger and the Deer”
AK Ramanujan	“Obituary”
Sarojini Naidu	“Queen’s Rival”
Grammar	Concord

Unit V

Roger Mc Gough	“My Bus Conductor”
Maya Angelou	“Still I Rise”
Langston Hughes	“The Negro Speaks of Rivers”
Grammar	Tenses and their forms

Text books:

1. Jack.Hydes, (1985), *Touched With Fire.* London: Cambridge UP.
2. C. D Narasimhaiah,(2006),*An Anthology of Common Wealth Literature*. New Delhi:

Supplementary reading:

1. Thomas, C.T. (2006),*Twentieth Century Verse: An Anglo-American Anthology*. Macmillan. New Delhi:
2. Henry Louis, and Y. NellieMcKay, (2004), *The Norton Anthology of African American Literature.* New York:
3. Ramachandran, C.N. and Radha Achar, (1998),*Five Centuries of Poetry.* New Delhi: Laxmi.

Outcome mapping

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3			3			3	3		3			3	3			3
CO2	2			3			3	3		3			3	3			3
CO3	3			2			2	2		2			2	2			2
CO4	3			3			3	3		3			3	3			3
CO5	2			2			2	2		2			2	2			2

Semester	19ICISC23: Core 2: Soft Skill: Computer Applications- I	L	T	P	C
II		3	0	0	3

Learning Objective (LO):

LO1	To Study the Fundamentals Concepts of Computers and Operating Systems.
LO2	To get familiar with basics of the Internet Programming.
LO3	To acquire knowledge and skills for creation of web site considering both client and server side programming.
LO4	To explore different web extensions and web services standards and ability to develop responsive web applications.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Describe the usage of computers and why computers are essential components in business and society.
CO2	Solve common business problems using appropriate Information Technology applications and systems.
CO3	Identify categories of programs, system software and applications. Organize and work with files and folders and utilize the Internet Web resources and evaluate on-line e-business system.
CO4	Design a responsive web site using HTML5 and demonstrate Rich Internet Application.

Unit – 1: Introduction to computers, Applications of computers, Concepts of data and information, A typical computer system, Memory concepts, History of computers, Types of computers. Input, output devices, data storage devices, software, the definition, the role of software, House keeping.

Unit – 2: The computer internals, typical PC configuration, booting, virus, antivirus, vaccine, versions of software. Operating system, definition, classification, basics of MSDOS, introduction to windows operating system, features of windows OS, desktop and desktop icons, starting programs, browsing and managing windows explorer, setting, Taskbars and creating shortcuts.

Unit – 3: Introduction to internet, client sever basics, E-mail, Telnet and Archie, FTR – Gopher, Jug head and Veronica, WAIS and world wide web, fundamentals of HTML, TCP / IP and E – Commerce.

Unit – 4: Issues involved in web site management, addressing, designing web sites with front page.

Unit – 5: Multimedia, concept, requirements, applications and future, hardware and software requirements for Multimedia development and delivery platforms, multimedia methodologies fundamental and use of hypertext, hypermedia, sound, images, animation, video. Using multimedia, multimedia interface, planning and development of multimedia projects.

Text Books:

1. Sanjay Saxena, (2015), *"A first course in computers"*, Vikas Publishing House, New Delhi.
2. Alexies Leon and Mathews Leon *"Internet in a nutshell"* Leon Press, Chennai and Vikas Publishing House, New Delhi.
3. Tay Vaughan (1999), "*Multimedia Making it work"*, Osborne, Tata McGraw Hill.

Reference Books:

1. Ron Mansfield, (1997), "*Windows 95 for Busy People"*, Obsorne, McGraw Hill.
2. *Krishnan, "Computer fundamentals and Windows with Internet Technology"*, Scitech Publications Pvt Ltd, Chennai, India.
3. *Krishnan, "Windows and MS-Office 2000 with database concepts"*, Scitech Publications Pvt Ltd, Chennai, India.

Outcome Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3		1	3	2		2		2	3			3	1		3		2
CO2	3	2	3					3		2						3	1	
CO3			3		3		1						2	3				1
CO4	3	2		3	2	1		3					3			3	3	

Semester	19IBOTC24: Core 3: Algae, Fungi and Lichens	L	T	P	C
II		4	0	0	4

Learning Objective (LO):

LO1	To gain knowledge on the structure, reproduction and life cycle of Algae, Fungi and Lichens

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Appreciate the comparative account of various algae
CO2	Understand the structure and reproduction of fungi
CO3	Comprehend the structure of lichens and their importance
CO4	Appreciate the economic importance of Algae, Fungi and Lichens

Algae

Unit – 1

Introduction**:** General characteristic features, classification in Algae (Fritsh-1942). Chlorophyceae, Phaeophyceae,, Rhodophyceae and Cyanophyceae. Thallus structure. Pigmentation. Reserve food material. Reproduction, Life cycle in Algae.

Unit – 2

Range of structure and reproduction of *Chlamydomonas, Volvox, Chlorella*, *Sargassum*, *Polysiponia*, *Oscilatoria* and *Anabaena*. Economic importance of algae.

Fungi

Unit- 3:

General characters of Fungi, Classification with Text/Reference to Alexopoulos and Mims – range of structure, reproduction, life history, Economic importance of fungi.

Myxomycetes - *Stemonitis*

Chytridiomycetes – *Synchytrium*

General characters- classification, life history in Oomycetes :*Albugo, Pythium*

Plasmodiophoromycetes :*Plasmodiophora* ; Zygomycetes : *Mucor.*

Unit- 4:

General characters- classification, life history - Ascomycetes : *Yeast, Penicillium, Peziza***.** Basidiomycetes: *Puccinia,Polyporus.*

Deuteromycetes: *Cercospora.*

Lichens:

Unit- 5:

Classification, structure, nutrition, reproduction and economic importance of Lichens:- *Parmelia, Usnea.* Ecological importance of Lichens.

Text Books :

1. Dube, H.C. (2018). *A Textbook of Fungi, Bacteria and Viruses*, Vikas Publishing Houses Pvt Ltd.

2. Vashishta. B.R., A.K. Sinha and Adarsh Kumar. (2015). *Botany for Degree students - Algae.* S. Chand and Company Ltd., New Delhi.

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Reference Books / Supplementary reading:

1. Alexopoulos.C.J., C.W. Mims and M. Blackwell. (2007). *Introductory Mycology*. IV Edition. Wiley India (P) Ltd., Daryaganj, New Delhi.
2. Geeta Sumbali .(2005). *The Fungi.* Narosa Publishing House, New Delhi.
3. Sundararajan, S. (2005). *Practical manual of Algae*, Anmol publications Pvt.Ltd.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3			
CO2	3	3	3							3	3	3			
CO3	3	3						2		3	3	3			
CO4	3	3	3							3	3	3			

Semester	**19IBOTP25: Core 4: Practical - I Microbiology ,PlantPathology, Algae, Fungi and Lichens**	**L**	**T**	**P**	**C**
II		**0**	**0**	**6**	**5**

Learning Objective (LO):

LO1	To know about the microbes
LO2	To gain knowledge on Algae, Fungi and Lichen

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyze the various microbes (virus and bacteria)
CO2	Analyze the algae, fungi and lichens

Microbiology and Plant Pathology

1. To study the structure of compound and dissection microscope
2. Preparation of culture media for bacteria, fungi-sterilization procedures
3. Isolation of rhizophere, rhizoplane, phylloplane microorganisms
4. Isolation of pure culture from soil-serial dilution
5. Gram staining procedure
6. Verification of Koch's postulates
7. Identification of Plant diseases included in the theory syllabus

Algae

*Chlamydomonas, Volvox, Chlorella, Sargassum, Polysiponia, Oscilatoria*and*Anabaene*

Fungi

Stemonitis, Synchytrium ,Albugo,Pythium, Plasmodiophora, Mucor, Yeast, Penicillium, Peziza, Puccinia,Polyporus, Cercospora

Lichens

Parmelia, Usnea.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	-	3	-	3	3	-	-	-	-	3	3	3	-	-
CO2	3	-	3	-	3	3	-	-	-	-	3	3	3	-	-

Semester	19IZOA16: ALLIED ZOOLOGY - II	L	P	C
II	ANIMAL DIVERSITY - II	3	0	3

Learning Objective (LO):

LO1	To learn the cytological details of cells
LO2	To learn anatomical details of human
LO3	To learn the basic principles of genetics
LO4	To learn the developmental process in frog
LO5	To learn basic concepts of evolution

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify various organelles and their functions
CO2	Correlate developmental patterns in animals
CO3	Understand evolutionary process taking place in biological world
CO4	Analyse the anatomical details of human and Critically evaluate genetic principles involved in multiple alleles and sex determination

Unit 1:Cell Biology

Introduction: Microscopy and Cytological techniques.

Animal cell - Ultra structure : Plasma membrane - Nucleus - Mitochondria - Ribosomes - Endoplasmic reticulum - Lysosomes - Golgibodies - Centrosomes - Chromosomes.

Cancer Biology: Cancer definition - Types of cancer - Management of cancer-Radio therapy-Chemotherapy.

Unit 2:Human Anatomy

Human systems : The integumentary - Skeletal - Muscular - Digestive - Respiratory - Circulatory - Lymphatic - Nervous – Sense organs - Endocrine - Excretory – Reproductive systems.

Unit 3:Genetics

Introduction - Multiple alleles - Quantitative inheritance – Sex determination - Sex linked inheritance - Pleiotropy-Hardy Weinberg law- Population genetics.

Unit 4: Developmental Biology

Introduction - Types of eggs - Cleavage and types - Frog's egg - Gastrulation in frog embryo - Organogenesis in frog-Development of eye and heart in frog.

Unit 5: Origin of life

Theories - Geological time scale - Fossils - Extinct animals – Mass extinction-Evidences for evolution-Comparative anatomy-Embryology- Physiology-Vestigeal organs-Geographical distribution.

Practicals:

1. Study of microscope-Light Microscope
2. Preparation of mitosis in onion root tip
3. Identification of blood group
4. Experiments on mendelian inheritance
5. Vital staining chick blastoderm
6. Study of animal adaptation

Text Books:

1. Verma P.S and V. K. Agarwal (2002). *Concept of Cell Biology*,S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.

2. Verma P. S. and V. K. Agarwal Reprint (2003). *Genetics***,** S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.

3. Ranganathan T. S. 6/e Rev. (2002). *A Text book of Human Anatomy*, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.

4. Verma P. S. and V. K. Agarwal Reprint (2003). *Chordate Embryology*, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.

5. Arumugam N. Reprint. (1999). *A Text book of Embryology*, Saras Publication A R P Camp Rd, Periavilai, Kottar, Nagercoil - 629 002.
6. Verma P. S. and V. K. Agarwal Reprint (1999). *Concept of Evolution*, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.
7. Arumugam N. 9/e.(1999). *Organic Evolution*,Saras Publication A R P Camp Rd, Periavilai, Kottar, Nagercoil - 629 002.

Reference Books

1) Arnold Berk, Chris A. Kaiser and Harvey Ledish. (2016). *Molecular Cell Biology*. WH Freeman.
2) Sandeep Saxena. (2012). *Animal Physiology*. Oxford University Press.
3) Robert Tamarin. (2017). *Principles of Genetics*. McGraw Hill.
4) Lewis Wolpert, Cheryll Tickle and Alfonso Martinez Arias. (2015). *Principles of Development*. OUP, Oxford.
5) Kenneth Kardong. (2018). *Vertebrates: Comparative Anatomy, Function, Evolution*. McGraw Hill.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	19ITAMC31: LANGUAGE – I: Course 3: TAMILஅறஇலீ கியீ ீ கரீ பீயீ ீ	L	T	P	C
III		3	0	0	3

கீ றலீ நேரீ கீ

LO1	தமிழில் தோல்றிய அற இலல்கியல்களைல்ல் கால்வல்ல இலல்கியல்களைல்ல் அறில் கல் செல்தல். அவல்றில் வகைகளை வரலால்ல்டல் வல்ல்தல்.
LO2	இலல்கியல்களைல்ல் அவை தொடல்ான இலல்கிய வரலால்றைல்ல் இணைல்ல்ல்ல்தல்.

கற்றல்வெளிப்பாடு

இத்தாள்பாடம் மூலம்மாணவர்கள்

CO1	அற இலக்கியங்கள் எப்படி மனதை நெறிப்படுத்தும் சமுதாயத்தை கட்டுப்படுத்துகிறது எனபதை வகுத்துரைத்தல்
CO2	அற இலக்கியங்களும் முற்படுத்தப்பட்ட அறநெறிக் கருத்துக்களை வாழ்வியலில் கடைப்பிடிக்க முயலுதல்
CO3	நல்ல சமுதாயம் உருவாக்க அறஇலக்கியங்களும் முற்படுத்தப்பட்ட அறக்கருத்துக்களை எடுத்துரைத்தல்

அலகு – 1 அறஇலக்கியம்

1. திருக்குறள் - உழவு, ஒழுக்கம் உடைமை, காலமறிதல், நல்ல பண்புவாழ்நாமை

அலகு – 2 அறஇலக்கியம்

1. நாலடியார் - பெரியாரைப்பணியாமை

2. பழமொழிநானூறு - கருவூர்

அலகு - 3 காப்பியம்

1. சிலப்பதிகாரம் - இந்திரவிழாவூரெடுத்தகாதை

2. மணிமேகலை - ஆபுத்திரன் திறம் அறிவித்தகாதை

அலகு - 4 காப்பியம்

1. பெரியபுராணம் - அமர்நீதிநாயனார்புராணம்

2. கம்பராமாயணம் - வாலிவதைப்படலம்

அலகு - 5 இலக்கியவரலாறு

சமகாலம்முன்பு கால அறஇலக்கியங்கள்–திருக்குறளின்பெருமை–அறஇலக்கியங்களின் வளர்ச்சி –காப்பிய இலக்கணம் - பக்திஇலக்கியம்–காலத்தோறும் தோற்றிய காப்பியங்கள் - வரலாறு.

பாட நூல் :

1. பதிப்பாசிரியர் ச. மெய்யப்பன், (2017), திருக்குறள், (இரண்டாம்பதிப்பு), மணிவாசகர்பதிப்பகம், சென்னை- 08.

2. ச.வே.ல்ப்ன்மணல்ல், (2012),நாலல்யால் பழமொழி நால் ல், (இரல் டால்பதில்ல்) மணல்வாசகல்பதில்பகல், செல்னை- 08.
3. இளல்கோவல்கல்,(2008),சி லல்பதிகாரல், (பதினொல்றால்பதில்ல்), டால்டல் உ.வே.சா. பதில்ல்செல்னை
4. சீல்தலைல்சால்தனால் (2008), மணமேகலை, (எல்டால்பதில்ல்), டால்டல் உ.வே.சா. பதில்ல் செல்னை
5. சேல்கிழால் (2010), பெல்யல்ராணல்,(ல் தல்பதில்ல்), ல் ல்லைநிலையல், செல்னை
6. கல்பல் கல்பராமாயணல், அல் ணாமலைல்பல்கலைல்கழகல், வெளல்பல்,
7. ச.வே.ல்ப்ன்மணல்ல், (1999) தமில் இலல்கிய வரலால், (ல் தல்பதில்ல்), மணல்வாசகல்பதில்பகல், செல்னை.
8. சோ.ந.கல்தசாமி, (2004), தமில் இலல்கிய வரலால், (ல் தல்பதில்ல்), மணல்வாசகல் பதில்பகல், செல்னை.

Outcome mapping

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3	3	2										3	2	3	3	3
CO2	3	3	2										2	2	2	3	3
CO3	3	2	2											2			3

Semester	19IFREC31: Language- I: Course -3	L	T	P	C
III	French-III	3	0	0	3

Learning Objective (LO):

LO1	Buy some products in a shop
LO2	Ask the news of someone
LO3	Talk about the climate
LO4	Introduce their family
LO5	Talk about their accommodation.

Course Outcomes (CO):

At the end of the course, the student will be able to:

CO1	**Ask the price of the product, pay the product.**
CO2	Ask about their daily activities
CO3	To give and ask information about the climate
CO4	Describe their family
CO5	Describetheir accommodation wherethey live.

Unit I

Demander des nouvelles de quelqu'un(les activités de la journée)

Choisir, acheter, payer un objet

Unit II

S'informer sur la présence ou l'existence d'une personne ou d'un objet (Parler d'un logement ; s'orienter, Décrire un trajet, Exprimer un besoin)

S'informer sur l'état physique de quelqu'un

Le temps en France et parler du temps

Unit III

Evaluez-vous

Evasion dans la Poésie

Unit IV

Souvenez-vous (Les moments de la vie)

Demander /donner des informations sur la biographie d'une personne (enchainer les idées)

Unit V

Demander /donner des informations sur ses relations amicales ou familiales.

Présenter sa famille.

TextBook:

1. J. Girardet et J. Pecheur, (2012), ***Echo A1*** - méthode de français***,*** Langers, Paris

Supplementary Readings:

1. Marie-Noelle Cocton et Emilie Pommier, (2015), ***Saison A1*** - méthode de français, Les Editions Didier, Paris.
2. Angels Campa, Claude Mestreit, Julio Murillo et ManuelTost, (2001), ***FORUM***– Méthode de français, HACHETTE LIVRE, Paris.
3. Mauger Bleu, (2014), ***Le Cours de langue et de la civilisation française***, - Méthode de français, Hachette, Paris
4. Michele Boulares et Jean-Louis Frerot, (1997), ***GrammmaireProgressive du Français avec 400 exerices***, CLE International, Paris.

OUTCOME MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PSO5
CO1	-	2	3	2	2	3	2	3	3	3	3	3	-	-	-
CO2	3	-	2	-	3	-	2	2	-	3	-	-	-	-	-
CO3	3	2	-	-	2	3	-	2	3	-	-	-	2	-	-
CO4	3	3	3	3	3	-	3	-	2	2	2	-	-	2	-
CO5	-	-	3	3	3	3	3	2	2	2	2	-	-	-	3

Semester	**19IHINC21: Language I Course 3: Hindi-III**	L	T	P	C
III		3	0	0	3

Learning Objectives:

- To study various comedy stories.
- To introduce Indian epics.
- To understand the concepts of drama

Unit - I: Introduction, ekanki. Andher Nagari - Bharathendhoo Harishchandra

Unit - II: Mahabharath Ki EkSanj - Bharath BhoosahnAgrwal [Full]

Unit - III: Drama. Ladai - SarveswarDayalSaxeena [Full]

Unit - IV: stories,Tatava-vyanghya

Unit - V: Upstick Ki Muskhan - Vishnu Prabakar [Full]

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Text Books

1. Andher Nagari - Bharathendhoo Harishchandra, VinodhPustak Mandir, Agra-2
2. PrathinidhiEkanaki - Dr. Dashrath Oojaa, Jawahar Pustakalya, Mathura
3. EkanakiManach - Dr.V.P. Abhithap, Jawahar Pustakalya, Mathura
4. Ladai - SarveswarDayalSaxeena, RajkamalPrakashan, New Delhi

Supplementary Reading

1.Hindi natakuthbhavaurvikas-dashrath ojha-rajpal and saons, new Delhi.7.

2.hindi natakaurrangmanch-pahachanaurparak-Dr. Indranathmadan, newdelhi.7.

Course Outcomes

At the end of the course, the student will be able to:

CO1: Understand the basic structure of short stories.
CO2: Knowledge on Mahabharath.
CO3: Describe the basic concepts of human feelings.
CO4: Apply the concepts of comedy in stories.
CO5: Describe the effects of western culture.

Outcome Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PS O5
CO1	-	3	3	2	2	3	2	3	3	3	3	3	-	-	-
CO2	3	-	3	-	3	-	2	2	-	3	-	-	-	-	-
CO3	3	3	-	-	2	3	-	2	3	-	-	-	2	-	-

Semester	19IENGC32: LANGUAGE – II: English Through Literature III: Drama	L	T	P	C
III		3	0	0	3

Learning Objective (LO):

By introducing the course, it is intended to:

LO1	Enhance the conversational competence of the learners by introducing drama in English
LO2	Make the students the understand characteristics of the Elizabethan Age.
LO3	Make them appreciate Shakespearean drama
LO4	Make them learn the key elements of sentence structures
LO5	Make the students master the mechanics of writing

Course Outcomes

At the end of the course, the student will be able to:

CO1:	Obtain a literary acumen to answer MCQs of NET/SET examinations and othercompetitive examination
CO2:	Appreciate conversational English

CO3:	Recognize the dramatic elements of Shakespearean dramas
CO4:	Use punctuations and capitals effectively in their composition
CO5:	Recognize the elements of the spoken discourses

Unit I

William Shakespeare	*The Tempest* (Act I)
Grammar	"Phrases and Clauses"

Unit II

William Shakespeare	*The Tempest* (Act II)
Grammar	"Simple, Compound, and Complex Sentences"

Unit III

William Shakespeare	*The Tempest* (Act III)
Grammar	"Transformation of Sentences"

Unit IV

William Shakespeare	*The Tempest* (Act IV)
Grammar	"Sequence of Tenses and Reported Speech"

Unit V

William Shakespeare	*The Tempest* (Act V)
Grammar	"Punctuation and Capitals"

Text Books:

1. Shakespeare, William. *The Tempest*, New Delhi: S. Chand & Co., 2008.
2. Green, David. *Contemporary English Grammar, Structures, and Composition*. Chennai: MacMillan, 2010.

