



**ST. ALBERT'S COLLEGE (AUTONOMOUS)
ERNAKULAM**

Affiliated to Mahatma Gandhi University, Kottayam, Kerala

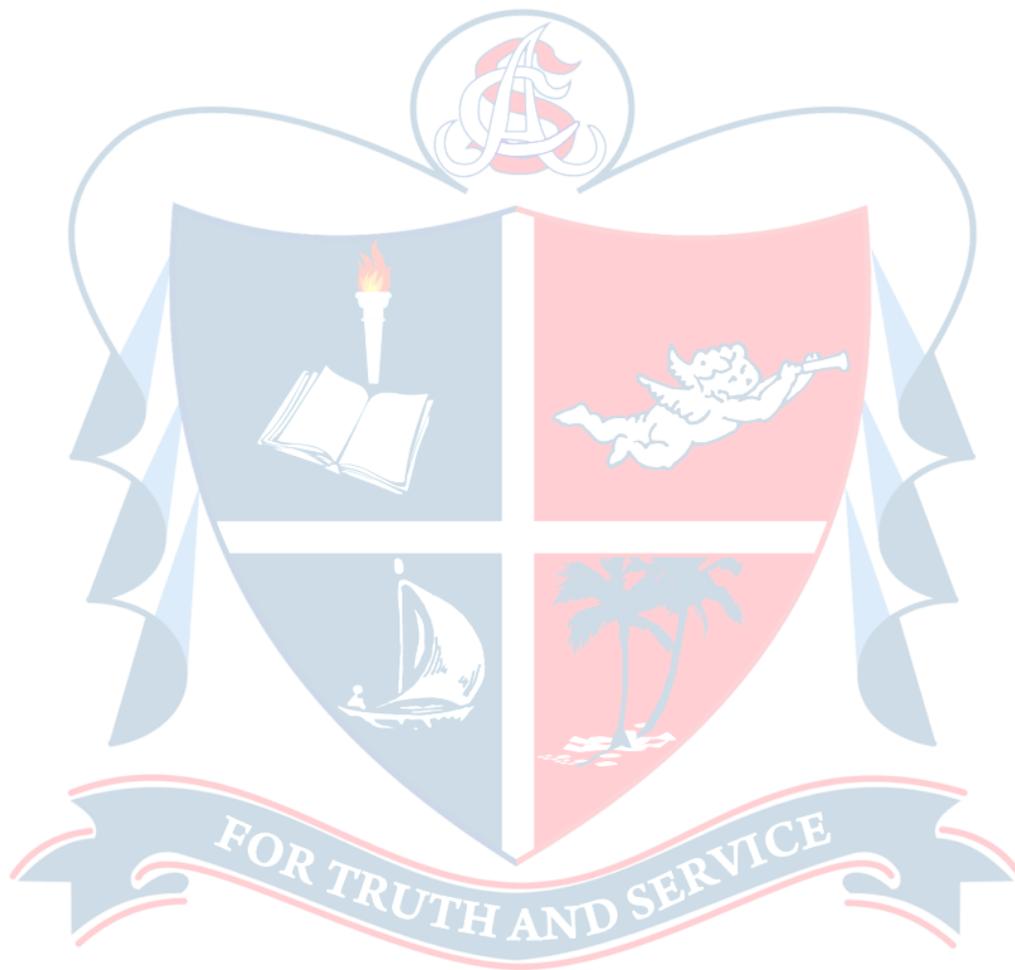
SYLLABUS FOR UNDERGRADUATE PROGRAMMES

**BACHELOR OF SCIENCE (HONOURS) IN
BOTANY**

SACA – UGP

(WITH EFFECT FROM 2024 ADMISSION)

UNDERGRADUATE PROGRAMMES (HONOURS) SYLLABUS



Syllabus of BSc Botany

Prepared by the Board of Studies on 4th March 2024

Dr. K. Madhusudhanan

Chairman, Board of Studies

Approved by the Academic Council on 14th March 2024

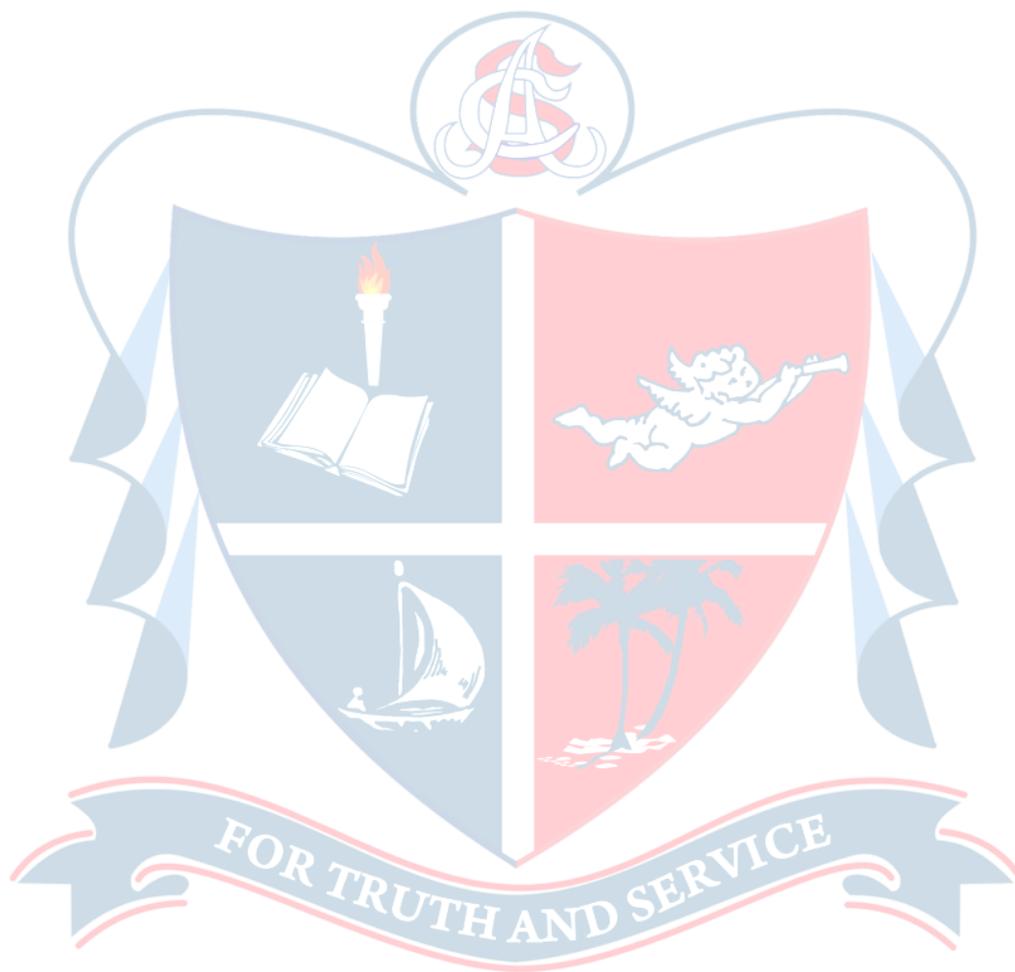
Dr. Bijoy V.M., Principal

Chairman, Academic Council

Approved by the Governing Council on 27th March 2024

Fr. Dr. Antony Thoppil

Chairman, Governing Council



Board of Studies

Sl. No:	Name	Designation	Qualification
1	Dr. K. Madhusudhanan	Professor and Head Department of Botany, St. Albert's College (Autonomous)	Ph. D.
a) Entire faculty of each specialization			
1	Dr. Siju M. Varghese	Assistant Professor, Department of Botany, St. Albert's College (Autonomous)	Ph. D.
2	Ms. Drishya K. Reghuvaran	Assistant Professor, Department of Botany, St. Albert's College (Autonomous)	M.Sc.
3	Ms. Mary Joseph	Assistant Professor, Department of Botany, St. Albert's College (Autonomous)	M.Sc.
4	Dr. Anna Ancy Antony A.	Assistant Professor, Department of Botany, St. Albert's College (Autonomous)	Ph. D.
5	Dr. Anisha S.	Assistant Professor, Department of Botany, St. Albert's College (Autonomous)	Ph. D.
b) Experts in the Subject:			
1	Dr. Siril E. A.	Professor & Head Department of Botany University of Kerala.	Ph. D.
2	Dr. Jos T. Puthur	Professor Department of Botany University of Calicut.	Ph. D.
c) Nominee of Vice Chancellor:			
1	Dr. M. Anilkumar	Associate Professor & Head Department of Botany Union Christian College Aluva.	Ph. D.
d) Placement Representatives:			
1	Mr. Nikesh R.	Agricultural Assistant Grade I Krishi Bhavan Kanjoor Angamaly.	M. Sc.
e) Meritorious alumnus:			
1	Dr. Stephen Sequeira	Assistant Professor, Department of Botany	Ph. D.

		Maharaja's College (Autonomous) Ernakulam.	
f) Experts from outside whenever special courses are to be formulated			
1	Dr. Vinoth Thomas	Scientist (Retd.), Rubber Board of India, Kottayam	Ph. D.
Other teachers of the college			
1	Dr. Krishnakumar K. S.	Assistant Professor, Department of Chemistry St. Albert's College (Autonomous)	Ph. D.