Supplementary Reading:

1. Cahn. L Victor. *Shakespeare the Playwright: A Companion to the Complete Tragedies Histories, Comedies, and Romances*. London: Praeger, 1996.
2. Crystal, David. *Shakespeare's Words: A Glossary and Language Companion*. London: Penguin, 2009.
3. Greenbaum , Sidney. *Oxford English Grammar.* London: Oxford UP, 2005.
4. McCarthy. *Cambridge Grammar of English*. London: Cambridge UP, 2018.
5. Quirk, Randolph, (2010), A *Comprehensive Grammar of the English Language*. London: Pearson.

Outcome mapping

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3			3			3	3		3			3	3			3
CO2	2			3			3	3		3			3	3			3
CO3	3			2			2	2		2			2	2			2
CO4	3			3			3	3		3			3	3			3
CO5	2			2			2	2		2			2	2			2

Semester	19IBOTC33: Core 5: Bryophytes and Pteridophytes	L	T	P	C
III		4	0	0	4

Learning Objective (LO):

LO1	To acquire the knowledge on the structure of Bryophytes and Pteridophytes

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Comprehend the Morphology and Systematic positions of Bryophytes
CO2	Appreciate the Morphology and systematic positions of Pteridophytes
CO3	Understand the economic importance of Pteridophytes
CO4	Comprehend the heterospory and the evolution of seed

Unit – 1 Bryophytes

Introduction, General characteristic features, classification (Watson's), origin and evolution and alternation of generation

Unit – 2

Life cycle, Structure and reproduction(Vegetative, Asexual and Sexual) of *Marchantia, Anthoceros, Porella* and *Funaria*

Unit – 3 Pteridophytes

Introduction, General characteristic features, classification (Reimer's 1954) and Stelar evolution in Pteridophytes

Unit – 4

Reproduction (Vegetative, Asexual and Sexual) Apogamy and Apospory, Heterospory and Seed habit

Unit – 5

Life cycle, Structure and reproduction of Fossil forms, *Rhynia* and *Astroxylon*, Living forms *Lycopodium, Equisetum, Adiantum and Marsilea*

Text Books:

1. Gilbert Smith.(1976). *Cryptogamic Botany-Volume I*, Tata McGraw Hill Book Company Ltd, New Delhi.
2. Parihar, N.S. (2005). *An Introduction to Embryophyta – Bryophyta*, Central Book Depot, Allahabad.
3. Vashishta. B.R., A.K. Sinha and Adarsh Kumar. (2016). *Botany for Degree students-Bryophyta*. S. Chand and Company Ltd., New Delhi

Reference Books / Supplementary reading:

1. Sporne, K.R.1975. The Morphology of Pteridophytes. Hutchinson University Library, London.
2. Watson. E.V. 2003. Structure and Life of Bryophytes – B.I Publications, New Delhi.

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3			
CO2	3	3	3							3	3	3			
CO3	3	3						2		3	3	3			
CO4	3	3	3							3	3	3			

Semester	19IBOTP34:Core 6: Practical – II Bryophytes and Pteridophytes	L	T	P	C
III		0	0	6	5

Learning Objective (LO):

LO1	To gain knowledge on Bryophytes
LO2	To know about the morphology of Pteridophytes

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify the given Bryophytes
CO2	Identify the given Pteridophytes

Bryophytes:

Marchantia, Anthoceros, Porella and *Funaria*

Pteridophytes

Fossil Forms:

*Rhynia*and *Asteroxylon*

Living Forms:

Lycopodium, Equisetum, Adiantum and *Marsilea*

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3		3		3	3					3	3	3		
CO2	3		3		3	3					3	3	3		

Semester	19ICHEA01: Allied– II: Chemistry – I Course 1	L	T	P	C
III		4	0	0	4

Learning Objective (LO):

LO1	To develop knowledge in coordination chemistry
LO2	To understand basics in chemical kinetics and photochemistry

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyze the experimental data and present it systematically
CO2	Appreciate , describe and adopt suitable separation techniques
CO3	Understand the role of metal ions in biologicalsystems

Unit–I : Basic Organic Chemistry

Classification of organic compounds - Hybridization in methane, ethane, acetylene, benzene -Classification of reagents - electrophiles, nucleophiles and free radicals - Classification of reactions - addition, substitution (nucleophilic & electrophilic) , elimination, condensation and polymerisation - Polar Effects-Inductive effect, resonance, hyper-conjugation, stericeffect.

Unit–II : Chemistry of Some Useful Organic

Compounds

Structure and uses of the following:

Paracetamol, Penicillin, Morphine, Camphor, Thiopental Sodium, BHC, DDT, CF2Cl2. Synthesis, properties and uses of, PTFE, PVC, Bakelite, Nylon 6, 6.

Unit–III : Acid-Base Equilibria

Bronsted definition, Lewis definition, Ka Kb, pKa and pKb for Bronsted acids and bases. Relative strengths of Bronsted acids and bases. pH Buffer solution. Henderson's equation. Theory of acid-base indicators.

Unit–IV: Coordination Chemistry

Definition of terms-classification of ligands-chelation- Nomenclature of coordination compounds. Effective Atomic Number and its application to Ni(CO)4, [Ni(CN)4]2-, [Co(CN)]63- Role of metal ions in biological systems such as Hemoglobin, Vitamin B12.

Unit–V : Chemical Kinetics and Photochemistry

Rate of chemical reaction, Differential rate expression, order and molecularity, Integrated rate expressions for first, second, and zero order reactions, Half-life period. Effect of temperature on reaction rate - Activation energy. Arrhenius equation, Catalysis - Homogeneous and heterogeneous catalysis.

Introduction to photochemistry - Grothus - Draper Law, Stark-Einstein's Law. Quantum Yield. Fluorescence, Phosphorescence, Photsensitisation.

Books for Study:

1. VeeraiyanV. ,(2006), *Text book of Ancillary Chemistry*, Highmount Publishinghouse.
2. James E.Huheey, (1983), *Inorganic Chemistry*, 3rd edition, Harper &Row,Publishers, Asia, PvtLtd.,
3. Soni P.L. (2006), *Textbook of Organic chemistry*, S. Chand and Company,. NewDehi.
4. Soni P.L. (2006),*Text book of Inorganic Chemistry*, S. Chand and Company, NewDehi.
5. Puri B.R., Sharma and Pathania, (2006).*Text book of Physical Chemistry*, Vishal Publishing Co.,Punjab.India.
6. Dara S.S., (2006), *Text book of Environmental chemistry and Pollution Control*.- S.Chand and Co. NewDehi.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7
CO1	3	3						3									
CO2	3		3						3		3						
CO3	3			3						3							
CO4	3	3				3	3	3								3	3

Semester	19ITAMC41:Language – I: Course 4 Tamil சீ கஇலீ கியீ ீ செீ மொழிவரலீ ீ	L	T	P	C
IV		3	0	0	3

கீ றலீ நேரீ கீ

LO1	உலகல்செல்மொழியல்வரலால்றைல்ல்தல்.
LO2	தமில்செல்மொழியல்தனல்சிறல்ல்களைல்ல்செல்மொழிஇலல்கியல்களைல்ல்வல் வல்ல்தல்.
LO3	தமில்செல்மொழியல்தனல்சிறல்ல்களைல்ல்செல்மொழிஇலல்கியல்களைல்ல்வல் வல்ல்தல்
LO4	இலல்கியல்களைல்ல்அவைதொடல்வானஇலல்கியவரலால்றைல்ல்இணைல்ல்வல்ல் தல்.

Course Outcomes (CO):கல்றல்வெளல்வால்

இல்தல்வாடல் ல்வல்மாணவல்கல்

On successful completion of the course, the student will be able to:

CO1	பல் டையல் தமில் மரல்களைல்ல் சல் க அமைல்ல்களைல்ல் வல்ல்வல்
CO2	தமில்மொழியல் தனல்ல்வல்தைல் செல்மொழியல் இயல்கல் மல்ல் சல்க இலல்கியல்களல் ல்ணைல்கொல் ல் வல்ல்வல்
CO3	இலல்கண இலல்கிய வகைமைகளை அறில்ல் தல்னைல்டைபாளராக உல்வால்க ல் யல் வல்

அலீ – 1 அகஇலீ கியீ கீ

1. ல்ல்ல்தொகை - 125, 129, 177, 302, 397 (நெல்தல்)
2. நல்றிணை - 206, 217, 304, 334, 382 (ல்றில் சி)
3. ஐல்ல்ல் ல் - 17, 18, 71, 75, 96,(மல்தல்)
4. அகநால் ல் - 147, 303, 370 (பாலை)
5. கலில்தொகை - 104, 105(ல் ல்லை)

அலீ -2 ீ றஇலீ கியீ கீ

1. ல்றநால் ல் -பெல் பால்ல்லவல்கல் 76, 83, 133, 146, 178, 188, 227, 261, 264, 278

அலீ -3 பீ ீ பரீ ீ

1. நெல்நெல்வாடை

அலீ -4 சீ கஇலீ கியவரலரீ

தொல்காப்பியம் - சல்ககாலல் - ல் ல்சல்கல்கல்–பால்ல்ல்தொகைகல்–தொல்ல்லெ றை–தனஙல்தல்மைகல்.

அலீ -5 பயீ பரீ ீ தமீ ீ செ மொழிவரலரீ ீ

மொழிவனால்கல்– மொழில்ல்ல்பல்கல்–உலகல்செல்மொழிகல்– இல்தியல்செல்மொழிகல்– செல்மொழில்தல்திகல் - வரையறைகல்–வால்ல் செல்மொழில்தமில்–தமிழில் தொல்மை–தமிழில் சிறல்ல்கல்–தமில்ல்செல்மொழில் ல்கல்–தமில்செல்மொழி அறிஞீதேல்ல்-பல்திமால்கலைஞுல் ல் தல் தல்காலஅறிஞல்கல்வரை (அறிஞல்கல் - அமைல்கல் - நில்வனல்கல்–இயல்கல்கல் தொடல் ல் யல்சிகல் - அறல்ஞபேரால்டல்கல்– உலகல்தமில்ல் செல்மொழி மாநால், கோவை-2010)

பாட் ீ கீ :

1. ச.வே.ல்ப்பன்மணல்வல் (ப.ஆ), (2011), ல்ல்ல்தொகை, நல்றினை, ஐல்ல்ல்ல் ல், அகநால் ல், கலில்தொகை, (இரல் டால்பதில்ல்) மணல்வாசகல்பதில்பகல், செல் னை
2. ச.வே.ல்ப்பன்மணல்வல் (ப.ஆ)- (2011), ல்றநால் ல், (இரல் டால்பதில்ல்) மணல்வாசகல் பதில்பகல், செல் னை
3. ச.வே.ல்ப்பன்மணல்வல் (ப.ஆ), (2011), பல்ல்ல்பால்ல் (நெல்நல்வாடை) (இரல் டால்பதில்ல்), மணல்வாசகல்பதில்பகல், செல் னை
4. தெ.பொ.மன்னால்சி ல்ல்தரல், (2018), சல்கமொழி வரலால் ,(ல் தல்பதில்ல்), நில் செல் சல்ல்ல்தக நிலையல்
5. மணவை ல் ல் தபா, (2010), செல்மொழி உல்ல் ல் ல்றல் ல், (ல் தல்பதில்ல்), சீதை பதில்பகல், செல் னை
6. ச.வே.ல்ப்பன்மணல்வல், (2011), சல்கஇலல்கியல், (இரல் டால்பதில்ல்), மணல்வாசகல் பதில்பகல், செல் னை

7. ல் .வரதராசல், (2015), தமில் இலக்கிய வரலால், (ல் ல்றால்பதில்ல், சாகில்திய அகாதெமி வெளல்வல், ல்ல்தில்லி

Outcome mapping

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3	3	2										3	2	3	3	3
CO2	3	3	2										2	2	2	3	3
CO3	3	2	2											2			3

Semester	19IFREC41: Language- I: Course -2	L	T	P	C
IV	French-IV	3	0	0	3

Learning Objective (LO):

LO1	Draw a France map and name its regions and cites.
LO2	Fix an appointment
LO3	Draw a person physically and name its parts.
LO4	Talk about the qualities and defects of the person
LO5	Talk about their health problems

Course Outcomes (CO):

At the end of the course, the student will be able to:

CO1	**Describe a country**
CO2	Take an appointment with a doctor or with friends, etc.
CO3	Express in which part of the body they have pain.
CO4	Describe a person physically and mentally
CO5	Ask others about how they are feeling using expressions such as ‘Qu’est-ce que tu as? Où̀est-ce que tu as mal?’

Unit I

Faire un bilan du sondage

Aborder quelqu’un (Parler de moyens de communication)

Unit II

Faire valoir son droit

Exprimer une opinion sur la vérité d'un fait.

Savoir-vivre en France

Unit III

Donner un conseil

Téléphoner /Prendre rendez-vous

Unit IV

Exposer un problème/ réagir

Parler du corps et des problèmes de santé

Unit V

Parler des qualités et des défauts des personnes

Demander / donner une explication

décrire une personne

Evaluez-vous

TextBook:

1. J. Girardet et J. Pecheur, (2012), ***Echo A1*** - méthode de français**,** Langers, Paris

Supplementary Readings:

1. Marie-Noelle Cocton et Emilie Pommier, (2015), ***Saison A1*** - méthode de français, Les Editions Didier, Paris.
2. Angels Campa, Claude Mestreit, Julio Murillo et ManuelTost, (2001), ***FORUM***– Méthode de français, HACHETTE LIVRE, Paris.
3. Mauger Bleu, (2014), ***Le Cours de langue et de la civilisation française***, - Méthode de français, Hachette, Paris
4. Michele Boulares et Jean-Louis Frerot, (1997), ***GrammmaireProgressive du Français avec 400 exerices***, CLE International, Paris.

COs	PO 1	PO2	PO3	PO 4	PO5	PO 6	PO 7	PO8	PO 9	PO1 0	PSO 1	PS O2	PS O3	PS O4	PS O5
CO1	-	2	3	2	2	3	2	3	3	3	3	3	-	-	-
CO2	3	-	2	-	3	-	2	2	-	3	-	-	-	-	-
CO3	3	2	-	-	2	3	-	2	3	-	-	-	2	-	-
CO4	3	3	3	3	3	-	3	-	2	2	2	-	-	2	-
CO5	-	-	3	3	3	3	3	2	2	2	2	-	-	-	3

Semester	**19IHINC21: Language I Course 3: Hindi-IV**	L	T	P	C
IV		3	0	0	3

Learning Objectives:

- To learn the important poems of famous Hindi poets.
- To imbibe the knowledge of writing in Premchand stories.
- To understand the relation between poems and stories.
- To gain knowledge on stories of BeeshmaSahini

Unit - I: Introduction, Poem

.Kabeer - 1 To 10 DohasTulasi - 1 To 10 Dohas.

Unit - II: Rahim - 1 To 10 Dohas

Unit – III: Edgaah - Premchand. Madhuva -Jayashankar Prasad.

Unit - IV: stories, Chief Ki Daavat - BeeshmaSahinI

Unit - V: HANUMAN JI ADHALATH ME - HARISHAKNA PARSAYE

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Text Books

1. PADHYA MANJARI - DR. T.NIRMALA&DR.S.MOHANRajkamalPrakashan, New Delhi
2. Premchand kipradhinikahaniya,rajkamalprakshan,new Delhi.7.
3. Kahani:nayikahani: namvirsingh,RajkamalPrakashan, New Delhi.
4. Bihari-ompraksh.vaniprakshan,newdelhi 110002.

Supplementary Reading

1. Nayikahani:prakrutiaurpaat:surendrachowdari.
2. Naveen ekanki , D.B.H.P. SABHA, madras17.
3. Bihari ki kavya sruti: jayapraksh.

Course Outcomes

At the end of the course, the student will be able to:

CO1: Understand the concepts of Hindi poems.

CO2: Knowledge on stories of Premchand.

CO3: Describe the basic concepts of hindi stories.

CO4: Apply the concepts of writings of Jai sankar Prasad.

CO5: Understand the writing style of BeeshmaSahini.

Outcome Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	-	3	3	2	2	3	2	3	3	3	3	3	-	-	-
CO2	3	-	3	-	3	-	2	2	-	3	-	-	-	-	-
CO3	3	3	-	-	2	3	-	2	3	-	-	-	2	-	-
CO4	3	3	3	3	3	-	3	-	2	2	2	-	-	2	-
CO5	-	-	3	3	3	3	3	2	2	2	2	-	-	-	3

Semester	19ENGC42:Language – II: Course 4 English Through Literature IV: Short Story	L	T	P	C
IV		3	0	0	3

Learning Objective (LO):

LO1	Develop the communicative competence of learners in the English Language through training them in the skills of listening, speaking, reading, and writing
LO2	Enable the students to know about the origin and development of short story
LO3	Write objectively, avoiding vagueness, prejudice, and exaggeration
LO4	Enable the learner to function through the written mode of English language in all situations including classroom, library, laboratory etc
LO5	Discover an author's purpose, and draw conclusions about certain events, evaluating cause and effect, and understanding point of view

Course Outcomes

At the end of the course, the student will be able to:

CO1: Use more vocabularies while writing

CO2: Ensure about the history and development

CO3: Develop a flow in writing

CO4: Come up with new ideas while reading stories from different perspectives

CO5: Write in a style appropriate for communicative purposes

Unit I

1. O' Henry — "The Gift of The Magi"
2. Ken Liu — "The Paper Menagerie"

Grammar — Synonyms and Antonyms

Unit II

1. Flora Annie Steel — "Valiant Vicky"

2. Oscar Wilde — "Happy Prince"
   Grammar — Words often confused

Unit III

1. R. K. Narayan — "The Martyr's Corner"
2. Mahasweta Devi — "Draupati"

Grammar — Paragraph-Writing

Unit IV

1. Leo Tolstoy — "How much Land Does a Man Need?"
2. Somerset Maugham — "The Verger"

Grammar — Letter-Writing

Unit V

1. Langston Hughes — "On the Road"
2. Premchand — "Bakthi Marg"

Text books:

1. Srinivasa Iyengar, K.R.,(1996.), *Indian Writing in English*. New Delhi: Sterling Pub.,
2. Michael Swan, (2016.), *Practical English Usage*, New Delhi: Oxford University Press,

Supplementary reading:

1. Frank Robert Palmer,. (1975.), *Grammar: (by) Frank Palmer*. New Delhi: Penguin Books
2. Browns, Julie, ed., (1997), *Ethnicity and the American Short Story*, New York: Garland,.
3. Patea, Viorica (2012), *Short Story Theories: A Twenty-First-Century Perspective*. Amsterdam [etc.]: Rodopi,

Outcome mapping

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3			3			3	3		3			3	3			3
CO2	2			3			3	3		3			3	3			3
CO3	3			2			2	2		2			2	2			2
CO4	3			3			3	3		3			3	3			3
CO5	2			2			2	2		2			2	2			2

Semester	19IBOTC43: Core 7: Gymnosperms and Palaeobotany	L	T	P	C
IV		4	0	0	4

Learning Objective (LO):

LO1	To acquire knowledge on the structure and reproduction of Gymnosperms
LO2	To know the types of fossils and the techniques used to study the fossils

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the knowledge on the structure and reproduction of Gymnosperms
CO2	Comprehend the economic importance of Gymnosperms
CO3	Comprehend the advanced characters of Gnetopsida
CO4	Understand the types of fossils and the techniques used for their study
CO5	Appreciate the fossil fuels and their conservations

Gymnosperms

Unit - 1

General Characters and Classification of Gymnosperms by K.R.Sporne. Economic importance. Structure, reproduction and life cycle of *Cycas*

Unit - 2

External morphology, Internal structure of root, stem and leaves of *Pinus*, Reproduction and Life Cycle of *Pinus*

Unit - 3

External morphology, Internal structure of root, stem and leaves of *Gnetum*, Reproduction and Life cycle of *Gnetum*

Palaeobotany

Unit - 4

General Account of Palaeobotany. Types of fossils, process of preservation, techniques of fossil study. Study of Pollen (Palynology) – Acetolysis.

Unit - 5

Geological time scale – Determination of geological age of fossil (Carbon dating). Knowledge, Conservation and exploration of fossil fuels

Text Books:

1. Bhatnagar S.P and Alok Moitra.(2003). *Gymnosperms.* New Age Internat.(P) ltd, New Delhi.
2. Biswas.C and B.M.Johri,(1999). *The Gymnosperms*, Narosa Publishing House, Chennai.
3. Agashe, S.N. (1995). *Palaeobotany*, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

Reference Books / Supplementary reading:

1. Stewart, W.N. and Rothwell,G.W. (2010). *Palaeobotany and evolution of plants*. 2nd Edition., Cambridge University Press, London.
2. Sporne, K.R. (2015). *The Morphology of Gymnosperms*, Hutchin, University Ltd. London

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	2	3		
CO2	3	3						3		3	3		3		2
CO3	3	3								3	3	3	3		
CO4	3	3								3	3	3	3		2
CO5	3	3			2			2		3	3	3	3	3	

Semester	19IBOTC44: Course 8: Morphology of Angiosperms	L	T	P	C
IV		5	0	0	5

Learning Objective (LO):

LO1	To acquire knowledge on the morphological features of angiosperms

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the Morphology of the root, shoot and leaf of plants
CO2	Comprehend the inflorescence type of various angiospermous plants
CO3	Appreciate the pollination mechanism involved in angiosperms
CO4	Analyze the types of fruits in Angiosperms

Unit – 1

Parts of Plant: Root – Characteristics of the root; Tap root and its modifications; Branched root modification – Pneumatophores; Adventitious root and its modification; Epiphytes, Velamen and Assimilatory roots.

The Stem – Characteristics of the Stem; Nodes, Internodes and Buds. Modifications of Stem – Aerial and Sub aerial modifications – Thorn, Phylloclade, Cladode and Bulbil.

Unit – 2

Leaf: Phyllotaxy; Parts and Types of Leaves; Stipules and their kinds; Margin, Surface and Shape of leaves; Venation; simple and compound leaves; Modification of leaves and Heterophylly.

Unit – 3

Inflorescence: Racemose and its types: Cymose and its types; Special types of Inflorescences.

Flower: Perianth; Position of floral leaves on the Thalamus. Bract and its kinds; Symmetry of the flower – Actinomorphy and Zygomorphy; Polypetalous and Gamopetalous flowers; Aestivation; Cohesion and Adhesion of stamens.

Gynoecium - Apocarpous and Syncarpous; Pistillode; Placentation; Structure and types of Ovule.

Unit – 4

Methods of pollination and process of fertilization, Double fertilization and Triple fusion - Development of Embryo: Dicot and Monocot embryos;

Seed - Albuminous and Exalbuminous seeds.

Germination – Epigeal and Hypogeal – Viviparous. Development of seedling.

Unit – 5

Fruit: Development of Fruit – Dehiscence of fruits;

Classification - Simple – Dry dehiscent and Dry indehiscent; Splitting of Schizocarpic fruits;

Simple, fleshy and its types; Aggregate and Multiple fruits.

Dispersal of seeds and fruits.

Text Books:

1. Pandey, B.P. (2015). *College Botany*.S.Chand& Co., New Delhi
2. Vashistha, B.R. (1999). *Botany*. S.Chand& Co., New Delhi.
3. Lowson J.M and Birbal Sahni.(1960). *Text Book of Botany.* University tutorial Press Ltd, London

Reference Books / Supplementary reading:

1. James D. Mauseth.(2013). *Botany Methods- An Introduction to Plant Biology*. Panima Book Agency, Bangalore.
2. Arther J. Eames. (2015).*Morphology of Angiosperms*. Tata McGraw Hill Publishing, London, U.K.

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		
CO2	3	3								3	3	3	3		
CO3	3	3								3	3	3	3		
CO4	3	3								3	3	3	3		

Semester	19IBOTP45: Core 9: Practical – III Gymnosperms and Palaeobotany&Morphology of Angiosperms	L	T	P	C
IV		0	0	6	5

Learning Objective (LO):

LO1	To know about the characteristic features of Gymnosperms
LO2	To gain knowledge of fossils
LO3	To find out the Morphologyof angiosperms

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify the given gymnosperms
CO2	Analyze the type of plant fossil

Gymnosperms:

Identification and description of *Cycas, Pinus,* and *Gnetum*

Palaeobotany:

Study of fossil types such as Impression, compression, casts, molds and petrifications.

Morphology of Angiosperms

1. Parts of a plant
2. Types of Root and their modifications
3. Types of Stem and their modifications
4. Types of Leaves and their modifications
5. Inflorescence and their types
6. Floral parts of monocots
7. Floral parts of dicots
8. Methods of Pollination and process of fertilization
9. Classification of fruits and their characteristic features
10. Seed structure in monocot and dicot plants
11. Mechanisms of Fruit and Seed dispersal
12. Seed Germination Methods

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3		2		3	3					3	3	3		
CO2	3		2		3	3					3	3	3		

Semester	19ICHEA02: Allied-II: Chemistry - II Course 2	L	T	P	C
IV		4	0	0	4

Learning Objective (LO):

LO1	To develop knowledge in electrochemistry and industrial chemistry
LO2	To understand Quantitative Analysis and separation techniques

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyze the quality of water samples
CO2	Appreciate , describe and adopt suitable separation techniques
CO3	Identify compounds using spectral techniques

Unit–I : Chemistry of Natural Products

Terpenoids: Structure and uses – Camphor, vetivones.

Alkaloids – Structure and uses, papavarine, cocaine

Structures and important biological properties

Unit–II : Electrochemistry

Galvanic cells – emf - standard electrode potential - reference electrodes -electrochemical series and its applications-glass electrode and pH determination - Electroplating process -Nickel and Chrome plating - Different types of cells - primary cell, secondary cell. Fuel cells. Corrosion and methods of prevention.

Unit–III : Industrial Chemistry

Production and uses of gaseous fuels like water gas, producer gas, liquefied petroleum gas, gobar gas and compressed natural gas - Fertilizers-manufacture and uses of urea, ammonium sulphate, superphosphate, Hardness of water: temporary and permanent hardness, disadvantages of hard water - Softening of hard water - Zeolite process, Purification of water for domestic use: use of chlorine, Ozone and UV light - Definition and determinations of BOD and COD.

Unit–IV : Analytical Chemistry - I

Introduction to Quantitative Analysis and separation techniques - Principle of volumetric and gravimetric analysis-Estimation of hardness by EDTA method. Estimation of Ni, Ba and Cu by gravimetric methods. Electrogravimetry – theory of electrogravimetric analysis – determination of copper (by constant current procedure) - Separation techniques - extraction - distillation – crystallization.

Unit–V : Analytical Chemistry - II

Colorimetric methods, Beer's law and its validity, estimation of fluoride ion by photocolorimeter, flame photometry and atomic absorption spectroscopy- NMR spectroscopy:

Nuclear spin and conditions for a molecule to give rise to NMR spectrum – theory of NMR spectra, number of NMR signals, equivalent and non-equivalent protons, position of NMR signals, shielding, de-shielding, chemical shift – δ and τ scales, peak area and number of protons – splitting of NMR signals – spin-spin coupling.

Books for Study:

1. Veeraiyan. V, (2006), *Text book of Ancillary Chemistry*, Highmount Publishing house,.Chennai.
2. Vaithyanathan. S, (2006),.*Textbook of Ancillary Chemistry*, Priya Publications,Chennai.
3. Soni. P. L,(2006),*Text book of Organic chemistry*, Sultan Chand &Company, NewDelhi.
4. Puri, Sharma and Pathania, (2006.),*Text book of Physical Chemistry*, Vishal Publishing Co.,Jalandar.
5. Dara. S.S, (2006).*Text book of Environmental chemistry and Pollution Control*- S.Chand and Co., NewDelhi.
6. Day. R.A and Underwood. A.L(1999), *Quantitative Analysis*, Prentice Hall,NewDelhi.
7. Kemp.W, (1989), *Organic spectroscopy*, Palgrave,USA
8. Silverstein R.M and F.X.Webster(1998) *Spectrometric identification of organic compounds*, John Wiley,NewYork..
9. Jag Mohan, (2000).*Organic spectroscopy* (Principles & Applications), Narosa Publishing house.India.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PS O2	PSO 3	PSO 4	PS O5	PS O6	PS O7
CO1	3	3					3										
CO2	3		3					3		3		3					
CO3	3			3					3								
CO4	3	3			3	3	3									3	3

Semester	19ICHEP01: Allied Practical – II Chemistry	L	T	P	C
IV		0	0	6	2

Learning Objective(LO):

LO1	To develop knowledge in volumetric titrations.
LO2	To understand reactions involved in complexometric titrations..

Course Outcomes(CO)

At the end of the course, the student will be able to

C O1	Estimate commercial caustic soda for carbonate and hydroxide content.
C O2	Estimation of metal ions using EDTA and EBT as indicator

Titrimetric Analysis

1. Estimation of sodium hydroxide with standard sodium carbonate using HCl as a link solution
2. Standardization of given sodium hydroxide solution using potassium hydrogenphthalate.
3. Estimation of commercial caustic soda for carbonate and hydroxide content.
4. Titration involving $KMnO_4$ and standard sodium oxalate.
5. Estimation of Mg^{2+} using EDTA and EBT as indicator.
6. Estimation of Zn^{2+} using EDTA and EBT as indicator.

Text Book:

1. Vogel A. I., (2002), Textbook of Quantitative Inorganic Analysis, Pearson India Publishers, NewDelhi.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PS O1	PSO 2	PSO 3	PSO 4	PS O5	PS O6	PS O7
CO1	3	3						3			3						
CO2	3		3						3		3						

Semester	19IBOTC51: Core 11: Anatomy and Embryology of Angiosperms	L	T	P	C
V		5	0	0	5

Learning Objective (LO):

LO1	To understand the anatomy and Embryology of Angiosperms

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Comprehend the plant tissue types
CO2	Understand the anatomy of leaves and stomatal types
CO3	Comprehend the properties of wood
CO4	Understand the Microphorogenesis and Megasporogenesis
CO5	Appreciate the fossil fuels and their conservations

Anatomy

Unit – 1:

Tissue Types and their distribution: Parenchyma, Collenchyma, Sclerenchyma, Xylem and Phloem, Tissue system: meristematic and permanent, simple and complex tissues. Vascular bundles: types - open and closed- – concentric, collateral, bicollateral and radial. endarch, exarch and mesarch xylem.

Unit – 2:

Root system – Structure of primary root in monocotyledons and dicotyledons. Shoot system structure- primary shoot in monocotyledons and dicotyledons. Secondary growth in root and shoot – Anomalous secondary thickening – cortical bundles – medullary bundles.

Unit – 3:

General structure of wood; characteristics of growth rings. Leaf anatomy: Internal structure of a monocotyledons and dicotyledons leaves – Stomata and its types.

Embryology of Angiosperms:

Unit - 4:

Structure of anther and pistil – types of pollination – Microsporogenesis: Morphology, cytology, development and formation of male gametes – role of vegetative and generative nuclei – pollen wall ornamentation.

Unit - 5:

Megasporogenesis: Types and organization of the embryo sac – role of synergids and antipodal haustoria, nutrition of embryo sac – Double Fertilization –Triple fusion , Embryo development in dicot and monocots.

Text Books:

1. Arthur J. Eames and Lawrence. H., Mac Daniels. (2005). *An Introduction to Plant Anatomy*. Tata McGraw Hill Publishing Co.Ltd, New Delhi.
2. Pandey, S.N and A.Chadha. (2005). *Plant Anatomy and Embryology*. Vikas publishing House Pvt Ltd., New Delhi.
3. Singh.V., P.C. Pande and D.K.Jain. (2005). *Embryology of Angiosperms.* Rastogi Publications. Meerut.

Reference Books / Supplementary reading:

1. Bhojwani, S.S and Bhatnagar, S.P. (2015). *Embryology of Angiosperms*. Vikas Publication Pvt Ltd, New Delhi.
2. Fahn,A.(1990). *Plant Anatomy*. Pergamon press, Oxford, UK.

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		
CO2	3	3								3	3	3	3		
CO3	3	3								3	3	3	2		
CO4	3	3								3	3	3	3		
CO5	3	3								3	3	3	2		

Semester	19IBOTC52:Core 12:Taxonomy of Angiosperms, Economic Botany and Evolution	L	T	P	C
V		5	0	0	5

Learning Objective (LO):

LO1	To acquire the knowledge on the salient features, classification and the economic importance of angiosperms
LO2	To find out the evolutionary concepts

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the basic principles of systematics
CO2	Understand the plant nomenclature
CO3	Comprehend the specimen preparation for Herbarium
CO4	Appreciate the diagnostic features and the economic importance of various Angiosperms
CO5	Understand the various concepts of origin and evolution of life

Taxonomy of Angiosperms:

Unit – 1

Principles of Taxonomy, Taxonomy and its importance. Classification of Angiosperms- Artificial Classification - Bentham and Hooker, Phylogenetic classification- Engler and Prantl.

Taxonomic hierarchy, ICN, Principles of ICN, Naming of Taxa(genus and species), author citation. Type Concept

Herbarium - Preparation and uses, National and International Herbaria. Modern trends in Taxonomy – Cytotaxonomy, Biosystematics. Botanical Survey of India - Headquarters and Regional offices – current activities of BSI.

Unit – 2

A detailed study on the diagnostic features and the economic importance of the following families

Nymphaeaceae

Capparidaceae

Portulacaceae

Malvaceae

Rutaceae

Lythraceae

Unit - 3

Asteraceae

Solanaceae

Asclepiadaceae

Convolvulaceae

Bignoniaceae

Amaranthaceae

Commelinaceae

Zingiberaceae

Cannaceae

Poaceae

Economic Botany:

Unit - 4

Importance of Economic Botany. Brief account of Binomial, sources and uses of the following : Fruits and vegetables – Mango, Papaya, Guava and Banana – Brinjal, Raphanus and cabbage. Cereals, millets, pulses and nuts-Rice, wheat, ragi, red gram, black gram, and Cashew - Fibres and fibre yielding plants – Textile fibres – Surface fibres (cotton) – Soft or bast fibres (Jute) – Hard fibres (coir) - Spices and Condiments -roots (*Ferula asafoetida*) underground stem (*Allium cepa*), bark (*Cinnamomum zeylanicum*) Drugs – obtained from roots, underground stems, bark, stems, leaves, flowers, fruits, seeds and entire plants

Evolution:

Unit -5

Origin of life - Operon concept of chemical evolution. Evolutionary theories of Lamark, Darwin, De Vries, Modern synthetic theory of evolution.

Text Books:

1. Dutta, S.C. (2003). *Systematic Botany*, New age International (P) Ltd Publication, New Delhi
2. Gurucharan Singh, (2019). *Plant Systematics-Theory and Practice*, Oxford & IBH Publishing company (P) Ltd, New Delhi
3. Pooja.(2011). *Economic Botany.* Discovery Publishing House, New Delhi

Reference Books / Supplementary reading:

1. Kochhar.(2016). *Economic Botany in the tropics*. Macmillan publishers
2. Sivarajan, V.V. (1999). *Principles of Taxonomy*. Oxford and IBH Publications, New Delhi

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		3
CO2	3	3								3	3	3	3		3
CO3	3	3						2		3	3		3	2	3
CO4	3	3						2		3	3		3		
CO5	3	3								3	3	3	3		2

Semester	19IBOTC53: Core 13: Biological Techniques	L	T	P	C
V		4	0	0	4

Learning Objective (LO):

LO1	To acquire the knowledge on various biological techniques

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the working principles of various Microscopes
CO2	Comprehend various chromatographic techniques and their working principles
CO3	Appreciate the centrifugation methods
CO4	Understand the various Electrophoretic methods

Unit – 1

Microscopy: Compound Microscope, Parts of Compound Microscope, Phase contrast microscopy, Electron Microscopy- TEM, SEM, Tissue preparation in light and electron microscopy, Fixatives, Staining – single and double staining. Micrometry: Camera Lucida, Ocular and Stage Micrometer. Microtomy: types, material preparation for Microtomes -fixatives, dehydration, infiltration, preparation of paraffin wax block.

Unit- 2

Calorimetry and Photometry – Beer- Lambers Law; Colorimeter and Spectrophotometer, Electromagnetic Spectrum, UV Spectroscopy, pH Meter, EC Meter.

Unit - 3

Chromatography: Principles and applications, mobile and stationery phase, Rf value, paper chromatography, TLC, HPLC and Ion-Exchange chromatography.

Unit- 4

Centrifugation: Principles and Applications, Types of Centrifuges, parts of centrifuges, Velocity gradient centrifugation, Differential centrifugation

Unit - 5

Electrophoresis: Principles and Applications. Separation of micro and macromolecules by Agarose Gel Electrophoresis, SDS –PAGE, Blotting techniques.

Text Books:

1. Jayaraman, J. (1992). *Techniques in Biology.* Higgin Bothams Pvt Ltd, Chennai.
2. Krishnamurthy, K.V, (1988). *Methods in Plant Histochemistry*. Viswanathan printers and publishers, Chennai.
3. Marimuthu,R.(2010). *Microscopy and Microtechnique*, MJP publishers, Chennai

4. Wilson, K and John Walker. (2000). *Principles and Techniques of practical Biochemistry.* Cambridge University Press.

Reference Books / Supplementary reading:

1. Albert Schneider, (2012). *Microscopy and Microtechnique.* Rare book club.com, United States, New York.
2. John E.Sass. (2007). *Elements of Botanical Microtechnique*. Bente press, London, UK.
3. Michael J.Bykstra.(1992). *Biological Electron Microscopy*. Springer-Verlag, New York.
4. Srivastava, M.S. (2008). *Bio- analytical Techniques*, Narosa Publishing House, New Delhi.

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3						3	3	3	3		
CO2	3	3	3	2	3					3	3	3	3		
CO3	3	3	3	3	3					3	3	3	3		
CO4	3	3	3	3	3					3	3	3	3		
CO5	3	3								3	3	3	3		2

Semester	19IBOTP54:Core 14: Practical – IVAnatomy, Embryology of Angiosperms, Taxonomy of Angiosperms, Economic Botany, Evolution and Biological Techniques	L	T	P	C
V		0	0	12	6

Learning Objective (LO):

LO1	To find out anatomy and Taxonomy of angiosperms and the economic importance
LO2	To study the embryology of angiosperms

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify the given plant family
CO2	Identify the given plant material of economic importance
CO3	Analyze the technique involved permanent slide preparation
CO4	Appreciate the fossil fuels and their conservations

Anatomy:

1. Examination of Root and Shoot Apices; Maceration,
2. Study of simple tissues and complex tissues.
3. Study of cross section in monocot and dicot root.
4. Study of monocot and dicot stem
5. Study of monocot and dicot leaf.
6. Types of stomata and stomatal index.
7. Anomalous secondary thickening in *Bougainvillaea, Boerhaavia and Nyctanthes*stem.

Embryology

1. Dissection of pollinium from Calotropis
2. Dissection of embryo from Tridax and Cleome
3. Development of microsporangium, pollengrains and their variations,
4. Different types of ovary, ovules and placentation,
5. Female gametophyte – monosporic, bisporic and tetrasporic embryo sacs
6. Endosperms and their haustorial apparatus,
7. Dissection of Anther and angiosperm embryos.

Taxonomy of Angiosperms, Economic Botany and Evolution:

1. Detailed study of the families mentioned in the theory with representative species from the local area.
2. Familiarity of the binomial nomenclature of the available species from the local flora using Gamble flora.
3. Identification of family, genus, species and morphology of the useful parts of plants mentioned in the theory.
4. Darwin, Lamarck, Anatomical evidence of Evolution

Biological techniques

1. Principles, identification and components of Light , Polarizing , TEM and SEM
2. Measurement of stomatal index using micrometry
3. Fixing , Embedding and Sectioning with microtome
4. Single and Double stained slide preparation with hand and microtome sections
5. Measurement of soil pH
6. Measurement of electrical conductivity
7. Separation of biological compounds using paper and TLC chromatography
8. Electrophoresis separation of proteins by SDS-PAGE

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3		3		3	3					3	3	3		
CO2	3		3		3	3					3	3	3		2
CO3	3		3		3	3							3		
CO4	3		3		3	3					3	3	3		

Semester	19IBOTV55: Core 15: Value Education	L	T	P	C
V		4	0	0	5

LEARNING OBJECTIVES

LO1.This paper focuses on Value Educations among the young minds.

LO2.To nurture the rational ethics among the students community.

LO3.To understand the importance of Human Freedom as responsibility.

LO4.To taught about Lifestyle, Equality and Fraternity.

LO5.To include the ethical values to the students and develop the ethical culture.

COURSE OUTCOMES

At the end of the course, the student will be able to

CO1.The students may lead a life in ethical way and also able to take ethical based rational decision in their life.

CO2.Better understanding of moral consciousness of day to day life.