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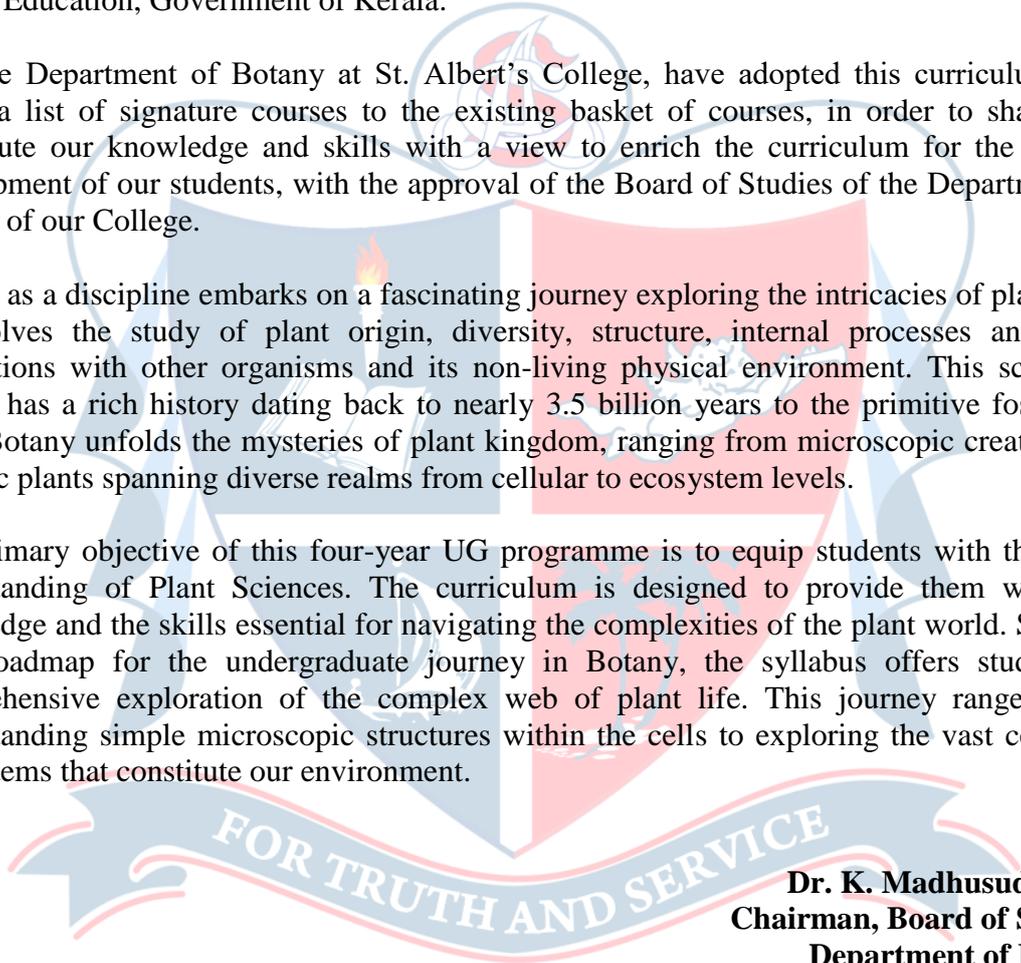
Preface

The introduction of the four-year degree programme (FYUGP) represents a significant paradigm shift in the higher education within Kerala. The Department of Higher Education, Government of Kerala has spearheaded this initiative to be implemented in the academic year 2024-25. In response, Mahatma Gandhi University had undertaken a comprehensive process of curriculum design, ensuring alignment with guidelines established by the Department of Higher Education, Government of Kerala.

We, the Department of Botany at St. Albert's College, have adopted this curriculum and added a list of signature courses to the existing basket of courses, in order to share and contribute our knowledge and skills with a view to enrich the curriculum for the further development of our students, with the approval of the Board of Studies of the Department of Botany of our College.

Botany as a discipline embarks on a fascinating journey exploring the intricacies of plant life. It involves the study of plant origin, diversity, structure, internal processes and their interactions with other organisms and its non-living physical environment. This scientific pursuit has a rich history dating back to nearly 3.5 billion years to the primitive fossilized cells. Botany unfolds the mysteries of plant kingdom, ranging from microscopic creatures to gigantic plants spanning diverse realms from cellular to ecosystem levels.

The primary objective of this four-year UG programme is to equip students with the deep understanding of Plant Sciences. The curriculum is designed to provide them with the knowledge and the skills essential for navigating the complexities of the plant world. Serving as a roadmap for the undergraduate journey in Botany, the syllabus offers students a comprehensive exploration of the complex web of plant life. This journey ranges from understanding simple microscopic structures within the cells to exploring the vast complex ecosystems that constitute our environment.