UNIT – I

Value education – Meaning – Nature and Purpose

Importance of Value Education

UNIT – II

Basic Features of Rational Ethics- Moral consciousness and conscience

Love – the ultimate moral norm

UNIT – III

Morality and Freedom - Human Freedom and Moral Responsibility- God, Religion and Morality

Sanction for Moral Life.

UNIT – IV

Social Ethics: Value of life and human beings

Liberty. Equality and Fraternity

UNIT – V

Ethical Issues Today: Religious Ethics- Family Ethics- Political Ethics - Business Ethics- Ethics and Culture.

TEXT BOOKS

1. Heroled Titus, *Ethics for Today*. New Delhi: Eurasia Publishing House, 1964.
2. Madan, G.R., *Indian Social Problems*, New Delhi: Allied Publishers, 1966.

SUPPLEMENTARY READINGS

1. Sharma, R.N., *Principles of Sociology*, Meerut: Educational Publishers, 1968
2. Willam, K., *Ethics* , Delhi: Prentice Hall of India,1999
3. Arumugam, N., *Value based Education*, Madras: Saras, 2012

Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3					1					2				1			2
CO2		3		1		1		2		2		2		1				
CO3		2			2					1				2			2	
CO4	1		2			1						1			2		3	
CO5	3			3			2		1		3		3		2			2

Semester	19IBOTC61: Core 16: Cytology, Genetics and Plant Breeding	L	T	P	C
VI		4	0	0	5

Learning Objective (LO):

LO1	To acquire knowledge on the structure of cell and cell organelles
LO2	To develop skill on genetics and Plant breeding

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the general features of cell and cell organelles.
CO2	Comprehend the structure of Chromosomes and their types
CO3	Understand the basic principles of Mendelian genetics
CO4	Understand the effect of mutation on Plant development
CO5	Appreciate the technique involved in Plant Breeding

Unit– 1

Structure of cells: Prokaryotic cell – Bacterial cell and Blue green algae. Eucaryotic cell – Ultra structure of plant cell. Mitochondria – Ultra structure and functions. Plastids – Types, Ultra structure of chloroplast functions. Ribosomes – types, Ultra structure and functions. Structure and functions of Endoplasmic reticulum, Golgi apparatus and Lysosomes. Nucleus – Ultra structure, nuclear membrane and functions. Nucleolus – Fine structure and functions.

Types of cell division – Amitosis, Mitosis and Meiosis – Karyokinesis and Cytokinesis – Significance of mitosis and meiosis.

Unit– 2

Chromosomes – structure – types of chromosomes, Karyotype – Idiogram. Special types of chromosomes – Polytene and Lampbrush chromosomes. Structural changes of chromosomes – deficiency – duplication – translocation and inversion. Numerical changes of chromosomes – aneuploids and euploids. Polyploids – auto and allo polyploids

Unit – 3

Mendelian genetics – Introduction, Mendel's laws. Monohybrid cross, Dihybrid cross, Test cross, Back cross. Non-Mendalian Genetics- Introduction, Incomplete dominance and Interaction of genes, Multiple alleles, Quantitative inheritance, linkage and crossing over, significance of crossing over, sex determination.

Unit – 4

Construction of chromosome map in *Drosophila*. Three point cross. Mutations – Spontaneous and Induced mutations, Molecular basis of gene mutations, Point and Frame shift mutations.

Plant Breeding

Unit – 5

Objectives of Plant breeding, Breeding methods: Methods of Plant breeding in self and cross pollinated crops. Hybrid vigour and hybridization. Breeding for special purposes- Breeding for diseases & pest resistance – breeding for quality- breeding for hybrid varieties.

Text Books:

1) Rastogi, S.C. (2016). *Cell Biology*. New Age International Publication, New Delhi.
2) Chaudhari,H.K. (1984). *Elementary Principles of Plant Breeding*. Oxford IBH, New Delhi.
3) Sambamurthy, A.V.S.S. (2006). *Genetics*. Narosa Publishing House, New Delhi

Reference Books / Supplementary reading:

1. Gupta,P.K. (2003). *Cytogenetics*. Rastogi Publications, New Delhi.
2. Singh,B.D. (2001). *Plant Breeding, Principles and Methods*. Kalyani Publications, New Delhi

3. Vijendra Das, L.D. (2005). *Genetics and Plant Breeding*. New Age International (P) Ltd.,NewDelhi..

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		
CO2	3	3								3	3	3	3		2
CO3	3	3								3	3	3	3		
CO4	3	3						2		3	3	3	3		
CO5	3	3						2		3			3	2	2

Semester	19IBOTC62:Core 17:Plant Physiology and Biochemistry	L	T	P	C
VI		5	0	0	5

Learning Objective (LO):

LO1	To acquire knowledge on Physiology and Biochemistry of plants

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the general features of cell and cell organelles.
CO2	Comprehend the structure of Chromosomes and their types
CO3	Understand the basic principles of Mendelian genetics
CO4	Understand the effect of mutation on Plant development
CO5	Appreciate the technique involved in Plant Breeding

Plant physiology

Unit- 1

Importance of water to plant life – physical properties of water: diffusion, osmosis, absorption, transport of water and transpiration – physiology of stomata.

Absorption and translocation of minerals. Mineral nutrients – micro and macro nutrients and their role.

Unit- 2

Photosynthesis: Structure of Chloroplast, Mechanism of light absorption, photo-phosphorylation: Photosynthetic electron transport (cyclic and non-cyclic) Carbon metabolism: C_3,C_4 and CAM pathways and their distinguishing features.

Unit- 3

Respiration: Aerobic and anaerobic - Glycolysis, Kreb's cycle and electron transport system, factors affecting respiration, photo-respiration and its significance.

Unit- 4

Nitrogen metabolism, Biological Nitrogen fixation and Nitrogen cycle. Plant growth and development: Growth regulators: Auxins , Gibberellins, Cytokinins and Ethylene and their influence on plant growth.

Photoperiodism, Vernalization and Senescence. Biochemistry:

Unit - 5

Structure, classification and properties of carbohydrates, lipids, proteins and Nucleic acids. Enzymes – properties, nomenclature and classification. Co-enzymes and co-factors. Mechanism of enzyme action

Text Books:

1. Jain, V.K.(2017). *Fundamentals of Plant Physiology*, S.Chand& Company Ltd., New Delhi
2. Srivastava, H.S. and N.Shankar. (2013). *Plant Physiology and Biochemistry*. Rastogi publications.
3. Verma, S.K. (2018). *A Text book of Plant Physiology*, S.Chand& Co., New Delhi.

Reference Books / Supplementary reading:

1. Hopkins,W.G.(1999) .*Introduction to Plant Physiology,* John Wiley & Sons Inc., New York
2. Moore, T.C. (1994). *Biochemistry and Physiology of Plant Hormones* (second edition). Springer –Verlag, New York, USA.
3. Salisbury and Ross. (2007). *Plant Physiology*. Wordsworth Publishing co., Belimont, USA.

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3			3		3	3	3	3		
CO2	3	3	3	3	3			3		3	3	3	3		
CO3	3	3	3	3	2			3		3	3	3	3		
CO4	3	3	3	2	3			3		3	3	3	3		
CO5	3	3	3	3	2			3		3	3		3		

Semester	19IBOTC63: Core 18: Ecology and Biodiversity	L	T	P	C
VI		5	0	0	5

Learning Objective (LO):

LO1	To acquire knowledge on the basic concepts of Ecology
LO2	To know about Biodiversity and its conservation

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the basic and applied aspects of Environmental Biology
CO2	Understand the various types of pollution and its control measures
CO3	Comprehend the principles of biodiversity and their conservation

Ecology

Unit – 1

Ecology – Introduction –Scope and Importance. Ecological Factors: Climatic, Edaphtic, and Biotic factors. The Environment –Atmosphere, Lithosphere, Hydrosphere and Biosphere.

Structure and functions of ecosystems – Producer, Consumer and Decomposer. Energy flow– Food chain, Food web, Trophic level and Ecological pyramids. Types of ecosystems. Terrestrial (Forest, Desert and Grassland) and Aquatic (Freshwater, Marine) Biogeochemical cycle: Hydrological, Gaseous and Sedimentary cycle.

Unit – 2

Natural resources – Forest, water, mineral, food, energy and land –conservation of natural resources.

Methods of studying vegetation- qualitative and quantitative characters. Quadrats:- types – Ecological succession: types, processes, causes, Theories of succession. Hydrosere and Xerosere. Ecological Indicators.

Unit – 3

Pollution – causes, effects and control of: Air, Water, Soil, Thermal, Noise and Radioactive pollution. Climate change: Global warming, Acid rain, Ozone layer depletion. Disaster management- Floods, earth quake, Cyclone, Tsunami and land slide.

Biodiversity

Unit – 4

Introduction – Definition – Genetic, species and ecosystem diversity – Values of biodiversity – biodiversity at global, national and local level. India as mega diversity nation – causes for loss of biodiversity – conservation of biodiversity (*In situ* and *Ex situ*) – Hot spots of biodiversity – Endangered and Endemic species of India

Unit – 5

Principles of Phytogeography –Vegetational types of India – Endemism – Age and area hypothesis – Altitudinal and latitudinal distribution of vegetation-continuous and discontinuous distribution of vegetation - Application of Remote sensing to ecological studies.

Text Books:

1. Ambasht. R.S. (1998). *A Text book of Plant Ecology*. Students & Friends Publications, Varnasi.
2. Sharma.P.D. (2017). *Ecology and Environment*. 13th edition, Rastogi Publishers, Meerut.
3. Asthana D.K and Meera Asthana. (2016). *A Text book of Environmental Studies*. S. Chand& Company, New Delhi.

Reference Books / Supplementary reading:

1. Dash.M.C. (2007). *Fundamentals of Ecology*. Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi.
2. Joshi PC and Namita Joshi. (2004). *Biodiversity and Conservation*. APH Publishing Corporation, New Delhi.
3. Odum, E.P. Gary W. Barrelt. (2005). *Fundamentals of Ecology*- Brooks/Cole Cenage learning, UK.

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	2			3		3	3	3	3		
CO2	3	3	3	3	3			3		3	3	3	3		2
CO3	3	3	3	3	3			3	2	3	3	3	3	2	2

Semester	19IBOTC64:Core 19:Molecular Biology, Genetic Engineering and Biotechnology	L	T	P	C
VI		4	0	0	5

Learning Objective (LO):

LO1	To study the basic concept of Molecular Biology
LO2	To gain knowledge on applications of Genetic Engineering

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the molecular mechanisms of gene and protein expression
CO2	Appreciate the gene manipulations in plants
CO3	Comprehend transgenic plants and their uses
CO4	Understand the principles of tissue culture and its uses

Molecular Biology

Unit – 1

Nuclic Acid – structure and properties (Physical, chemical,spectroscopic and thermal), DNA types (A,B,C and Z), Watson and Crick model of DNA. DNA synthesis and replication, DNA Polymerase , Methylation of DNA, damage and repair of DNA , RNA synthesis- type, RNA polymerase role, transcription- initiation, elongation, termination, post transcriptional changes in RNA.

Unit - 2

Genetic code – Types of codons, Translation ribosomes assembly, formation of initiation complex, initiation factors, elongation and termination, Wobbel hypothesis, translational proof reading, translation inhibitors, post- translational modification of proteins, general principles of gene regulation, gene regulation in prokaryotes, Operon concepts, Lac Operon, positive and negative control, catabolite respiration- Gene silencing

Genetic Engineering

Unit - 3

Basic principles: Restriction endonucleases – method of gene transfer-Electrophoration – microinjection –plasmid and cosmids, phagemits. cDNA libraries, Southern and Northern plotting techniques

Unit – 4

Genetic Engineering of nif genes in non-leguminous plants- marker gene, enzymes, Organization and integration, Fungicidal and herbicidal resistance markers - biocontrol method of pest and disease. Transgenic plants (Bt-cotton, Bt- tomato and golden rice)

Biotechnology

Unit – 5

History of Plant tissue culture – Laboratory organization – Nutrient medium composition – Nutreint medium – MS and B5. Principles of tissue culture – Totipotency- Explant – Inoculation-incubation – Callus formation – Redifferntiation – Hardening- Meristem culture – Protoplast isolation, purification, fusion, somatic hybridization. Synthetic seeds – Applications of Plant Tissue Culture.

Text Books:

1. Allison.A. (2007). *Fundamental Molecular Biology*. Blackwell Publishing, UK.
2. Dubey,R.C.(2008). *A text book of Biotechnology*. S.Chand publishers, Meerut.
3. Ignachimuthu, S.(1997). *Biotechnology: An Introduction*-2nd Edition, Panima Book Distributors. Narosa Publishing House, New Delhi.
4. Sambamurthy A.V.S.S.; (2008); *Molecular Biology*; Narosa Publishers- New Delhi

Reference Books / Supplementary reading:

1. Freifelder, (2000). *Molecular Biology*, Narosa Publishing House, New Delhi.
2. Lindsey. (2007). *Plant Tissue Culture*. Springer (India) Pvt. Ltd., New Delhi
4. William. J.Thieman, Michael A.Palladino. (2012). *Introduction to Biotechnology.* Benjamin Cummings publishers.

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3							3	3	3	3		
CO2	3	3	3	3	3					3	3	3	3		3
CO3	3	3	3	3	3			2	2	3	3	3	3		
CO4	3	3	3	3	3			2		3	3	3	2		3

Semester	19IBOTP65: Core 20: Practical – V Cytology, Genetics, Plant Breeding, Plant Physiology, Biochemistry, Ecology , Biodiversity, Molecular Biology, Genetic Engineering and Biotechnology	L	T	P	C
VI		0	0	12	6

Learning Objective (LO):

LO1	To study the basic principles of Cell Biology
LO2	To know the plant physiology and biochemistry
LO3	To study the ecological principles

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand cell and cell organelles
CO2	Analyze the principles of genetics and plant breeding
CO3	Understand the principles of plant physiology and biochemistry
CO4	Understand the techniques involved in genetic engineering and biotechnology
CO5	Comprehend the basic plant breeding methods

Cell Biology

1. Learning and perfecting squash and smear techniques.
2. Study of cell division: Mitosis – *Allium cepa, Rhoeo.*
3. Meiosis – *Allium cepa, Helianthus*.
4. Preparation of Idiogram.
5. Study of special types of chromosomes

Genetics and Plant Breeding

1) Monohybrid cross and test cross, Dihybrid cross and test cross, Incomplete dominance, Gene interaction, Quantitative inheritance, Sex – Linked Inheritance, Chromosome map. Emasculation – Cross pollination, Hybridization Techniques

Plant Physiology and Biochemistry

1. Determination of osmotic potential by plasmolytic method.
2. Effect of monochromatic light on apparent photosynthesis
3. Separation of chloroplast pigments using paper chromatographic technique
4. Estimation of chlorophyll content using Arnon's method
5. Rice coleoptile straight growth test for Indole acetic acid.
6. Estimation of Protein content
7. Estimation of Reducing sugar content
8. Estimation of Starch content
9. Estimation of Lipid content
10. Estimation of α- amylase and β- amylase

Ecology and Biodiversity:

1. Identification of plants in Botanical Garden
2. Determination of Abundance of a particular species in a given area.
3. Determination of frequency of a particular species in a given area.
4. Determination of density of a particular species in a given area.
5. Determination of the biomass of a particular area.
6. Determination of the biotic components of pond ecosystem.
7. Determination of the biotic components of Grassland ecosystem.
8. Ecological adaptations of plants:

   Hydrophytes: *Hydrilla, Eicchornia, Nymphaea*

   Xerophytes: *Nerium, Casuarina, Opuntia*

9. Special mode of Nutrition (adaptation)
   (i) Symbiosis : Root nodules of blackgram
   (ii) Mycorrhiza: Root of *Pinus*
   (iii) Epiphyte: *Vanda*
   (iv) Insectivorus:*Nepenthes*
   (v) Parasitic Plant:*Cuscuta*
10. Determination of soil properties (pH, EC, moisture content, temperature, soil texture)

Molecular Biology, Genetic Engineering and Biotechnology:

1. Isolation of DNA from tender coconut
2. Separation of plant genomic DNA by electrophoresis
3. Quality checking of DNA by Electrophoresis
4. Southern blotting (Demonstration)
5. Western blot - detection of proteins (Demonstration)
6. Explaining the process of making Transgenic crops (Bt cotton, Bt Brinjal, Golden rice and Milk products)
7. Sterilisation of Explants
8. Preparation of Media
9. Callus, Embryo and Shoot tip culture
10. Artificial seeds and method of protection (synthetic seed)
11. Isolation of Protoplast by Enzymatic method

Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3		3		3	2					3	3	3		
CO2	3		3		3	2					3	3	3		
CO3	3		3		3	3					3	3	3		
CO4	3		3		3	3					3	3	3		
CO5	3		3		3	3					3	3	3		

Semester	19IBOTC66: Core 21: Experiencial Learning	L	T	P	C
VI		0	4	0	2*

Gardening:

Gardening classes highlighted about the importance of soil texture and compostion and to learn cultivation and maintenance of different types of Medicinal plants and ornamental plants.

Semester	19IBOTC71: Core 22: Plant Diversity – I (Algae and Bryophytes)	L	T	P	C
VII		4	0	0	4

Learning Objective (LO):

LO1	To acquire knowledge on the structure, reproduction and life cycle of algae and Bryophytes

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify, classify and describe the morphological nature of various types of algae
CO2	Understand the occurrence, structure and life cycle of algae and bryophytes
CO3	Appreciate the phylogency and evolutionary relationship in non-flowering plants
CO4	Gain adequate knowledge on comparative account of various algae and bryophytes and economic importance of algae and bryophytes
CO5	Comprehend the economic importance of Algae and Bryophytes

Algae

Unit – 1

Introduction, General Characteristic features, Classification(Fritsch,1949), range of structure, reproduction and evolutionary trends of; Chlorophyceae (*Chlamydomonas, Volvox, Chlorella, Hydrodictyon, Ulothrix, Ulva, Draparnaldia, Oedogonium, Caulerpa, Acetabularia, Halimeda, Codium, Valonia, Chara, Nitella. Desmids)*, Xanthophyceae (*Voucheria)* Bacillariophyceae(*Diatom).*

Unit – 2

Range of structure, reproduction and evolutionary trends of Phaeophyceae(*Ectocarpus, Padina, Stoechospermum, Sargassum, Turbinaria)*, Rhodophyceae(*Batrochospermum,*

*Polysiphonia, Gracilaria*and Cyanophyceae(*Microcystis, Lyngbya, Spirulina, Nostoc, Anabaena, Scytonema*and*Stigonema).*

Unit – 3

Origin and evolution of sex in algae – Ecology of algae - Distribution of algae in soil, fresh water and marine environment- Role of Algae in soil fertility. Culture and cultivation of algae - Algal pigments and their uses,Algae and Environment, Algal blooms and Toxins, Economic importance of algae, Fossil algae.

Bryophytes

Unit- 4

Introduction, general characters, classification, origin and evolution of Bryophytes. Alternation of generation in Bryophytes and inter relationship of Bryophytes.

Unit- 5

Range of structure of gametophyte and Sporophyte of Bryophytes (*Riccia, Targionia, Marchantia, Reboulia. Dumortiera, Pallavicinia, Riccardia, Porella, Anthoceros, Sphagnum* and *Bryum*). Reproduction in Bryophytes. Fossil Bryophytes and Economic importance of Bryophytes.

Text Books :

1. Sharma O.P, (2015),*Text book of Algae*, Tata McGraw – Hill Publications Pvt – New Delhi
2. Sureshkumar and KhalingMikawlrawng, (2014). *Textbook of Bryophyta.*Sonali Publications, New Delhi
3. VauDeuHock,C., D.G. Mann and H.M. Johns. (2019). *Algae- An Introduction to Phycology*. Cambridge University Press., New Delhi
4. Vashishta. B.R., A.K. Sinha and Adarsh Kumar. (2016). *Botany for Degree students-Bryophyta*. S. Chand and Company Ltd., New Delhi.
5. Vashishta. B.R., A.K. Sinha and Adarsh Kumar. (2015). *Botany for Degree students - Algae*. S. Chand and Company Ltd., New Delhi.

Reference Books / Supplementary reading:

1. Fritsch,F,E.(1972). *Structure and Reproduction of Algae I & II*, Cambridge University Press.
2. Rashid.A. (2007). *An Introduction to Bryophyta* – Vikas Publications, New Delhi.
3. Watson,E.V.(2015). *The Structure and Life of Bryophytes*. United Book Prints, New Delhi

Outcome Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		
CO2	3	3								3	3	3	3		

CO3	3	3								3	3	3	3		
CO4	3	3								3	3	3	3	2	
CO5	3	3								3	3	3			2

Semester	**19IBOTC72:Core 23: Fungi, Lichens and Plant Pathology**	**L**	**T**	**P**	**C**
VII		**4**	**0**	**0**	**4**

Learning Objective (LO):

LO1	To study the classification, structure and reproductive features of fungi and lichens
LO2	To study the basic principles of plant pathology

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Gain adequate knowledge on comparative account of various fungi, lichens and plant pathogens
CO2	Appreciate the salient features of Fungi and lichens
CO3	Appreciate the disease of various crop plants
CO4	Understand the host parasite interaction process
CO5	Appreciate the economic importance of fungi and lichens

Fungi

Unit – 1

Introduction to Fungi, Position of Fungi among living organisms – criteria and evidences - Recent trends in the classification of Fungi with special reference to Alexopoulos and Mims. Structure, Nutrition of fungi - Myxomycotina :*Stemonitis, Physarum*.Eumycotina : *Olpidium*.Mastigomycotina : *Phytophthora, Perenospora*. Plasmodiophoromycetes :*Plasmodiophora.*Zygomycotina :*Pilobolu*s.

Unit – 2

Classification and diversity of Fungi Ascomycotina :*Aspergillus,Xylaria, Claviceps. Peziza, Morchella.* Basidiomycotina *: Lycoperdon, Ustilago, Polyporus.*Deuteromycotina : *Alternaria, Fusarium.* Spore dispersal and factors affecting spore germination, reproduction, life history, phylogeny and affinities of the major groups of Fungi. Heterothallism, Parasexual cycle, Degeneration of sexuality. Economic importance, Fungi as bio-control agents.Ecology of Fungi - Soil Fungi – Sugar Fungi – Cellulose and lignin degrading Fungi. Role of fungi in Industry-Medicine and food.Mycorhiza: Structure and types- uses in Agriculture

Lichens

Unit – 3

General account of structure and life cycle of Lichens-broad outline of classification. Structure, reproduction and lifecycle of the following types: a) *Parmelia*; b) *Usnea*. Ecological role and economic importance of lichens.

Plant Pathology

Unit – 4

History of Plant Pathology–Diagnosis of Plant diseases - Koch's Postulates – Symptoms and signs. Classification of Plant Diseases – Host-pathogen interaction –Disease resistance - Histological and biochemical aspects - Metabolic changes during disease development.

Unit - 5

Etiology, Symptoms-Causative agents and Control of the following diseases: Tobacco Mosaic , Bunchy top of Banana- Leaf spot in Cotton- Sheath Blight of Paddy- Citrus canker- Soft rot in vegetables. Little leaf of Brinjal; Blast of Paddy, Red rot of Sugar cane, Leaf spot diseases of groundnut and Damping-off of vegetable seedlings. Plant disease management - Principles and methods of disease control – Chemical, Biological and Agronomical Practices - Legislation and quarantine practices in India.

Text Books :

1. Dubey,H.C. (2018). *An Introduction to Fungi*. Scientific Publishers, Jodhpur.
2. MannajkumarKalita.(2017). *Fundamentals of Plant Physiology*. Kalyani Publishers, New Delhi
3. Sambamurthy A.V. S.S. (2006). *A Textbook of Plant Pathology*. I.K. International Pvt.Ltd., New Delhi.
4. Sharma,O.P. (2005). *The Text book of Fungi.* Tata McGraw Hill publishing company Ltd, New Delhi.
5. Sharma,P.D. (2009). *The Fungi.* Rastogi publications, Meerut.
6. Singh. R.S. (2015). *Plant Diseases.* Oxford & IBH publishing Co.Pvt Ltd. New Delhi

Reference Books / Supplementary reading:

1. Alexopoulos, C.J., C.W. Mims and M. Blackwell. (2007). *Introductory Mycology.* IV Edition. Wiley India (P) Ltd., Daryaganj, New Delhi.
2. Aneja, K.R and R.S Mehrotra. (2018). *An Introduction to Mycology*. New Age International Publishers, New Delhi
3. Bhupendra Singh Kharayat.(2017). *Foundations in Plant Pathology*. Kalyani Publishers, New Delhi
4. Dasgupta, M.K.(2004). *Principles of Plant Pathology.* Allied publishers Ltd. New Delhi.
5. Rangaswami,G and A.Mahadeven. (2006). *Diseases of crop plants in India*. Prentice Hall Pvt.Ltd. New Delhi.

Outcome Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		
CO2	3	3								3	3	3	3		
CO3	3	3								3	3	3	3		
CO4	3	3								3	3	3	3		
CO5	3	3								3	3	3	3		2

Semester	19IBOTC73:Core 24: Microbiology	L	T	P	C
VII		4	0	0	4

Learning Objective (LO):

LO1	To study the classification, structure and reproductive features of bacteria and viruses
LO2	To understand the basic concepts of Biofertilizers and Microbial Ecology of Soil

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyze the classification and structure of microorganisms
CO2	Understand the various microbial culture techniques
CO3	Learn about the advantages of microorganisms to the society
CO4	Comprehend the importance of Biofertilizers

Microbiology

Unit – 1

General account of Bacteria, Nutrition and growth curve of Bacteria, Methods of culturing bacteria, kinds of media and preparation techniques, – Isolation: serial dilution technique - pure culture – maintenance and preservation- inoculation of bacteria- Bacterial staining methods – Stains and dyes,Gram's, flagellar and other types of staining.

Unit – 2

Morphology of viruses – classification of viruses – Virus-Vector relationships –replication of virus. Satellite virus. Bacteriophages - Viroids and Prions – isolation and purification of viruses. Uses of virus in Biotechnology.

Unit – 3

Role of microbes in cycling of nitrogen, carbon and phosphorus. Microbial control- methods of physical control (heat, cold, desiccation, radiation and sound waves). Microbial leaching of minerals. Sterilization by filteration, chemical agents – disinfectants, antiseptics and antibiotics. Role of Microbes in waste water treatment, General design and application of biofermentor. Microbes in food spoilage and food poisoning. Food preservation - Micro organisms as food – Probiotics.

Unit – 4

Microbes used as Biofertilizer: Importance of biofertilizer; Role of Biofertilizer; Different types of Biofertilizers; *Rhizobium; Azospirillum; Azotobacter, Azolla* and Blue –Green algae; Advantages and disadvantages of biofertilizers.

Unit – 5

Microbial Ecology of Soil: Soil as habitat: Types of Soil; Chemical involved in Soil habitats; Role of Microorganisms on the environment; Microorganisms inhibiting soil; Microbiology of decomposition; Factors affecting decomposition; Ecological significance of soil microorganisms.

Books for study:

1. Ananthanarayan, Panikers. (2020). *Microbiology* -11th Edition. University Press (India) Pvt Ltd, Hyderabad.
2. Textbook of Prescott's Microbiology– 10th Edition . . (2020). WCB Mc Graw Hill, Boston
3. Bhattacharjee, R.N, (2015). *Fundamentals of Microbiology*. Kalyani Publishers, Ludhiyana.
4. Dubey, R.C. and D.K. Maheswari, (2016). *A Textbook of Microbiology*, S. Chand & Company, New Delhi
5. Kanungo, R, Ananthanarayan and Panikers. (2017).*Textbook of Microbiology* (10th Ed). University Press, Hyderabad, India
6. Pommervi,J.C. (2018). *Fundamentals of Microbiology* (11th Ed). Jones & Bartlett Learning, USA
7. Sharma, P.D. (2017). *Microbiology. Rastogi Publications*, Meerut.

Reference Books / Supplementary reading:

1. Brain D.Robertson and Brendan W.Wren.(2012). *Systems Microbiology: Current topic and Applications*. ISBN. 978-1-908230.
2. John P.Harley.(2007). *Microbiology Lab Manual*. 7th Edition. McGraw Hill Medical Publication division
3. Mathews K.R., Montville, T.J and K.E.Kniel. (2017). *Food Microbiology: An Introduction*. ASM Press, Washington.
4. Murugalatha,N et.al. (2017). *Microbial Techniques*. MJP Publishers, New Delhi

Outcome Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		
CO2	3	3						2		3	3	3	3		
CO3	3	3						2	2	3	3		3		2
CO4	3	3						2		3	3	2	3		2

Semester	19IBOTP74: Core 25: Practical – VI Plant Diversity – I, Fungi, Lichens, Plant Pathology and Microbiology	L	T	P	C
VII		0	0	12	6

Learning Objective (LO):

LO1	To observe the structure of Algae, Bryophytes, Fungi and Lichens
LO2	To observe the staining methods of Microorganism
LO3	To find out the blood group

Course Outcomes (CO)

CO1	Identify the given algae, Bryophytes, fungi and Lichens
CO2	Analyze the various microorganisms
CO3	Identify the type of Blood Group

Algae:

Chlamydomonas, Volvox, Chlorella, Hydrodictyon, Ulothrix, Ulva, Draparnaldia, Oedogonium, Caulerpa, Acetabularia, Halimeda, Chara, Nitella. Desmids, Voucheria, Diatom, Ectocarpus, Padina, Stoechospermum, Sargassum, Turbinaria.,Batrochospermum, Polysiphonia, Gracilaria, Microcystis, Lyngbya, Spirulina, Nostoc, Anabaena, Scytonema , and Stigonema

Bryophytes:

Riccia, Targionia, Marchantia, Reboulia. Dumortiera, Pallavicinia, Riccardia, Porella, Anthoceros, Sphagnum and *Bryum.*

Fungi:

Structure, reproduction and diagnostic features of *Stemonitis, Physarum, Olpidium, Phytophthora, Peronospora, Pilobolus, Saccharomyces, Aspergillus, Xylaria, Claviceps, Peziza, Morchella, Lycoperdon, Ustilago, Polyporus, Alternaria, Fusarium*

Lichens:

Collection and identification of lichen specimens and make labelled sketches of specimens. Study the external and internal structures of the types mentioned.

Plant Pathology:

Verification of Koch's postulates. Identification of plant diseases included in theory syllabus.

Microbiology:

Staining of microorganisms: Simple staining. Gram staining – spore and acid fast staining, preparation of culture media – Synthetic and Non-synthetic. Isolation of microorganisms. Aerobic and anaerobic forms and soil microbes, purification technique of microorganisms. Serial dilution technique. Hanging Drop method.

Outcome Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5
CO1	3		3		3	2					3	3	3		
CO2	3		3		2	3					3	3	3		
CO3	3		3		3	3					3	3	3		

Semester	19IBOTC81:Core 26: Plant Diversity – II (Pteridophytes, Gymnosperms and Palaeobotany)	L	T	P	C
VIII		4	0	0	4

Learning Objective (LO):

LO1	To acquire knowledge on living and fossils forms of Pteridophytes and Gymnosperms

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Gain adequate knowledge on comparative account of Pteridophytes

CO2	Comprehend the structure of Gymnosperms
CO3	Understand the palaeobotany to trace the evolution of plants
CO4	Appreciate the economic importance of Pteridology and Gymnosperms
CO5	Understand the types of fossil fuels and their conservation

Pteridophytes

Unit – 1

Introduction- General characteristic features and classifications (Reimer's) of Pteridophytes. Origin and evolution of Pteridophytes. Stelar evolution in Pteridophytes. Range of structure and reproduction in fossil forms: *Rhynia, Horneophyton, Asteroxylon, Lepidodendron, Lepidocarpon, Sphenophyllum*and *Calamites.*

Unit - 2

Range of structure and reproduction of Living forms: *Psilotum, Selaginella,Equisetum*, *Angiopteris, Osmunda, Adiantum, Pteris, Marsilea* and *Salvinia.* Sporangial Development and Soral evolution- Spore germination.Gametophyte development – Types and structure. Heterospory and seed habit – Economic importance of Pteridophytes

Gymnosperms

Unit – 3

Classification of Gymnosperms (Sporne,1965). A general account of distribution, morphology, anatomy, reproduction, phylogeny and relationship of the following orders with special reference to the genera mentioned against each order.

Cycadopsida

1. Pteridospermales
Lyginopteridaceae : *Lyginopteris,Heterangium, Lagenostoma*.
Medullosaceae : *Medullosa, Trigonocarpus*
Glossopteridaceae : *Glossopteris*
Caytoniaceae : *Caytonia.*
2. Bennettitales
Cycadeoideaceae : *Cycadeoidea.*
3. Pentoxylales
Pentoxylaceae : *Pentoxylon*
4. Cycadales
Cycadaceae : *Cycas*

Unit – 4

Coniferopsida

1. Cordaitales.

Cordaitaceae : *Cordaites*.

2. Coniferales.

Cupressaceae : *Cupressus*

Podocarpaceae : *Podocarpus*.

Araucariaceae : *Araucaria*

3. Taxales

Taxaceae : *Taxus.*

4. Ginkgoales

Ginkgoaceae : *Ginkgo*

Gnetopsida

Gnetaceae : *Gnetum*

Evolution of Gymnosperms. Economic importance of Gymnosperms.

Palaeobotany

Unit – 5

Contributions of Birbal Sahani to Palaeobotany – Study of fossils in understanding evolution – Fossilization and fossil types. Economic importance of fossils – fossil fuels and Industrial raw materials. Geological time scale- Radio carbon dating, Fossils and fossilization. Kinds of fossils: Impressions, compressions, casts, molds, petrifications and coal balls. Importance of the study of Palaeobotany

Books for study:

1. Bhatnagar, S.P. and Alok Moitra, (2003). *Gymnosperms*, New age International Pub., New Delhi.
2. Parihar,N.S. (2005).*An Introduction to Embryophyta – Pteridophytes* – Central Book Dep, Allahabad.
3. ShirpadN.Agashe. (1995). *Palaeobotany*. Oxford & IBH Publishing Co.Pvt.Ltd, New Delhi.

Reference Books / Supplementary reading:

1. Johri,R.M. (2012). *A Textbook of Gymnosperms*. Dominant publishers and Distributors pvt., ltd, New Delhi.
2. Rashid.A. (2007). *An Introduction to Pteridophyta* – Vikas Publications, New Delhi.
3. Arnold C.R.(2000). *Introduction to Palaeobotany*. TMH publishing Co.Ltd., Bombay

Outcome Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		

CO2	3	3								3	3	3	3		
CO3	3	3								3	3	3	3		
CO4	3	3						2		3	3		3		2
CO5	3	3						2		3	3		2	2	3

Semester	**19IBOTC82: Core 27:Anatomy, Embryology of Angiosperms and Morphogenesis**	**L**	**T**	**P**	**C**
VIII		**4**	**0**	**0**	**4**

Learning Objective (LO):

LO1	To acquire the knowledge on anatomy and embryology of vascular plants
LO2	To apply knowledge on the organ development in plants

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyze the various tissues in plants, their structure and functions
CO2	Understand the secondary growth in dicot and monocot plants
CO3	Comprehend the embryo and endosperm development in plants
CO4	Appreciate the development of various organs in plants

Plant Anatomy

Unit – 1

Cell Structure, Cell wall ultrastructure and their chemical nature. Tissue- Permanent tissue- Simple tissue: Parenchyma, Collenchyma and Sclerenchyma. Complex Tissue: Xylem and Phloem . Meristem - concept of apical organization of shoot and root apexes. Dermal, secretary tissues and transfer cells

Unit – 2

Structure and location of tissue system- primary and secondary structure of root and stem of dicot and monocot, vascular cambium, cork cambium, periderm formation lenticels, anomalous secondary thickening , wood anatomy-physical chemical properties of wood compression and tension wood, nodal and leaf anatomy. Vascular skeleton of flower and fruit. Ecological anatomy.

Embryology

Unit - 3

Flower structure and development- Micropsporogenesis and male gametophyte development – Megasporogenesis and female gametophyte development. Pollination, fertilization, embryo development – dicot , monocot endosperms and their types

Unit - 4

Pollen pistil interaction – self imcompatability – barrier of fertilization –control of fertilization and current concept of fertilization - polyembryony – apomixis- parthenocarpy and practical applications – experimental embryology

Morphogenesis

Unit - 5

Polarity, symmetry and totipotency. Morphogenic centres of origin and organization, differentiation, dedifferentiation, redifferentiation of cells and organs. Morphogenetic factors shoot, root, leaf development and phyllotaxy. Transition to floral meristem and floral development in *Arabidopsis* and *Antirrhinum*

Books for study:

1. Bhojwani,S.S., S.P. Bhatnagar and P.K.Dantu. (2015). *The embryology of Angiosperms*. Vikas publishing House pvt.,Ltd, Noida.
2. Gulam Ahmad Siqqique. (2014). *Plant Anatomy*, Agrotech Press, Jaipur
3. Tayal, M.S. (2008). *Plant Anatomy*. Rastogi publications, Meerut.
4. Pandey, S.N and A.Chadha. (2005). *Plant Anatomy and Embryology*. Vikas Publishing House Pvt Ltd., New Delhi.

Reference Books / Supplementary reading:

1. Edmend W. Sinnott.(1960). *Plant Morphogenesis*. McGraw Hill Book Company, Inc- USA
2. Katherine Esau. (2006). *Anatomy of seed plants*. John willey &sons publications, New Jersy.
3. Maheshwari, P. (1982). *An Introduction to Embryology of Angiosperms*. Tata Mc Grow Hill. New York.
4. Shivanna.K.R. (2003). *Pollen Biology and Biotechnology*. Oxford IBH, New Delhi.

Outcome Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		
CO2	3	3								3	3	3	3		
CO3	3	3								3	3	3	2		
CO4	3	3								3	3	3	2		

Semester	19IBOTC83: Core 28: Cell Biology , Genetics and Plant Breeding	L	T	P	C
VIII		4	0	0	4

Learning Objective (LO):

LO1	To acquire the knowledge on Plant cell and cell organells
LO2	To understand the genetics and breeding of plants

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the structure of cell and cell organelles
CO2	Appreciate the cell division
CO3	Comprehend the Mendelian principles of Genetics
CO4	Understand the mutational changes in plants
CO5	Appreciate the Principles of Plant breeding

Cell Biology

Unit – 1

Structural organization and functions of intracellular organelles: Cell wall, Nucleus, Mitochondria, Golgi body, Lysosome, Endoplasmic reticulum, Ribosome, Peroxisome, Plasmid, Vacuole, Chloroplast, structure& function of cytoskeleton and its role in motility. Cell Membrane, Structure and membrane transport. Cell signaling: signaling through G-protein coupled receptors - signal transduction pathways - second messengers - regulation of signaling pathways. Hormone receptors - signal transduction and gene expression.

Unit – 2

Cell division: Types of cell divisions, Events of cell division, Differences betweenmitosis and meiosis - Molecular basis of cell cycle.Synopsis, synaptinemal complex, mechanism of crossing over and formation of chiasma.Chromosomes: Types, fine structure of eukaryotic chromosome – kinetochore, chromomeres, satellite, Euchromatin and Heterochromatin- special types of chromosomes - Chromosome banding and chromosome painting. Chromosomal variation and aberration, Karyotype analysis

Genetics

Unit – 3

Mendelian Inheritance – Introduction, basic concepts and outputs. Non-Mendelian Inheritance- Types of Interaction of Genes. Sex determination in plants and sex linked inheritance, Chromosome mapping –reverse genetics and epigenetics and their biological importance. Extra-nuclear inheritance: cytoplasmic inheritance – chloroplast and Mitochondrial

genome in higher plants. Transposable elements, Jumping genes- Population genetics- Genetic Map

Unit – 4

Classification of Mutation – Gene and chromosomal mutation: spontaneous and induced mutation – physical and chemical mutagens. Molecular basis of gene mutation, point, frame shift and suppressor mutation. Gene regulatory mechanisms.

Plant Breeding

Unit - 5

Introduction**-** floral biology and its significance of crop plants in relation to their breeding systems. Breeding methods: Methods of plant breeding in self and cross pollinated crops. Selection techniques: Types of selection – Pure line selection – Mass selection – Simple recurrent selection and Clonal selection.Plant Hybridization – Types and process of Hybridization and Heterosis**.** Modern methods of Plant breeding- Mutation breeding and polyploidy breeding. National and International organizations for crop improvement.

Books for study:

1. Inbasekar.(2013). *Cell Biology and Genetics*. Panima Book Distributors, Bangalore.
2. Rastogi,S.I.(2016). *Cell Biology*. New Age International Publishers, New Delhi.
3. Ramachandra R.K. (2014). *Principles of Plant Breeding*. Narendra Publishing House, New Delhi
4. Singh B.D., and Gurpreet Singh Bhatia, (2017). *Principles of Genetics and Plant Breeding*. Kalyani Publishers, New Delhi
5. Verma,P.S and V.K.Agarwal.(2016). *Genetics*. S.Chand Company pvt ltd., New Delhi

Reference Books / Supplementary reading:

1. Basu.S.B. and M.Hossain,(2004). *Principles of Genetics.* Books and Allied (P). Ltd, Kolkatta.
2. Gardner, Simmons, Snustad, (2018).*Principles of Genetics*; Wiley student edition.
3. Phundan Singh, (2019). *Essential of Plant Breeding*. Kalyani Publishers, New Delhi
4. Pragya Khanna, (2008).*Cell and Molecular Biology.* I.K. International Publications- New Delhi.
5. Sanjay Kumar Singh, (2005). *Plant Breeding.* Campus book international, New Delhi.