Dr. K. Madhusudhanan
Chairman, Board of Studies
Department of Botany

**THE ST. ALBERTS COLLEGE (AUTONOMOUS)
UNDERGRADUATE PROGRAMMES (HONOURS)
REGULATIONS, 2024**

SACA-UGP (Honours)

PREAMBLE

The University Grants Commission (UGC) has issued the Curriculum and Credit Framework for Undergraduate Programmes 2023 (CCFUP) which would provide a flexible choice-based credit system, multidisciplinary approach, multiple entry and exit options, and establish three Broad Pathways, (a) 3-year UG Degree, (b) 4-year UG Degree (Honours), and 4-year UG Degree (Honours with Research).

The Kerala Higher Education Reforms Commission has recommended a comprehensive reform in the undergraduate curriculum for the 2023-24 academic year, adopting 4-year undergraduate programmes to bring Kerala's undergraduate education at par with well acclaimed universities across the globe.

The Kerala State Curriculum Committee for Higher Education has been constituted and have proposed a model Kerala State Higher Education Curriculum Framework (KSHECF) for Undergraduate Education. Further, an Executive Committee and various sub committees were constituted for the implementation of the Regulations. Further, MGU has framed the Rules and Regulations based on this namely: **THE MAHATMA GANDHI UNIVERSITY UNDERGRADUATE PROGRAMMES (HONOURS) REGULATIONS, 2024** {MGU-UGP (Honours)} under the New Curriculum and Credit Framework, 2024. Being an Autonomous college affiliated to MG University, St. Albert's College is adopting all the major components of MGU UGP (Honours) 2024 in the title SACA-UGP (Honours) to our UG curriculum from the academic year (2024-25) onwards.

1. Short Title and Commencement

- i.** The Regulations will be called as **“THE ST. ALBERT'S COLLEGE (AUTONOMOUS) UNDERGRADUATE PROGRAMMES (HONOURS) REGULATIONS, 2024 {SACA-UGP (Honours)}”** under the New Curriculum and Credit Framework 2024.
- ii.** These Regulations will come into effect from the academic year 2024-2025 and will have prospective effect.

2. Scope, Application

- i. These Regulations shall apply to all undergraduate programmes (except B. Voc.) of ST. ALBERT'S COLLEGE (AUTONOMOUS) for the Admissions commencing in the academic year 2024-2025.
- ii. Every programme conducted under the SACA-UGP shall be monitored by the SACA-UGP Academic Committee (Academic Council).

3. Definitions

Unless context otherwise required,

- i. FYUGP means Four Year Undergraduate Programme.
- ii. Academic Year: Two consecutive (one odd and one even) semester followed by a vacation in one academic year.
- iii. Academic Coordinator/Nodal Officer: Academic Coordinator/Nodal Officer is a faculty nominated by the College Council to co-ordinate the effective conduct of the FYUGP including Continuous Comprehensive Assessment (CCA) undertaken by various departments within the College. She/ he/ they shall be the convenor for the College level Academic Committee.
- iv. Academic Week: A unit of five working days in which the distribution of work is organized, with five contact hours of one-hour duration on each day.
- v. Academic Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week in a semester. It is defined both in terms of student efforts and teacher's efforts. A course which includes one hour of lecture or tutorial or minimum 2 hours of lab work/ practical work/ field work per week is given one credit hour. Accordingly, one credit is equivalent to one hour of lecture or tutorial or two hours of lab work/ practical work/ field work/ practicum and learner engagement in terms of course related activities (such as seminar preparation, submitting assignments, group discussion, recognized club-related activities etc.) per week. Generally, a one credit course in a semester should be designed for 15 hours lecture/ tutorials or 30 hours of practical/ fieldwork/ practicum and 30 hours learner engagement.
- vi. Academic Bank of Credits (ABC): An academic service mechanism as a digital/virtual entity established and managed by Government of India to facilitate the learner to become its academic account holders and facilitating seamless learner mobility, between or within degree-granting Higher Education Institutions (HEIs) through a formal system of credit recognition, credit accumulation, credit transfers

and credit redemption to promote distributed and flexible process of teaching and learning. This will facilitate the learner to choose their own learning path to attain a Degree/ Diploma/ Certificate, working on the principle of multiple entry and exit, keeping to the doctrine of anytime, anywhere, and any level of learning.