Outcome Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		
CO2	3	3								3	3	3	3		
CO3	3	3	2							3	3	3	3		
CO4	3	3						2		3	3	3	3		
CO5	3	3						2		3	3	3	3		

Semester	19IBOTP84: Core 29: Practical – VII Plant Diversity – II, Anatomy, Embryology of Angiosperms, Morphogenesis, Cell Biology, Genetics and Plant Breeding	L	T	P	C
VIII		0	0	12	6

Learning Objective (LO):

LO1	To find out the cell structure and cell organelles
LO2	To know about the Mendalian inheritance
LO3	To gain knowledge on various propagation methods

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyze the structure of cell division
CO2	Analyze the chromosome types
CO3	Understand the Mendalian inheritance
CO4	Comprehend the various Plant propagation methods

Pteridology:

Fossil forms: *Rhynia, Horneophyton, AsteroxylonLepidodendron. Lepidocarpon, Sphenophyllum*and *Calamites.*

Living forms: *Psilotum, Selaginella, Equisetum, Angiopteris, Osmunda, Adiantum, Pteris, Marsilea* and *Salvinia.*

Gymnosperms:

Identification and characteristic features of *Lyginopteris*, *Heterangium, Lagenostoma, Trignocarpus, Cycas, Cupressus, Podocarpus, Araucaria, Ginkgo,* and*Gnetum* .

Palaeobotany:

Compression, Impression, Petrified Fossils, Cast and mold, Amber and coal ball

Anatomy:

Examination of root and shoot apices ; maceration , clearing and peeling techniques; primary and secondary structure of dicot, monocot stem; anomalous secondary thickening in *Bougainvillaea, Boerhaavia, Nyctanthes, Bignonia, Aristolochia, Strychnos*and *Dracaena*. nodal anatomy – different types of nodes. Different types of stomata.

Embryology:

Different stages of anther, embryo sac, endosperm and embryo development

Pollen germination and viability test

Dissection of embryo – *Tridax, Crotalaria* and *Cleome*

Endosperm and endosperm haustoria – Cucurbitaceae members

Morphogenesis:

Wounding of young stem and study of the wound healing response

Effect of removal of leaf primordium and axiliary buds

Cell Biology:

1. Squash and smear techniques
2. Study of cell division – mitosis (*Allium cepa, Rhoeo, Urgenia, Scilla*)
3. Study of meiosis - (*Allium cepa, Helianthus, Tredescantia* flower buds)
4. Study of chromosomal aberrations and polyploidy
5. Karyotype analysis – Idiogram preparation
6. Study of special types of chromosomes

Genetics:

1. Genetics problems in Mendelian inheritance, gene interaction, quantitative inheritance , multiple alleles, sex linkage and genetic maps

Plant Breeding

1. Methods of vegetative propagation – Layering, Budding and Grafting
2. Hybridization techniques

Outcome Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3		2		3	3					3	3	3		
CO2	3		2		3	3					3	3	3		
CO3	3		3		2	3					3	3	3	2	
CO4	3		3		2	3					3	3	3		

Semester	19IBOTC91: Core 30:Taxonomyof Angiosperms and Economic Botany	L	T	P	C
IX		4	0	0	4

Learning Objective (LO):

LO1	To acquire knowledge on morphology, taxonomy and the economic importance of Angiosperms

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the classification and nomenclature of plants
CO2	Appreciate the application of computers in plant taxonomy
CO3	Comprehend the characteristic features of various families of angiosperms
CO4	Understand the economic importance of Angiospermic plants

Taxonomy of Angiosperms

Unit – 1

Essentials of taxonomy. Historical account on classification of angiosperms. A detailed account of the systems of classification of Linnaeus, Bentham and Hooker, Engler and Prantl and a general account on the system of classification of Takhtajan . Chemotaxonomy and Numerical taxonomy. APG IV System and its significance.

Nomenclature and taxonomical techniques. Plant Nomenclature – Brief history on the origin and development of nomenclature; Detailed study of the major provisions of the International Code of Nomenclature(ICN) for algae, fungi and plants– Effective and valid publications , Role of priority and its limitation, typification, different kinds of types, author citation, rejection and retention of names and conserved names.

Unit- 2

Methods of Plant exploration ; Management of herbaria, major herbaria in India and the World, Specimen preparation for herbarium, Role of herbaria in taxonomy. Botanical Survey of India (BSI).

Different kinds of identification keys, Construction of dichotomous keys- Indented and bracketed keys. Various kinds of taxonomic literature: Floras, Revisions, Manuals, Monographs, Periodicals. Computational taxonomy, Information systems- data banking and use of computers in taxonomy, computer constructed keys. Uses of molecular tools in taxonomy: ITS, RFLP, RAPD and AFLP. DNA Bar-coding.

Unit – 3

A detailed study of the following families with their interrelationship and phylogeny

Annonaceae
Portulacaceae
Sterculiaceae
Zygophyllaceae
Rhamnaceae
Sapindaceae
Fabaceae
Combretaceae
Myrtaceae
Lythraceae

Passifloraceae
Cucurbitaceae
Apiaceae

Unit – 4

A detailed study of the following families with their interrelationship and phylogeny

Rubiaceae
Apocyanaceae
Gentianaceae
Boraginaceae
Scrophulariaceae
Acanthaceae
Lamiaceae
Nyctaginaceae
Verbenaceae
Euphorbiaceae
Casuarinaceae
Liliaceae
Poaceae

Economic Botany

Unit – 5

A brief account of botany, cultivation and utilization of cereals, pulses, nuts, vegetables and fruits - spices and condiments- fats and oils-essential oils- commercial crops- wheat, cotton and sugarcane, fibres, timbers- tannins, resins, alkaloids- Drug yielding plants- Plants as a source of renewable energy – Ethnobotany and its importance.

Books for study:

1. Gurucharan Singh, (2019). *Plant Systematics- Theory and Practice*. Oxford & IBH Publishing company (P) Ltd, New Delhi
2. Pandey.B.P. (2009). *Taxonomy of Angiosperms*.S.Chand& Co. Ltd. New Delhi.
3. Pandey,S.N and S.P. Mishra. (2014). *Taxonomy of Angiosperms.* Ane Books Pvt Ltd, New Delhi
4. Pandey,B.P. (2016). *Economic Botany*.S.Chand& Co. Ltd., New Delhi
5. Singh,S.K and Seema Srivastava. (2009). *Economic Botany*. Campus Book International, New Delhi.

Reference Books / Supplementary reading:

1. Jain, S.K.andR,R,Rao, (1977). *A Handbook of field and herbarium methods.* Today and Tomorrow's Printers and Publishers, New Delhi.
2. Lawrence, G.H.M. (1964). *Taxonomy of Vascular Plants*, Oxford & IBH Publishing company (P) Ltd, New Delhi.
3. Judd, Campbell, Kellogg, Stevens, Donoghue.(2008). *Plant systematics: A phylogenetic approach*. Third edition-Sinauer Associates, Inc publishers

4. Prasad,R.L.(2016). *Essentials of Economic Botany.* Scientific International Publishers and Distributors, New Delhi
5. Nautiyal,B.P,(2018). *Textbook of Systematic Botany*. Scientific International Pvt Ltd., New Delhi
6. Simpson M.G, (2018). *Plant Systematics*.3rd edition. Academic Press Inc., San Diego, USA

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		
CO2	3	3								3	3	2	3		
CO3	3	3	2							3	3	2	3		
CO4	3	3						2		3	3	3	3		2

Semester	19IBOTC92: Core 31: Biochemistry and Molecular Biology	L	T	P	C
IX		4	0	0	4

Learning Objective (LO):

LO1	To acquire the knowledge on biochemistry and Molecular biology of plants

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the structural features of carbohydrates, proteins and lipids
CO2	Appreciate the properties of enzymes
CO3	Understand the structure of DNA
CO4	Appreciate the protein synthesis

Biochemistry

Unit – 1

Carbohydrates: Classification of carbohydrates; Structure and properties of monosaccharides, Oligosaccharides, Polysaccharides – Glycoproteins. Protein and Amino acids: Structure, Classification and properties; Peptides - Structure: Primary, secondary, Ramachandran plot, tertiary and quaternary structures. Classification of Lipids: Structure and

properties of fatty acids, phospholipids, glycolipids, lipoproteins, cholesterol - structure and functions. Nucleic acid (DNA and RNA) – Chemical composition, properties, Watson and Crick structure of DNA, types and functions of RNA

Unit – 2

Enzymes- Classification and nomenclature chemical nature of enzymes – factors affecting enzyme action – Michaelis – Menten constant, MM equation, – Lineweaver Burk plot, enzyme inhibition, co enzymes- mechanism of enzyme action, isoenzymes. Secondary metabolites: structure, classification and properties of alkaloids, steroids, terpenoids, flavonoids. glycosides - their chemical nature and role.

Molecular Biology

Unit – 3

A, B and Z forms of DNA– Structure of prokaryotic gene – Regulatory structures – Promoter, Enhancer, Attenuator and Terminator - Structure of Eukaryotic gene -Introns and Exons, Unique and repetitive DNA- SINEs and LINEs, Satellite DNA- DNA Replication – Semiconservative mode of DNA Replication - Enzymology of DNA replication- Mechanism of DNA replication- RNA primers- - origin of replication - Replication fork - Okazaki fragments- Continuous and discontinuous synthesis of DNA – DNA damage and repair mechanism: Excision repair -mismatch repair.

Unit - 4

Transcription– definition– initiation, elongation and termination in prokaryotes and eukaryotes –promoters – pribnow box – TATA binding proteins – Complementary palindromes - Prokaryotic and Eukaryotic RNA polymerases - Post transcriptional modifications in prokaryotes and eukaryotes - capping- polyadenylation. RNA splicing, Sn RNPs, Spliceosome machinery, Exon shuffling, RNA editing.

Unit – 5

Genetic code –types of codons – codon usage – universal codon– Components of protein synthesis – structure of ribosome – polysomes – ribosome entry sites – selenocysteine insertion sequence - Protein synthesis in Prokaryotes – Initiation, Elongation,Termination, Translation and post-translational modifications in Eukaryotes, Inhibitors of translation, protein folding and targeting (brief account only). Gene regulation: prokaryotes – Lac operon, Catabolite repression. Eukaryotes – transcription factors. Alternative splicing regulated by activators and repressors, RNA interference.

Books for study:

1. Allison.A. (2007). *Fundamental Molecular Biology*. Blackwell Publishing, UK.
2. Bonner,J and W.H. Warner, (1961).*Plant Biochemistry*. Academic press. Inv.Ny.
3. Keshav Trehau, (2019). *Biochemistry*. New Age International Publishers, New Delhi
4. Rastogi,S.C, (2016). *Cell and Molecular Biology*. New Age International Publishers(p) limited, New Delhi.
5. Sambamurty A.V.S.S, (2008). *Molecular Biology*; Narosa Publishers- New Delhi

Reference Books / Supplementary reading:

1. Benjamin, Levin, (2006). *Genes* VIII. Pearson Education International, USA.
2. De Robertis and De Robertis, (2014). *Cell and Molecular Biology*. Lippincott. Williams and Wilkins. USA.
3. Nelson,D.L&M.M.Cox. (2017). *Lehninger's principles of Biochemistry*, Prentice hall, International N.J, 7th Edition.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3								3	3	3	3		
CO2	3	3								3	3	3	3		
CO3	3	3						2		3	3	3	3		
CO4	3	3						2		3	3	3	3		

Semester	19IBOTC93: Core 32: Biological Techniques and Research Methodology	L	T	P	C
IX		4	0	0	4

Learning Objective (LO):

LO1	To know the principles of various biological techniques and their applications
LO2	To acquire basic knowledge on Research methodology and computer application

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the basic working principles of various microscopes
CO2	Analyze the working principles of Calorimeter, Spectrophotometer, Electrophorosis
CO3	Understand the art of scientific writing
CO4	Appreciate various patents
CO5	Comprehend the computer applications in scientific research

Unit – 1

Principles, image formation and applications of Light, Confocal, Polarizing, Transmission and Scanning electron microscopes - Material preparation for Electron microscopy. Microscopic measurements: Micrometers – Ocular, Stage, Haemocytometer and Camera Lucida - Fixatives, Dehydrating agents, Stains and their uses.

Unit – 2

Calorimeter-Principles and Applications – Spectrophotometry –UV-visible –Infrared-Atomic absorption Spectrophotometer – Chromatography – TLC, Column, GC, HPLC and Affinity.

Electrophoresis – General principles –Native PAGE and SDS- PAGE– Agarose gel. Blotting techniques- Southern, Northern and Western.

ELISA, RIA, Polymerase Chain Reaction, RAPD, RFLP, SSR, DNA finger printing and FISH techniques

Research Methodology

Unit – 3

Scientific writing – Characteristics, Logical format for writing thesis and papers

Essential features of abstracts - components of thesis writing-

Introduction –Review of literature – Primary, secondary references

Materials and methods- Effective illustration- Tables and figures- Discussions, Reference styles – Harvard and Van couver system

Unit – 4

IPR Patents - Patent procedures– Patenting information systems and services in India - Trade secrets - Copy rights and Trade marks - Patenting biological materials - Higher plants and transgenic organisms.

Plant variety protection - Plant breeder's rights - Farmer's rights - WTO – GATT, TRIPS.

Bioethics – Biosafety regulations, IBSC, Good Laboratory practices.

Unit – 5

Computer in Biological science, scope and prospects.

Operation system – Definition- classification- input and output devices.

Introduction to windows operating system- MS windows – MS-Word-folders, files, MS Excel – MS Power point - creating slides – templates – animation and transitions - Data storage – Data analysis - On line publications: Electronic journals - Internet-World Wide Web-search engines – their functions- Email-e-access data base concepts and implication.

Biostatistics packages- Data base preparation- Graphic applications in biology.

Books for study:

1. Marimuthu,R.(2010). *Microscopy and Microtechnique*, MJP publishers, Chennai
2. Kothari, C.R, (1991). *Research Methodology—Methods and Techniques*. Wiley Eastern Ltd, New Delhi.

3. Krishnamurthy, K.V, (1988). *Methods in Plant Histochemistry*. Viswanathan printers and publishers, Chennai.
4. SreeRamalu, V.S, (1988). *Thesis writing*. Oxford & IBH publications, New Delhi.
5. Kumar,R.(2014). *Research Methodology: A Step by Step guide for beginners*. SAGE publications India Pvt., Ltd., New Delhi

Reference Books / Supplementary reading:

1. Singh, R. (2006). *Research Methodology in Plant Science.* M.J.P. Publications, New Delhi.
2. Connor and Peter Woodford, (1979). *Writing scientific paper in English*. Pitman Publ. Co, U.K.
3. Wilson, K and John Walker. (2000). *Principles and Techniques of practical Biochemistry*, Cambridge University Press.
4. Kothari,C.R and G. Garf,(2018).*Research Methodology- Methods and Techniques*. New Age International Publishers, Kochi

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3		3						3	3	3	3		
CO2	3	3	2	3	2	2				3	3	3	3		
CO3	3	3		3			2			3	3	3	2		
CO4	3	3		3				3		3	3	3	3		
CO5	3	3		3				3		3	3	3	3		2

Semester	19IBOTC94: Core 33: Plant Biotechnology and Genetic Engineering	L	T	P	C
IX		4	0	0	4

Learning Objective (LO):

LO1	To understand different biotechnological methods
LO2	To develop skills on genetic engineering of plants

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the methods of gene transfer
CO2	Appreciate the recombinant DNA technology

CO3	Understand the applications of Biotechnology in Transgenic crop plants

Plant Biotechnology

Unit – 1

Historical Background- Principle- Organization of Plant tissue culture laboratory – Aseptic techniques- Culture media –components – Steps of tissue culture – Leaf culture – Meristem culture – Protoplast isolation and culture – somatic hybridization techniques - anther and pollen culture – Haploids and their significance. Somaclonal variation.

Unit - 2

Cryopreservation technique- production of secondary metabolites through cell culture- Artificial seeds- Micropropagation of banana, sugarcane and eucalyptus.Plants as bioreactors: Edible vaccines - Plant neutraceuticals: Introduction, scope and applications. Molecular farming. Transgenic crops – GM plants: Cotton and Brinjal - Issues on GM crops.

Genetic Engineering

Unit – 3

Basic principles: Restriction endonucleases– Methods of gene transfer - Particle Gun method – Electroporation- Microinjection – Liposome - Calcium phosphate Co-precipitator - Cloning vectors – plasmids - phages - cosmids -viral vectors. Control of transgene expression in plants.

Unit - 4

DNA Sequencing Methods: Maxam and Gilbert – Sanger method and Pyro-sequencing method – Shot gun sequencing. c-DNA libraries - Genomics for evolutionary studies, Choice of host organisms for cloning- bacteria, yeast and plants- Preparation of molecular genetic maps in cereals, legumes, cotton and forest trees.

Unit – 5

Genetic engineering of *nif* genes in non leguminous plants – marker gene enzymes, vector, organization, transformation and integration. Transgenic plants – methods, selective marker genes and detection of gene transformation. Fungicide and herbicide resistance markers – Biocontrol methods of pest and diseases.

Books for study:

1. Dubey R.C,(2018). *A Textbook of Biotechnology*; Chand & Company LTD. New Delhi.
2. Phudan Singh, (2019). *Principles of Biotechnology*. Kalyani Publishers, New Delhi
3. Smith Rastogi and Neelam Pathak, (2009). *Genetic Engineering*. Oxford Univ.press.
4. Mishra, S.P, (2016). *Plant Tissue Culture*. Ane Books Pvt ltd.

Reference Books / Supplementary reading:

1. Ignacimuthu, S, (1997). *Biotechnology: An Introduction*. 2nd Edition, Narosa Publishing House, New Delhi.
2. Rastogi, S.C,(2007). *Biotechnology- Principles and Applications*. Narosa Publishing House, New Delhi.

3. Razdan,M.K, (2018). *Introduction to Plant Tissue Culture*.CBS Publishers & Distributors Pvt Ltd, New Delhi

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	-	-	-	2	-	3	3	3	3	-	3
CO2	3	3	3	3	-	-	-	2	-	3	3	3	3	-	3
CO3	3	3	3	3	-	-	-	2	2	3	3	3	3	2	3

Semester	19IBOTP95:Core 34: Practical – VIII Taxonomy of Angiosperms, Economic Botany, Biochemistry , Molecular Biology, Biological Techniques, Research Methodology, Plant Bio-technology and Genetic Engineering	L	T	P	C
IX		0	0	12	6

Learning Objective (LO):

LO1	To identify the families of angiosperms
LO2	To know about the various biochemical experiments
LO3	To gain knowledge on the various experiments on Biotechnology and Genetic Engineering

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify the given plant family
CO2	Analyze the given instrument
CO3	Analyze the experiments related to Biotechnology and Genetic engineering

Taxonomy of Angiosperms:

Detailed study of the families mentioned in the theory with two representative species from the local area.

Familiarity of the binomial nomenclature of the available species from the local flora using Gamble's flora.

Solving the taxonomical problems

Economic Botany:

Identification of family, genus, species and morphology of the useful parts of plants mentioned in the theory.

Biochemistry:

1. Estimation of total phenols
2. Estimation of aminoacids by ninhydrin method
3. Estimation of protein
4. Extraction and estimation of lipids
5. Assay of the enzyme catalase
6. Assay of the enzyme peroxidase
7. Extraction and separation of known and unknown amino acids by using paper chromatography method
8. Estimation of reducing sugar content
9. Estimation of starch content

Molecular Biology:

1. Isolation of high molecular weight genomic DNA from rice
2. Isolation of DNA from tender coconut
3. Separation of plant genomic DNA by electrophoresis
4. Qualification of Plant Genomic DNA by Spectrophotometric method
5. Quality checking of DNA by Electrophoresis
6. RAPD Techniques
7. Isolation of plasmid DNA
8. Southern blotting (Demonstration)
9. Western blot - detection of proteins (Demonstration)

Biological Techniques & Research Methodology:

1. Principles, identification and components of Light , Polarizing , TEM , SEM, ELISA and PCR
2. Electrophoretic separation of proteins by native and SDS-PAGE
3. Separation of DNA with agarose gel
4. RAPD
5. Acquiring of basic skills in Internet browsing
6. Familiarization of web browsers and search engines

Plant Biotechnology & Genetic Engineering:

1. Isolation of single cell protein
2. PCR – Technique with known primers
3. Bio control of plant insects using *Bacillus thuringiensis*
4. Bio control of plant insects using PHV.
5. Preparation of explants
6. Establishment and maintenance of carrot callus
7. Initiation and establishment of cell suspension culture of carrot
8. Embryogenesis in cultured cells of carrot
9. Microspore culture- preparation of artificial seeds

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3		3		2	3				3	3	3	3		3

CO2	3		3		2	2				3			3		3
CO3	3		3		2	3				3			3	2	2

Semester	**19IPSC090: Constitution of India**	**L**	**T**	**P**	**C**
IX		**2**	**0**	**0**	**2***

Learning Objective (LO):

LO1	To understand the basic features of Indian Constitution
LO2	To grasp about the basic Rights & duties of Indian Citizenry
LO3	To ponder over the form of Indian Political System
LO4	To have broad understanding about the pivotal provisions related with liberty, Equality and fraternity

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Imbibed about the basic features of Indian Political System
CO2	Enlighten with the rights & duties of Indian Citizens
CO3	Understand the significance of rule of law
CO4	Inculcated with basic liberties

Unit I : Introduction

Meaning of the Constructional law and Constitutionalism – Historical Perspective of the Constitution of India – Salient features Characteristics of the Constitution of India

.**Unit II : Rights and Duties**

Scheme of the Fundamental Rights – The scheme of the Fundamental Duties and its legal status – The Directive Principles of State Policy-Its importance and implementation

Unit III : Centre State Relationship

Federal Structure and distribution of legislative and financial powers between the union and the states- Parliamentary form of Government in India – The Constitution powers and status of the president of India.

Unit IV : Amendments and Provisions

The Historical perspectives of the constitutional amendments in India – Emergency Provision: National Emergency, President Rule. Financial Emergency

Unit V: Institutions

Judiciary –Judiciary Activism – Amending Procedures- Recent Trends –Rights to Information- Lokpal and LokAyukta

Books for study:

1. Bipan Chandra, Mridula Mukherjee, AdilityMakherjee. (2016).*India after Independence 1947-2000*, Penguin Publishers, New Delhi.
2. Durga Das Basu, (2018).*Introduction to the Constitution of India.*Prentice Hall, New Delhi.
3. Jogendra Yadav, (2000).*Transforming India: Dynamics of Democracy*, Oxford University Press New Delhi

Reference Books / Supplementary reading:

1. *The Constitution of India*.(1950) (Bare Act), Government Publications.
2. Busi S.N Ambedkar B.R,(2015).*Framing of Indian Constitution*
3. Jain M.P,(2014).*Indian Constitution Law.*Lexis Nexis
4. Paul R.Brass. (1999).*The politics of India Since Independence*. Cambridge University Press
5. Granvila Austin,(2006).*The Indian Constitution: Cornerstone of a Nation.* Oxford University Press, New Delhi

Semester	19IBOTCX1: Core 35: Plant Physiology	L	T	P	C
X		4	0	0	4

Learning Objective (LO):

LO1	To acquire knowledge on physiological aspects of plants

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the process of photosynthesis, respiration and nitrogen metabolism
CO2	Comprehend plant growth hormones
CO3	Understand the responses of plants to biotic and abiotic stresses
CO4	Comprehend the relationship between water and plants

Unit – 1

Water and Plant Relations: Physical and chemical properties of water – Imbibition, diffusion, osmosis, components of water potential - plasmolysis - Water absorption by roots – apoplast and symplast concept - water transport through the xylem – SPAC concept – Transpiration and evapotranspiration- stomatal structure and function – mechanism of stomatal opening and closing – mineral nutrition – essential nutrients – macro and micro nutrients – deficiencies and plant disorders – absorption of solutes – translocation of solutes –pathways and mechanisms. phloem loading and unloading - translocation of photosynthates – source-sink relationship – partitioning of assimilates and harvest index.

Unit – 2

Photosynthesis: The physical nature of light – the absorption and fate of light energy – absorption and action spectra- photoreceptors- Ultra structure and biochemical compartmentation of chloroplast; Photosynthetic electron transport and Photophosphorylation (cyclic and non-cyclic): Photosystems and reaction centres - Light harvesting complexes - Photo System I & II and Oxidation of water; carbon metabolism: C_3, C_4 and CAM pathways and their distinguishing features - photorespiration and its significance .

Unit – 3

An overview of plant respiration – Glycolysis – TCA cycle– Electron transport – oxidative phosphorylation and ATP synthesis – Chemiosmotic theory - Pentose phosphate pathway– Respiration and its significance in crop improvement. Cyanide resistant respiration;

Nitrogen fixation (biological - symbiotic and non-symbiotic), physiology and biochemistry of nitrogen fixation

Unit – 4

Growth and development – phases of plant growth – growth types- Growth substances- auxin, gibberellins, cytokinins, abscisic acid and ethylene - biosynthesis, physiological effect and mechanism of action in agricultural and horticultural crops - Photoperiodism – classification of plants and mechanism of flowering – Phytochrome and their action on flowering – Vernalization- mechanism and its practical application

Unit – 5

Plant senescence –types and mechanism of senescence- Abscission: Morphological and biochemical changes – significance. Fruit ripening- Biochemical, physiological changes and control of fruit ripening. Plant response to environmental stress: Biotic and abiotic stress –water, temperature, light and salinity- adaptive mechanism to various stresses (avoidance, escape, tolerance)–stress responsive proteins - antioxidative mechanism.

Books for study:

1. Jain, V.K, (2017). *Fundamentals of Plant Physiology*, S.Chand& Company Ltd., New Delhi
2. Devlin, R.M,(1996). *Plant Physiology*, PWS publisher, Boston.
3. Pandey, N.S and P.Pandey, (2016). *A Textbook of plant Physiology*. Daya Publishing house, New Delhi
4. Verma,S.K and Mohit Verma, (2018). *A Textbook of Plant Physiology*, Biochemistry and Biotechnology. S.Chand& Company Ltd., New Delhi
5. William G. Hopkins, (1999). *Introduction to Plant Physiology*, John Wiley and sons, INC, New York.

Reference Books / Supplementary reading:

1. Moore,T.C. (1989).*Biochemistry and Physiology of Plant Hormones* (2nd Edition). Springer-verlag, New York, USA.
2. Lincoln Taiz and Eduardo Zeiger, (2006). *Plant Physiology.*Sinauver Associates Inc. Publishers, Sunderland, Massachusetts
3. Salisbury, F.B and Cleon Ross, (2007). *Plant Physiology*, Wadsworth Publishing Company, Belimont.
4. Sinha.R.K, (2018). *Modern Plant Physiology*. Narosa Publishing House, New Delhi

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	2	-	-	-	-	-	3	3	3	3	-	-
CO2	3	3	3	2	-	-	-	-	-	3	3	3	3	-	-
CO3	3	3	3	2	-	-	-	-		3	3	3	3	-	-
CO4	3	3	3	2	-	-	-	-	-	3	3	3	3	-	-

Semester	19IBOTCX2: Core 36: Environmental Biology and Evolution	L	T	P	C
X		4	0	0	4

Learning Objective (LO):

LO1	To acquire knowledge on the components of environment
LO2	To know about Biodiversity and its conservation

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the ecosystem structure and functions
CO2	Comprehend the vegetation types of India
CO3	Appreciate the biodiversity conservation through *In-situ* and *Ex-situ*
CO4	Analyze the origin and evolution of life
CO5	Understand the study of vegetation

Environmental Biology

Unit – 1

The Environment: Physical environment, biotic environment, biotic and abiotic interactions. Autecology and Synecology. Ecological life cycle. Population ecology: population characteristics, population dynamics. Ecosystem ecology: Ecosystem structure and function. Ecological succession: types. Remote sensing – study of vegetation with remote sensing. Environmental pollution: causes, effects and control of air, water, soil, noise, marine, thermal and radioactive pollution. Green house effect, Ozone layer depletion and Acid rain.

Biomagnification: Eutrophication. Disaster Management: Earthquake, Volcanoes, Landslides and Tsunami.

Unit - 2

Biodiversity: Concepts, types, measures and distribution of diversity, Major Biomes of the world – Biogeographical zones of India- Vegetational types of India: Forest types, Grassland types.

Economic values of biodiversity, Loss of biodiversity. Endemism, Hotspots, Red data book, endangered plants and animals of India

Unit - 3

Conservation of Biodiversity and wild life (*Ex situ* and *In situ* methods) – Forests: Afforestation –Social forestry, Agro forestry, Extension forestry and Urban forestry. Sustainable development, Public awareness - Environmental protection Act. (Air, Water, Wildlife and Forest) Rio-summit agenda, Chipko movement. Importance of Environmental Impact Assessment (EIA) studies.

Unit - 4

Principles of Conservation: Conservation of natural resources. National and international conservation agencies (UNEP, MAB, WWF, CITES, RAMSAR and Biodiversity convention), Conservation strategy in India (Project Tiger, Biodiversity Heritage sites, Biosphere Reserves). Biodiversity act - 2002.

Evolution

Unit – 5

Origin of life: Chemosynthetic theory on the origin of life. Evolutionary theories of - Lamarck, Darwin and DeVries. Synthetic theory of evolution. Variation in Nature: Analysis of variation , Sources of variation (Mutation, recombination adaptation and selection)

Books for study:

1. Purohit,S.S., Shammi.K.J and A.K. Agarwal.(2019) . *A Text book of Environmental Sciences*. Students Edition. Jodhpur
2. Singh, H.R.(2014).*Environemntal Biology*. S.Chand& Company pvt.ltd, New Delhi
3. Sudha Gay.(2018). *Environmental Biology and Biotechnology*. RBSA Publishers, Jaipur
4. Sharma.P.D. (2017). *Ecology and Environment*. 13th edition, Rastogi Publishers, Meerut.
5. SubramaniyamN.S, A.V.S.Sambamurthy, (2008). *Ecology*. Narosha Publications, New Delhi.
6. Verma, P.S. & Agarwal, V.K, (2016). Cell Biology, *Genetics*, *Molecular biology, Evolution and Ecology*. S.Chand& Company pvt ltd., New Delhi..

Reference Books / Supplementary reading:

1. Joshi, P.C. Namita Joshi, (2004). *Biodiversity and Conservation*, APH publishing company, New Delhi
2. Krishnamurthy, K.V, (2017). *An advanced text book of Biodiversity*. Oxford & IBH, New Delhi.
3. Odum, E.P. Gary W. Barrelt, (2005). *Fundamentals of Ecology*- Brooks/Cole Cenage learning, UK.
4. Manoj Tiwari, KabilKhubhe and Archaria Tiwari, (2019). *Environmental Studies.* I.K. International Publishing House Pvt Ltd, New Delhi.

5. Monika Jain, (2014).*Environmental Biotechnology*. Narosa Publishing House, New Delhi

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3						3		3	3	3	3		
CO2	3	3						3		3	3	3	3	2	
CO3	3	3						2	2	3	3	3	3	3	
CO4	3	3						2		3	3	3	3		
CO5	3	3						2		3	3	3	3	3	

Semester	19IBOTPX3:Core 37: Practical – IX Plant Physiology, Environmental Biology and Evolution	L	T	P	C
X		0	0	12	6

Learning Objective (LO):

LO1	To know about the various Plant Physiological experiments
LO2	To gain knowledge on the various methods of vegetational study

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the physiological process of plants
CO2	Analyze the various experiments related to environmental biology
CO3	Analyze the various evidences of evolution

Plant Physiology:

1. Determination of osmotic potential by plasmolytic method.
2. Determination of water potential using gravimetric method.
3. Determination of water potential using dye method (Chardakov's method).
4. Effect of Monochromatic light on apparent photosynthesis.
5. Effect of CO_2 concentration on apparent photosynthesis.
6. Effect of temperature on protoplasmic membrane.
7. Separation of chloroplast pigments using paper chromatographic technique.
8. Estimation of chlorophyll content using Arnon's method.
9. Determination of rate of photosynthesis using O_2 electrode.
10. Experiment to study the rate of Hill activity of isolated chloroplast by dye-reduction.
11. Rice coleoptile growth test for Indole Acetic Acid.

12. Effect of Auxin on root initiation
13. Experiments to show the heribicidal action of Auxin (2-4D).
14. Effect of synthetic cytokinin on the destruction of chlorophyll.
15. Estimation of Proline content
16. Estimation of Glycinebetaine content
17. Determination of Relative water content
18. Estimation of Ascorbic Acid

Methods of studying vegetation:

1. Quadrat method : List quadrat, count-quadrat, minimum size of the quadrat for a given vegetation. Abundance, relative frequency, relative density and relative dominance. Important value index and polygraph charting
2. Transect method : Line transect, belt transect and bisect method.

Pollution studies:

Effect of industrial effluents on seed germination, - Estimation of dust pollution on plants. - Ecological Instruments- Ecological adaptation of plants.

Water analysis:

Estimation of EC,pH, turbidity and TDS.
Estimation of sulphate and nitrate
Analysis of Na, K, Ca and Cl in pond water

Soil analysis:

Estimation of EC,pH
Soil moisture content
Soil N,P,K, Ca, Mg

Evolution:

Charts – Evidences of evolution, Lamarckism, Darwin and DeVries,

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3		2	3					3	3	3		
CO2	3	3	3		2	3					3	3	3		
CO3	3	3	3		3	2					3	3	3		

DEPARTMENT ELECTIVE COURSES (DE)

Semester	19IBOTE16: Mushroom Cultivation	L	T	P	C
I		3	0	0	3

Learning Objective (LO):

LO1	To introduce the potential of Mushroom as the dietary supplement
LO2	To introduce the cultivation techniques, problems faced and management of mushroom cultivation including harvesting and processing

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Appreciate the Principle involved in Mushroom Cultivation
CO2	Comprehend the knowledge on edible and poisonous mushroom
CO3	Understand the cultivation methods of Mushroom
CO4	Gain adequate knowledge on E-herbarium
CO5	Appreciate the knowledge on pest and disease control methods of mushroom

Unit – 1 Introduction

Historical perspectives; classification of mushrooms, nutritional and dietary values of musrooms, edible and poisonous mushrooms

Unit – 2 Compost and Composting

Principles of Composting, Machinery required for compost making, material for compost preparation. Methods of Composting – Long method of composting (LMC) & Short Method of Composting (SMC).

Unit – 3 Spaen and Spawning

Facilities required for spawn preparation. Preparation of spawn substrate, preparation of pure culture, media used in raising pure culture, culture maintenance, storage of spawn.

Unit – 4 Cultivation Techniques for Selected Mushrooms

Cultivation techniques for commercially viable mushrooms- Paddy straw mushroom, Button mushroom – Spawning substrate preparation, growth, packing and maintenance of suitable environmental conditions. Factors influencing mushroom cultivation and harvesting. Mushroom delights.

Unit – 5 Pests Management during Mushroom Cultivation

Diseases and competitor moulds of mushrooms and their management. Dry bubble disease – Verticillium fungicola, Wet bubble disease – Mysogoneperniciosia , cobweb – Clasdobotrylumdendroides and Green mould- *Trichoderma* sp. Flies and mites

Books for study:

1. Chang ST and Miles PG. (2002). *Edible Mushroom and their Cultivation*. CRC Press. Florida
2. Kannaiyan and K. Ramasamy. (1980). *A handbook of edible mushroom*. Today and Tomorrow printers and publishers, New Delhi
3. Pathak Yadav Gour. (2010). *Mushroom production and processing Technology*. Agrobios, India

Reference Books / Supplementary reading:

1. Singh,M., B. Vijay and S. Kamal., and G.C.Wakchaure. (2011). *Mushrooms; Cultivation, Marketting and Consumption*. Directorate of Mushroom Research, Indian Council of Agricultural Research, Salem, India
2. Muruc Kumar. (2014). *Mushroom cultivation*. Neha publishers and Distributors
3. Kannainan, S., T.Marimuthu and K.Lenin. (2011). *Diversity and Production of Edible Mushrooms*. Associated publishing company

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3					3	3		3	3	3	3	2	3
CO2	3	3	2				3	2		3	3	3	3		3
CO3	3	3					2	3			3	3	3	2	2
CO4	3	3	2				2	3			3	3	3	3	2

Semester	19IBOTE17: Herbal Science	L	T	P	C
I		3	0	0	3

Learning Objective (LO):

LO1	To study the Medicinal plants and its importance
LO2	To find out the methods of cultivation and marketing of medicinal plants

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the role of Biotechnology in Fruit culture
CO2	Appreciate the cultivation of fruit trees
CO3	Comprehend the health benefits of various fruits
CO4	Appreciate the post harvest methods of fruits
CO5	Comprehend the knowledge on fruit processing industries

Unit – 1 Morphology of Angiosperms

Root- Structure and function and root modifications – stem structure and modifications – Leaf structure and its modifications – structure and functions – modifications of leaf. Inflorescence types- floral parts – floral formula and floral diagram. Fruit- structure and classification.

Unit – 2 Internal structure of Plant

Angiosperms anatomy – Tissue system- basic internal anatomical fatures of monocot and dicot root, stem, bark and leaf, fruit and seed anatomy –structure of wood- types of wood secretary cells – type, Lacticifers – germs- mucilage – resin

Unit – 3

Study of the following families – giving importance to morphological features and medicinal importance

Rutaceae, Meliaceae, Rubiaceae, Asteraceae, Aselepiadaceae, Apocynaceae, Lamiaceae, Euphorbiaceae, Liliaceae and Zilngiperaceae

Unit - 4 Production technology of Medicinal crops

Cultivates variables – propagation methods and planting density – manuring – irrigation – weed control –crop protection –harvest maturity- harvest and post harvest handling methods- storage and processing – yield trend and cost /benefit analysis of *Gymnema*, pelliwinkle, Senna, Aloe, Ashwagandha and Brahmi

Unit – 5 Marketing Herbal Products

Herbal Marketing –Concept and definition – Marketting of folk and traditional medicine and raw material- herbal marketing techniques – quality control – market structure, model and price determination – Herbal Market Identification- closed marketing system and multilevel marketing (MLM) – Scope of contract farming in herbal production- Government inter reunion in herbal marketing- organizations for research and development – training needs for herbal farmers

Books for study:

1. James A.J and Mac. Daniels, L.H. (1972). *Introduciton to Plant Anatomy*. Tata McGraw Hill, New Delhi
2. Sharma R. (2004). *Agrotechniques of Medicinal plants*.Daya publishing House, New Delhi
3. Gureharansingh. (2010). *Plant systematic*. Science publishers, Enfiled, NH, USA

Reference Books / Supplementary reading:

1. Acharya, S.S and N.K. Akarwal. (2000). *Agricultural Marketing in India.* Oxford and IBH Publishing Ltd., New Delhi
2. Atal C.K., and B. M. Kapur. (1982). *Cultivation and Utilization of Medicinal Plants*, Regional Research Laboratory (CSIR), Jammu Tawi.
3. Kader Moideen, M. Arumugam, Shakilaand A.anburani. (2006). *Production technology of Medicinal and aromatic crops*. Rasi printers, Chidambaram.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3					2			3	3	3	3		
CO2	3	3	2				2			3	3	3	3	2	2
CO3	3	3					3	2		3	3	3	3	2	2
CO4	3	3					3	2		3	3	3	3		3
CO5	3	3	2			2	3	2		3	3	3	3		3

Semester	19IBOTE36: Floriculture	L	T	P	C
III		3	0	0	3

Learning Objective (LO):

LO1	To acquire knowledge on the flowers and their uses
LO2	To understand the different cultivation practices of flower crops
LO3	To apply the knowledge on post harvest technology of ornamental flowers

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Comprehend cultivation methods and ornamental flower crops
CO2	Appreciate the knowledge on post harvest technology flowers
CO3	Understand the process of cultivation of indoor plants

Unit – 1

Present scenario and scope of floriculture in global market. Employment avenues in floriculture sector. Study of outdoor room concept: public area, private area and service area. Different features of gardens like gate, walls, arches, pergolas, paths, roads, edges, hedges, stepping stones, sun dial, bird bath, statues, water fountain, lawns, herbaceous borders, bonsai, topiary etc.

Unit – 2

Concept of CAD (Computer aided designs) for landscape designs. Methods of establishing lawns and their management including irrigation, fertilization, mowing, insect-pest and diseases and their control. Production of indoor plants and their maintenance.

Unit - 3

Commercial cultivation of rose, chrysanthemum, gladiolus, marigold, tuberose, jasmine and crossandra. Protected cultivation of commercial flower crops like rose, carnation, chrysanthemum, gerbera, orchids, antirrhinum etc). Flower arrangements: types and styles.

Unit – 4

Methods of dry flower making like air drying, embedded drying, water drying, press drying, glycerin drying, freeze drying etc. and other value added products

Unit – 5

Post-harvest handling of commercial flower crops including harvesting, pre cooling, pulsing, holding, dry and wet storage, packing, packaging and transportation.