- vii. Credit Accumulation: The facility created by ABC in the Academic Credit Bank Account (ABA) opened by the learner across the country in order to transfer and consolidate the credits earned by them by undergoing courses in any of the eligible HEIs.
- viii. Credit Recognition: The credits earned through eligible/ partnering HEIs and transferred directly to the ABC by the HEIs concerned.
- ix. Credit Redemption: The process of commuting the accrued credits in the ABC of the learner for the purpose of fulfilling the credits requirements for the award of various degrees. Total credits necessary to fulfil the criteria to get a degree shall be debited and deleted from the account concerned upon collecting a degree by the learner.
- x. Credit Transfer: The mechanism by which the eligible HEIs registered with ABC are able to receive or provide prescribed credits to individuals registered with ABA in adherence to the UGC credit norms for the course(s) registered by the learner in any HEIs within India.
- xi. Credit Cap: Maximum number of credits that a student can take per semester, which is restricted to 30.
- xii. Continuous Comprehensive Assessment (CCA): The mechanism of evaluating the learner by the course faculty at the institutional level.
- xiii. End Semester Evaluation (ESE): The mechanism of evaluating the learner at the end of each semester.
- xiv. Audit Course: A course that the learner can register without earning credits and is not mandatory for completing the SACA-UGP. The student has the option not to take part in the CCA and ESE of the Audit Course. If the student has 75% attendance in an Audit Course, he/ she/ they are eligible for a pass in that course, without any credit (zero-credit).
- xv. Courses: Refer to the papers which are taught and evaluated within a programme, which include lectures, tutorials, laboratory work, studio activity, fieldwork, project work, vocational training, viva, seminars, term papers, presentations, assignments, self-study, group discussion, internship, etc., or a combination of some of these elements.

- xvi. Choice Based Credit System (CBCS) means the system wherein students have the option to select courses from the prescribed list of courses.
- xvii. College-level Academic Committee: Is a committee constituted for the FYUGP at the College level comprising the Principal as the Chairperson, the Academic Co-ordinator/ Nodal Officer as its convenor.
- xviii. Academic Co-ordinator/ Nodal Officer: A senior faculty member nominated by the College Council.
- xix. Course Faculty: A faculty member nominated by the Head of the Department shall be in charge of offering a particular course in a particular semester of FYUGP.
- xx. Department means any teaching department in a college offering a course of study approved by the Governing body and statutory bodies of the College.
- xxi. Senior Faculty Advisor (SFA) is a faculty nominated by a Department Council to coordinate all the necessary work related to FYUGP undertaken in that department, including the Continuous Comprehensive Assessment.
- xxii. Department Council means the body of all teachers of a department in a college.
- xxiii. Faculty Advisor (FA) means a teacher from the parent department nominated by the Department Council to advise students in academic matters.
- xxiv. Graduate Attributes means the qualities and characteristics to be obtained by the graduates of a programme of study at the College, which include the learning outcomes related to the disciplinary areas in the chosen field of learning and generic learning outcomes. The graduate attributes for its programmes will be specified.
- xxv. Programme means the entire duration of the educational process including the evaluation leading to the award of a degree.
- xxvi. Programme Pathway: Combination of courses that can be chosen by a student that give options to pursue interesting and unconventional combinations of courses drawn from different disciplinary areas, like the sciences and the social sciences/ humanities. The pathways could be in terms of major- minor options with different complementary/allied disciplines.
- xxvii. Regulatory Body means University Grants Commission (UGC), All India Council for Technical Education (AICTE), National Council for Teacher Education (NCTE), Medical Council of India (MCI), Pharmacy Council of India (PCI), Indian Council for Agricultural Research (ICAR), Bar Council of India, Council of Architecture, National Assessment and Accreditation Council (NAAC) and

National Board of Accreditation (NBA) etc.

- xxviii. **Signature Courses:** Signature courses are the specialized Discipline Specific Elective courses or skill enhancement/value addition courses offered by the regular/ ad hoc/visiting/ emeritus/ adjunct faculty member of a particular Department with the prior recommendation of the BoS and the approval of Academic Council of the College.
- xxix. Letter Grade or simply 'Grade' in a course is a letter symbol (O, A+, A, B+, B, C, P, F, and Ab). Grade shall mean the prescribed alphabetical grade awarded to a student based on their performance in various examinations. The Letter grade that corresponds to a range of CGPA.
- xxx. **Grade Point:** Each letter grade is assigned a 'Grade point' (G) which is an integer indicating the numerical equivalent of the broad level of performance of a student in each course. Grade Point means point given to a letter grade on 10-pointscale.
- xxxi. **Semester Grade Point Average (SGPA)** is the value obtained by dividing the sum of credit points obtained by a student in the various courses taken in a semester by the total number of credits in that semester. SGPA shall be rounded off to two decimal places. SGPA determines the overall performance of a student at the end of a semester.
- xxxii. **Credit Point (P)** of a course is the value obtained by multiplying the grade point (G) by the credit (C) of the course: $P = G \times C$
- xxxiii. **Cumulative Grade Point Average (CGPA)** is the value obtained by dividing the sum of credit points in all the semesters earned by the student for the entire programme by the total number of credits in the entire programme and shall be rounded off to two decimal places
- xxxiv. **Grade Card** means the printed record of students' performance, awarded to them.
- xxxv. Words and expressions used and not defined in this regulation but defined in the M. G. University Act and Statutes, and College handbook shall have the meaning assigned to them in the Act and Statutes and handbook