Books for study:

1. Randhawa G. S., and Mukhopadhyay A., (2007). *Floriculture in India*. Allied Publishers Pvt. Ltd., New Delhi
2. Arora J. S., (1998). *Introductory Ornamental Horticulture*. Kalyani Publishers Pvt. Ltd., W. Bengal

Reference Books / Supplementary reading:

1. Bose, T.K. (2012). *Floriculture and Landscaping*. Allied Publishers Private Limited, New Delhi.
2. Bhattacharjee S. K., (2004). *Landscape gardening and design with plants*. Pointer Publishers Pvt. Ltd., Jaipur.
3. Hartman H. T., and Kester D. E., (2002). *Plant propagation: principles and practices*. Prentice Hall, Inc. Kate Kinsella.
4. Bhattacharjee S. K. and L.C. De, (2005). *Post-harvest technology of flowers and ornamental plants*. Pointer Publisher Pvt. Ltd., Jaipur.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3			2	2				3	3	3	2	2
CO2	3	3	3			2	3				3	3	3		
CO3	3	3	3			3	3				3	3	3	2	2

Semester	19IBOTE37: Pomology	L	T	P	C
III		3	0	0	3

Learning Objective (LO):

LO1	To acquire knowledge in the fruits and its uses
LO2	To understand the different cultivation of fruit crops
LO3	To apply the knowledge on post harvest technology of fruits

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the role of Biotechnology in Fruit culture
CO2	Appreciate the cultivation of fruit trees
CO3	Comprehend the health benefits of various fruits
CO4	Appreciate the post harvest methods of fruits
CO5	Comprehend the knowledge on fruit processing industries

Unit - 1

Importance of fruit culture (economic preposition, health benefits etc.) Setting up of industry based on the fruits present position and scope of fruit processing and equipments required for setting up a processing unit. Cultivation of tropical fruits (mango, banana, papaya, sapota, pineapple etc.).

Unit - 2

Cultivation of sub–tropical fruits (pomeranate, litchi, citrus, grapes, ber, aonpla etc.) their Cultivation of temperature fruits (apple, pear, plum, Alume, Peach, apricot, walnut, almond) cultivation practices with special reference to origin, varieties (cultivars, climate, soil, land

preparation, planting, manuring, irrigation, harvesting, ripening of fruits, grading, packaging, marketing) control of insect pest and diseases. Cultivation of temperate of fruits (apple, pear, plum, peach, apricot, walnut, almond).

Unit – 3

Root stocks of different fruit crops, their propagation, nursery management. Management of rootstocks and mother stocks. Fertigation in fruit crops

Unit - 4

Role of biotechnology and micro–propagation of importance fruits crops. Orchard rejuvenation, head back and high density planting in fruits.

Unit - 5

Maturity standards, harvesting, ripening, grading of fruits etc. Mechanized harvesting of fruits. Packing, storage and value addition and value added products from fruits.Pesticide use, safety of operators and consumers, concept of minimum residue limit in fruits crops

Books for study:

Chattopadhyay, T.K. (2003). *A textbook on Pomology*. Volume 1. Kalyani Publishers, Ludhiana.

Reference Books / Supplementary reading:

1. Bose, T.K., Mitra, S.K. and Sanyal, D. (2001). *Fruits: Tropical and Subtropical* (Vol. 1). Noya Udyog, Kolkata-6.
2. Chadha, K.L.(1991). *Advances in Horticulture*. Malhotra Publishing House, New Delhi, India.
3. Sharma, R.R. and Srivastav, M. (2004). *Plant propagation and nursery management.* Intl Book Distributing Co., Lucknow
4. Verma, L.R. and Joshi, V.K. (2000). *Post harvest technology of fruits and vegetables.* Indus Publishing Co., New Delhi.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3				2			3	3	3	3		
CO2	3	3	3				2			3	3	3	3	2	2
CO3	3	3	3				3	3		3	3	3	3	2	3
CO4	3	3	3				3	2		3	3	3	3		2
CO5	3	3	3			2	3	2		3	3	3	3		2

Semester	19IBOTE56: Biofertilizers	L	T	P	C
V		3	0	0	3

Learning Objective (LO):

LO1	To gain knowledge on the various Biofertilizers

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the importance of Biofertilizers
CO2	Appreciate the production technology of Biofertilizers
CO3	Comprehend the steps involved in Biofertilizer production

Unit – 1

Biofertilizers – Definition and types , importance of biofertilizers in agriculture

Unit – 2

Characteristics of biofertilizers- Rhizopium, Azotobactor, Azospirillum, Phosphate solubilizing microorganisms, Cyanobacteria, Azolla, Mycorrhizae

Unit – 3

Symbosis: Physiology, biochemistry and molecular genetics of symbiosis – Enzyme and their regulation, nitroganase, hydrogenase

Unit –4

Production technology: Strain selection, sterilization, growth and fermentation, mass production of various biofertilizers.

Unit –5

Application technology: standards and quality control, application for field and tree crops, nursery plants and seedlings. Application method for different biofertilizers.

Books for study:

1) Rangaswamy and Bagyaraj.(1996).*Agricultural Microbiology*. Prentice Hall India
2) Subbasrao, N.S. (1988). *Biofertilizers in Agriculture,*Oxford& IBH Publishing CO.Pvt. Ltd, New Delhi

Reference Books / Supplementary reading:

1. Tilak., K.V.B.R., K.K. Pal and Rin Ku Dey.(2009).*Microbes for sustainable Agriculture*.IK international publishing house, New Delhi
2. Alexander, M. (1977). *Introduction to Soil Microbiology.* Wiley publishers.
3. Subbarao, N.S.(2005). Soil Microbiology(*Soil Microorganism and Plant growth).*Oxford & IBH Publishing CO.Pvt. Ltd, New Delhi

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3			2	3				3	3	3	3	3
CO2	3	3	2			2	2				3	3	3	2	2
CO3	3	3	3			3	2				3	3	3	2	2

Semester	19IBOTE57: Micropropagation	L	T	P	C
V		3	0	0	3

Learning Objective (LO):

LO1	To gain knowledge on the various microprobagation methods of plants

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Appreciate the knowledge on various vegetative propagation methods of plants
CO2	Understand the microprobagation methods of plants
CO3	Comprehend the Microprobagation methods of ornamental plants
CO4	Appreciate the various organ culture methods of plants

Unit – 1

Vegetative propagation – Techniques of propagation by cuttings, grafting, budding and layering. Propagation by specialized stems and roots- Bulbs, Corms, Tubers, Rhizomes and Psudobulbs.

Unit – 2

Micropropagation in plants – Types of Micropropagation – Material and Advantages of Micropropagation – Methods and Applications of Micropropagation – General laboratory Facilitiesand Procedures – Disadvantages of Micro propagation.

Unit – 3

Techniques of Invitro culture for Micropropagation procedures – Establishment and stabilization- shoot multiplication – Root formation – Acclimation to greenhouse conditions.

Unit – 4

Plant Micropropagation – Herbaceous ornamentals – Forage and grain legumes and vine crops – woody legumes- Forest species – Explants used in Tissue culture – Protoplasts of Tree cultivars – Vitrification.

Unit – 5

Organ microculture – somatic embryogenesis in plants – techniques for Anther culture – Isolated pollen culture – Protoplast culture – Plant growth regulators role in micropropagation – infection of Host tissue – Host-nematode Interactions strategies using in vito systems for disease – resistance

Books for study:

1. Hudson, T. Hartmann, Dale E. Kester, Fred T. Davies, Jr. Robert L. Geneve.(1997). *Plant propagation. Principles and Practices*. Pretice Hall of India Pvt Ltd., New Delhi
2. Purohit .(2005). *Plant Tissue Culture*. Student Edition, Jodhpur- India

Reference Books / Supplementary reading:

1. Narayanasamy,S.(1994). *Plant Cell and Tissue Culture.* Tata McGraw-Hill publishing Company limited, New Delhi
2. George,E.F and P.D. Sherrington.(1984). *Plant Propagation by tissue culture*. Exegetics Ltd., UK
3. Lydianekyte, John kleyn, Holly scoghins and Mark bridges. (2013). *Plants from test tubes- An introduction to Micropropagation.* Timber press Inc., China

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3			2	3				3	3	3		3
CO2	3	3	3			2	3				3	3	3	2	3
CO3	3	3	3			3	2				3	3	3	2	2
CO4	3	3	3			3	2				3	3	3	3	2

Semester	19IBOTE85: Herbarium Keeping	L	T	P	C
VIII		3	0	0	3

Learning Objective (LO):

LO1	To acquire knowledge and skills in herbarium keeping
LO2	To understand the principles of herbarium management

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the herbarium and its types
CO2	Appreciate the process of Herbarium specimen preparation
CO3	Comprehend the physical and scientific curing of herbarium specimen
CO4	Gain adequate knowledge on E-herbarium
CO5	Understand the process involved in starting a new herbarium

Unit -1: Herbarium and Specimen Collection

Herbarium- Different types, functions. Collection of specimens, types, specialized collections, need, sample collections. Ancillary collections (spirit, carpological, seed and wood). Preparation of field note book and tags. Laws and ethics of collecting samples. Important herbarium centres in the world.

Unit -2: Drying, Mounting, Preserving and Labelling of Specimens

Pressing -standard and special pressing methods. Drying and drying methods of specimens. Mounting-equipment, procedure and special preservation and storage methods for algae, fungi, lichen, bryophytes, succulents and aquatic plants. Labelling-arranging and attaching specimens, annotation slips.

Unit -3: Physical and Scientific Curation

Storing specimens, guidelines for handling specimens, labelling specimens, filling specimens, Quick guide. Scientific curation- Taxonomy and nomenclature, identifying specimens, library and literature. Collectors, itineraries, maps and gazetteers. Centralized accessioning, recording and dispatch procedures. Preventing from insect damage. Special curation (eg succulents, palms).

Unit - 4: Computerization, E-herbarium and arrangement

Computerization of specimens, removing samples from specimens, removing and repairing specimens, duplicates. Collections of illustrations and photographic records. Family arrangement of specimen collections. Rearranging the collection according to a new publication. Photography of herbarium sheets and plants in the field. E-herbarium making.

Unit -5: Starting a new Herbarium and Record keeping

Starting a new Herbarium-purpose, determining basic needs, registering of Index herbarium, infrastructure and functional areas. Equipment and suppliers. Handling specimens and helping visitors. Herbarium services, Herbarium management. All records and correspondence concerning exchanges, loans and agreement, gifts, and accessions. Annual report.

Books for study:

3. Singh, H.B and B. Subramaniam. (2008). *Field Manual on Herbarium techniques*. National Institute of Science Communication and Information Resources, New Delhi
4. Sivarajan, V.V. (1989).*Introduction to principles of plant Taxonomy*. Oxford and IBH, New Delhi.
5. Bhattacharyya, B. (2005). *Systematic Botany*. Narosa Publishing House, New Delhi.

Reference Books / Supplementary reading:

1. Greuter, W. et al. (1989). *International Code of Botanical Nomenclature*. International Association of Plant Taxonomy, Leiden.
2. Michael,G. Simpson, (2006).*Plant Systematics*. Elsevier Academic Press, Burlington, MA.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3					3	3		3	3	3	3	2	3
CO2	3	3	2				3	2		3	3	3	3		3
CO3	3	3					2	3			3	3	3	2	2
CO4	3	3	2				2	3			3	3	3	3	2
CO5	3	3	2	2						3	3	3	3	3	

Semester	19IBOTE86: Forest Technology	L	T	P	C
VIII		3	0	0	3

Learning Objective (LO):

LO1	To know about the principles and scope of forest management
LO2	To study about the forest biotechnology

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the forest types of India
CO2	Appreciate the value of wild life conservation
CO3	Gain adequate knowledge on silviculture

CO4	Comprehend the physical, chemical and mechanical properties of wood
CO5	Understand the methods of studying the form

Unit - 1

Forestry-Definition, Classification, scope of forestry, forest utilization, major and minor forest products, commercial Timber yielding plants of South India.

Forest types of India, social forestry village forestry, farm forest, avenues.

Unit - 2

Principle and scope of forest management, elements of mensuration, sampling use of diameter (Girth) height and area spacement rotation, concept of sustained yield-conservation and conservation strategies ,sustainable development.

Wild life-Important animals of South India, preservation, sanctuaries endangered species causes for destruction and need for protection- wild life preservation act.

Unit-3

Elements of silviculture - silviculture of the following species:-

a. *Tectona grandis*
b. *Casuarinaequisitifolia*
c. *Eucalyptus*
d. *Bomboosasp*
e. *Santalum album*

Silvicultural systems - clear felling, simple coppice and selection felling.

Unit- 4

Wood structure , physical, chemical and mechanical properties of wood. Wood preservation, wood seasoning and wood preservatives.

Unit- 5

Tree Improvement -Genetic variation, geographic variation, genotype and phenotype, Tree improvement methods -species introduction, hybridization, Individual tree selection, vegetative propagation, grafting, biotechnology for forestry.

Books for study:

1. Kamal Kishor Sood and Vishal Mahajan, (2018). *Forests: Climatic Change and Biodiversity*. Kalyani Publishers, New Delhi
2. Shrivastava,M.B,(1998). *Introduction to Forestry.* South Asia Books; 1 edition, New Delhi
3. Sudhir,M.(2000).*Applied biotechnology and plant genetics.* Dominant Publishers, New Delhi
4. Vinod Kumar, (1995).*Nursery and Plantation practices in Forestry, Jodhpur*. Scientific publishers.

Reference Books / Supplementary reading:

1. Agarwal A, (1985). *Forest of India.* as cited in P. Leelakrishnan, Environmental Law in India, Butterworths India, New Delhi
2. Champion ,H.G and Griffith, (1967). *Manual of General silviculture for India*, 3rd edition, New Delhi.
3. WWF. (2007). *Timber Identification Manual*. TRAFFIC, New Delhi.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3						2		3	3	3	3	2	
CO2	3	3						2		3	3	3	3		
CO3	3	3						2		3	3	3	3		2
CO4	3	3	2		2			2		3	3	3	3		
CO5	3	3	2		2			2		3	3	3	3	2	2

Semester	19IBOTE95: Applied Botany	L	T	P	C
IX		3	0	0	3

Learning Objective (LO):

LO1	To understand the Post harvest technology of fruits
LO2	To study about the principles of seed storage
LO3	To acquire knowledge on seed certification

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the cultivation and marketing of various fruits
CO2	Appreciate the process of cultivation of various flower crops
CO3	Comprehend the methods of seed storage and seed dormancy
CO4	Gain adequate knowledge on seed viability and seed certification
CO5	Understand the process involved in fruit harvesting and packaging

Unit – 1

Classification of fruits – Temperate and subtropical production – varieties, climate and soil requirements – propagation, planting density and cropping system- training and pruning – uses of growth regulators and nutrients to improve production. Weed management – pests, disease and their control – harvesting, post harvesting handling and storage – Marketing and export of the following.

Citrus, Banana, Guava, Mango, Grapes, Papaya, pineapple and Tamarind.

Unit – 2

Rose, Jasmine, Crossandra, Marigold, Dhalia and Anthurium, Micropropagation of orchids- Shadenet and green house cultivation.

Unit – 3

Principles and methods of seed storage. Effect of storage environment on seed longevity. Growth of seeds – seed maturation, Germination – Factors affecting germination – metabolism during germination – seed dormancy – types of dormancy.

Unit – 4

Seed production in self and cross pollinated crops. Classes of seed: Nucleus, breeder, foundation and certified seeds - Seed harvesting, seed processing, seed treatments, seed testing and seed sampling. Viability and vigour - Seed borne pathogens - Seed certification, standard inspection, legislation and seed law-enforcement.

Unit – 5

Introduction: production of fruits- quality losses of fruits, Determination of harvest maturity and handling methods - Factors affecting fruits during storage, package design, packaging types.

Books for study:

1. Agarwal, P.K and M.Dadlani, (1992). *Techniques in seed science and technology*
2. Kumar, N, (1993). *Introduction to Horticulture*. Rajalakshmi publication, Nagercoil.
3. Hartme,H.T. and Kester,D.E, (1986). *Plant propagation principles and practices*. Prentice Hall of India Ltd., New Delhi
4. Trivedi,P.C, (2005). *Applied Botany.*Aamishankar Publishers & Distributors, Jaipur.

Reference Books / Supplementary reading:

1. Janick,J.W.H, (1988). *Horticultural Science*. Freeman and Co., San Francisco.
2. Agarwal,R.L, (2008). *Seed Technology*. Oxford and IBH publishing. New Delhi.
3. Khan.A.A.Ed,(1977). *Physiology and Biochemistry of seed dormancy and germination*.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3			2	3				3	3	3	3	2	
CO2	3	3			2	3				3	3	3	3		
CO3	3	3			2	2				3	3	3	3		2
CO4	3	3			2	2				3	3	3	3		2
CO5	3	3			2	2				3	3	3	3	2	2

Semester	19IBOTE96: Bioprospecting of Medicinal and Aromatic Plants	L	T	P	C
IX		3	0	0	3

Learning Objective (LO):

LO1	To acquire knowledge on medicinal and aromatic plants
LO2	To understand antioxidant metabolism
LO3	To study about post harvest technology in medicinal plants

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the history of herbal medicine
CO2	Appreciate the quality control of medicinal plant preparation
CO3	Comprehend the bioactive compounds found in plants
CO4	Understand the plant defense mechanism
CO5	Gain adequate knowledge on post-harvest technology in medicinal plants

Unit – 1

Medicinal and Aromatic Plants – Importance and Scope – Classification of medicinal plants – based on morphology of useful parts, habit, taxonomical , pharmacological , chemical and Ayurvedic formulations – Cultivation of medicinal and aromatic plants – History of herbal medicine- Contribution of the Egyptians, Chinese, Greeks, Arabs and Indians -Different systems of herbal medicine: Ayurveda, Siddha and Unani.

Unit – 2

Quality control for medicinal and aromatic plant materials: Microscopic and Macroscopic examination – Visual examination and odour – Histochemical detection of cell walls and contents. Drug Evaluation: Methods of drug evaluation: Organoleptic, Microscopic, Physical, Chemical and Biological evaluation. Chemical nature of drugs: Crude drugs – Preparation and preservation - Chemical nature and Methods of tests for Carbohydrates, Glycosides, Tannins, Volatile oils, Lipids, Resinous substances and Proteins.

Unit – 3

General properties of Alcohols, Aldehyde, Glutaraldehyde, Halogens, Phenols, Gases, Surface active agents and Metallic salts ; Secondary Metabolites - Classification , General characters, Chemical nature, Extraction and Estimation methods for Alkaloids, Flavanoids, Terpenoids and Phenolic compounds -Separation, Identification and Characterization of the potential bioactive compounds using UV, FTIR, ^{1}H NMR,^{13}C NMR, 2D NMR,GC-MS and XRD. Bioactive molecules – Antibacterial, Antifungal, Antiplasmodial, Larvicidal and Antiviral drugs – mode of its action.

Unit – 4

Antioxidant metabolism: Plant defense mechanism – Antioxidants – Reactive oxygen species – Enzymatic and non enzymatic antioxidants –Role of antioxidants –Estimation of antioxidants – Ascorbic acid and alpha Tocopherol. Antioxidant enzymes – Peroxidase, SOD and Catalase. Free radicals, types of free radicals, Production of free radicals and Lipid peroxidation.

Unit – 5

Post-harvest technology in medicinal plants: scope and importance. Processing and utilization – Storage of crude drugs, Adulteration with reference to plant drugs, types of adulterants and methods of adulteration, Identification of adulterants. - Importance of herbal marketing -Future prospects and constraints of the herbal drug industry - Regulatory status of herbal medicine in India.

Books for study:

1. Ananthanarayan, R. and C.K.J. Paniker,(1996). *Text book of Microbiology*. 5thEdn., Orient Longman Ltd., Chennai
2. Faroogi, A.A. and B.S.Sreeramu, (2004). *Cultivation of medicinal and aromatic crops*. Revised edition, Universities Press (India) Private Limited, Hyderabad.
3. Jain, S.K, (2018). *Manuals of Ethnobotany*. Scientific suppliers, New Delhi
4. Joshi,S.G, (2018). *Medicinal Plants*.CBS Publishers pvt Ltd., New Delhi

Reference Books / Supplementary reading:

1. WHO, (2002).*Quality control methods for medicinal plant materials*, World Health Organization, Geneva, A.I.T.B.S., Publishers and Distributors, New Delhi.
2. Harbone, J.B,(1998). *Phytochemical Methods; A guide to modern techniques of plant analysis*. 3rdEdn., Springer (India) Private Limited , New Delhi.
3. Mc.Kane, L. and J. Kandel, (1996). *Microbiology: Essential and Applications*. 2ndEdn., McGraw – Hill, Inc, New Delhi.

Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3				2				3	3	3	3		2
CO2	3	3				2				3	3	3	3		2
CO3	3	3				2				3	3	3	3		2
CO4	3	3				2				3	3	3	3		
CO5	3	3				2				3	3	3	3		

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