4. Features and Objectives of SACA-UGP 2024

The features and objectives of the SACA-UGP 2024 shall be:

- i. The features, meaning, and purpose of FYUGP shall be as stipulated by the UGC and as adapted by the Kerala State Higher Education Curriculum Framework (KSHECF) and MGU-UGP (Honours) for undergraduate education.

- ii. The practice of lateral entry of students to various semesters exists, but an exit with a Degree shall be awarded only upon successful completion of 133 credits as per the conditions stipulated in this regulation.
- iii. FYUGP shall have three Broad Pathways, (a) 3-year UG Degree, (b) 4-year UG Degree (Honours), and (c) 4-year UG Degree (Honours with Research).
- iv. Students who choose to exit after 3 years shall be awarded UG Degree in their respective Discipline/ Disciplines after the successful completion of the required minimum Courses with 133 credits.
- v. A 4-year UG Degree (Honours) in the Discipline/ Disciplines shall be awarded to those who complete the SACA-UGP with a specific number of Courses with 177 credits including 12 credits from a capstone level graduate project/dissertation. Those students who are not doing capstone project shall do three courses at the level 400 or above or three vocational training courses or internships for 12 credits.
- vi. Students who acquire minimum 75% in their graduation (upto 6th semester) are eligible for Honours with Research Programme. However, if necessary, College may conduct screening test for the honours with research programme in accordance with University and College Regulations time to time.
- vii. 4-year UG Degree (Honours with Research): Students who aspire to pursue research as a career may opt for 4-year UG Degree Honours with Research stream under FYUGP with a specific number of Courses with 177 credits including 12 credits from a research project in their major discipline.
- viii. The recognized research departments or departments with at least two faculty members having PhD shall offer the Honours with Research programme. Minimum 2 students (mentees) should be allotted to a faculty member (Mentor).
- ix. Students who have chosen the honours with research stream shall do their entire fourth year under the mentorship of a mentor.
- x. The mentor shall prescribe suitable advanced level/capstone level courses for a minimum of 20 credits to be taken within the institutions along with the courses on research methodology, research ethics, and research topic-specific courses for a minimum of 12 credits which may be obtained either within the institution or from other recognized institutions, including online and blended modes. Students shall also be allowed to pursue these three courses of 12 credits from suitable interdisciplinary/ transdisciplinary/ multidisciplinary/ vocational areas of their choice.
- xi. Students who have opted for the honours with research should successfully

complete a research project under the guidance of the mentor and should submit a research report for evaluation. They need to successfully defend the research project to obtain 12 credits under a faculty member of the University/ College/Recognized Research Institute. The research shall be in the Major/ allied discipline.

- xii. The research outcomes of their project work may be published in peer-reviewed journals or presented at conferences or seminars or patented.
- xiii. The proposed FYUGP curriculum comprises three broad parts: a) Foundation Components, b) Discipline Specific Pathway components (Major/ Minor), and c) Discipline Specific Capstone Components.
- xiv. The Foundation component of the FYUGP shall consist of a Set of General Foundation Courses and a Set of Discipline Specific Foundation Courses.
- xv. General Foundation Courses shall be grouped into 4 major baskets as Ability Enhancement Courses (AEC), Skill Enhancement Courses (SEC), Value Addition Courses (VAC), and Multi-Disciplinary Courses (MDC).
- xvi. Ability Enhancement Courses shall be designed specifically to achieve competency in English, other languages as per the student's choice with special emphasis on language and communication skills.
- xvii. English or other language courses shall be designed to enable the students to acquire and demonstrate the core linguistic skills, including critical reading, academic and expository writing skills as well as the cultural and intellectual heritage of the language chosen. Separate courses will be designed for Science, Humanities and Commerce streams.
- xviii. Multi-Disciplinary Courses (MDC) shall be so designed as to enable the students to broaden their intellectual experience by understanding the conceptual foundations of Science, Social Sciences, Humanities, and Liberal Arts. Students shall not be eligible to take the MDC in the same discipline that they have studied during their Plus Two. Third semester MDC can be Kerala specific content. Each BoS can prepare basket of courses under MDC.
- xix. Skill Enhancement Courses (SEC) shall be designed to enhance 21st century workplace skills such as creativity, critical thinking, communication, and collaboration.
- xx. Discipline Specific Courses shall include Discipline Specific Pathway Courses, both Major and Minor streams, enabling students to gain basic knowledge in the chosen discipline.

- xxi. Discipline Specific Foundation Courses shall focus on foundational theories, concepts, perspectives, principles, methods, and critical thinking essential for taking up advanced/ Capstone Courses. Practical courses shall be included in discipline specific foundation courses.
- xxii. The curriculum of the SEC should be designed in a manner that at the end of year-1, year-2, year-3, and year-4 students are able to meet the level descriptors for levels 5, 6, 7, and 8 of the UGC Guidelines on National Skills Qualifications Framework (NSQF).
- xxiii. Value Addition Courses (VAC) shall be so designed as to empower the students with personality development, perspective building, and self-awareness.
- xxiv. Discipline Specific Pathway Components (Major/Minor) shall provide the students with an opportunity to pursue in-depth study of a particular subject or discipline and develop competency in that chosen area, which includes Discipline Specific Core (DSC) courses and Discipline Specific Elective (DSE) courses as Major and Minor courses.
- xxv. Major components consist of three types: Discipline Specific Core or the Discipline Specific Elective Courses, and the research/laboratory/fieldwork.
- xxvi. Minor Courses can be selected from any discipline. A student who completes 12 credits in a particular stream will be eligible for a minor.
- xxvii. Students who complete a sufficient number of Courses in a discipline or an interdisciplinary area of study other than their chosen Major shall qualify for a Minor in that discipline or in a chosen interdisciplinary area of study.
- xxviii. Major Components shall be the main focus of study. By selecting a Major, the student shall be provided with an opportunity to pursue an in-depth study of a particular discipline.
- xxix. Each Board of Studies (BoS) shall identify specific Courses or baskets of Courses towards Minor Course credits. Students shall have the option to choose Courses from disciplinary/ interdisciplinary minors and skill-based courses related to a chosen programme.
- xxx. Students can opt for a change of Major at the end of the second semester to any Minor discipline studied among the foundation level courses. Students can also opt for a change of Major at the end of the second semester to any MDC.
- xxxi. Students should opt their 5th and 6th semester VAC and SEC from their Major disciplines only.

- xxxii. Course cum Credits Certificate: After the successful completion of a semester, this certificate is essential as proof for re-entry to another institution. This will help the learner for preserving the credits in the Academic Bank of Credits.
- xxxiii. The Advanced Level/ Capstone Level Courses shall be designed in such a manner as to enable students to demonstrate their cumulative knowledge in their main field of study, which shall include advanced thematic specialization or internships or community engagement or services, vocational or professional training, or other kinds of work experience.
- xxxiv. Advanced/ Capstone level Major Specialization shall include Courses focused on a specific area of study attached to a specific Major, which could be an Elective Course. They shall include research methodology as well.
- xxxv. The student has the option to register for and attend a course without taking part in the CCA and ESE of that course. Such a course is called the Audit Course. If the student has 75% attendance in an Audit Course, he/she/they is eligible for a pass in that course, without any credit (zero-credit). The Audit Course will be recorded in the final grade card of the student.
- xxxvi. All students shall undergo Summer Internship or Apprenticeship in a Firm, Industry or Organization; or Training in labs with faculty and researchers or other Higher Education Institutions (HEIs) or Research Institutions. A separate guideline for Internship Programmes will be published.
- xxxvii. Students will be provided the opportunities for internships with local industries, business organizations, agriculture, health and allied sectors, Local Government institutions (such as panchayats, municipalities), State Planning Board, State Councils/Boards, Research Institutions, Research Labs, Library, elected representatives to the parliament/state assembly/panchayath, media organizations, artists, crafts persons etc. These opportunities will enable the students to actively engage with the practical aspects of their learning and improve their employability.
- xxxviii. The College will assist in providing opportunities for field-based learning/minor Projects enabling them to understand the different socio-economic and development-related issues in rural and urban settings. The College will assist in providing the students with opportunities for Community engagement and services, exposing them to socio-economic issues to facilitate theoretical learning in real-life contexts.
- xxxix. Additional Credits will be awarded for those who actively participate in Social Activities, which may include participation in National Service Scheme (NSS), Sports and Games, Arts, participation in University/ college union related activities (for respective elected/nominated members), National Cadet Corps (NCC), adult

education/literacy initiatives, mentoring school students, and engaging in similar social service organizations that deemed appropriate to the College.

- xl. Grace marks shall be awarded to a student for meritorious achievements in co-curricular activities (in Sports/ Arts/ NSS/ NCC etc.). Such a benefit is applicable in the same academic year spreading over two semesters, in which the said meritorious achievements are earned. The Academic Council will decide from time to time the eligibility and other rules of awarding the grace marks.
- xli. Options will be made available for students to earn credit by completing quality-assured remote learning modes, including Online programmes offered on the Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) or other Online Educational Platforms approved by the competent body from time to time.
- xlii. Students shall be entitled to gain credits from courses offered by other recognized institutions directly as well as through distance learning.
- xliii. For the effective operation of the FYUGP, a system of flexible academic transaction timings shall be implemented for the students and teachers.
- xliv. Specialization: Student will have the option to achieve specialization within their Major by securing 12 credits from a disciplinary/interdisciplinary area. By choosing atleast 3 courses from discipline specific elective basket under a chosen field (preferably one from 200 level course and two 300 level courses) student will be awarded specialization in that particular area of study. Each student will have the option to achieve two specializations at a time from the institution.

5. Eligibility for Admission and Reservation of Seats

- i. The eligibility for admissions and reservation of seats for various FYUG Degree Programmes shall be in accordance with the norms/ rules made by the Government/University/College from time to time.
- ii. No student shall be eligible for admission to FYUG Degree Programmes in any of the disciplines unless he/she/they have successfully completed the examination conducted by a Board/University at the Plus Two level of schooling or its equivalent.
- iii. Students shall be admitted and enrolled in the respective programmes solely based on the availability of the academic and physical facilities within the institution. The College shall provide all students with a brochure detailing the Courses offered by the various departments under the various Programmes and the number of seats sanctioned for each Programme.
- iv. During the time of admission each student may be provided with a unique higher

education student ID which may be linked with the Aadhar number of the students so that his ID can be transferred if required to other higher education institutions as well.

- v. The students at the end of second semester may be permitted to change their major programme of study to any course/ institution/ university across the state. Based on the availability of seats and other facilities, the students may be permitted to opt any discipline which he/she/they had studied during the first two semesters as Discipline Specific Foundation courses/ Multidisciplinary Foundation courses. If ranking is required, it will be in the order of the highest-grade points secured in the discipline to which the switching of Major is sought.
- vi. Students shall be allowed to change their major programmes, if required, to a maximum of 10% of the sanctioned strength of that particular programmes depending upon the academic and infrastructural facilities available in the Institution.
- vii. Depending upon the availability of academic and infrastructural facilities, the Institution may also admit a certain number of students who are registered for particular programmes in each semester by transfer method, if required, from other Institutions subject to conditions as may be issued by the University.
- viii. A student who has already successfully completed a First-Degree Programme and is desirous of and academically capable of pursuing another First-Degree Programme may also be admitted with the prior approval of the University as per the conditions regarding programme requirements specified by the University.
- ix. A Student can also be admitted for an additional major/ second major/ additional minor and on completion of the required credits he/she/they can be awarded a second major/ additional major/ minor. He/she/they may be exempted from minor pathway and general foundation course requirement.
- x. The HEIs can also enrol students in certain courses as per their choice depending upon the availability of infrastructure and other academic facilities from other recognized HEIs who are already registered for a particular programme there either through regular/online/distance mode irrespective of the nature of programme (Govt/ Aided/ Self- finance/ Autonomous). On successful completion of the course the credits may be transferred through the Academic Bank of Credit (ABC), against the unique higher education ID provided by the College at the time of admission.

6. Academic Monitoring and student Support

The academic monitoring and student support shall be in the following manner, namely

- i. College should appoint a Senior Faculty member as Academic Co-ordinator/Nodal officer for the smooth conduct of FYUGP.
- ii. Advisory System: There shall be one Senior Faculty Advisor (SFA) for each department and one Faculty Advisor (FA) for 20 to 30 students of the class to provide advice in all relevant matters. The Head of the Department, in consultation with the SFA, shall assign FA for each student.
- iii. The documents regarding all academic activities of students in a class shall be kept under the custody of the FA/SFA.
- iv. All requests/ applications from a student or parent to higher offices are to be forwarded/recommended by FA/SFA.
- v. Students shall first approach their FA/ SFA for all kinds of advice, clarifications, and permissions on academic matters.
- vi. It is the official responsibility of the institution to provide the required guidance, clarifications, and advice to the students and parents strictly based on the prevailing academic regulations.
- vii. The SFA shall arrange separate or combined meetings with FA, faculty members, parents, and students as and when required and discuss the academic progress of students.
- viii. The FA/SFA shall also offer guidance and help to solve the issues on academic and non-academic matters, including personal issues of the students.
- ix. Regular advisory meetings shall be convened immediately after the commencement of the semester and immediately after announcing the marks of the Continuous Comprehensive Assessment (CCA).
- x. The CCA related results shall be uploaded on the College portal only after displaying the same on the department notice board/other official digital platforms of the college at least for two working days.
 - i. Any concern raised by the students regarding CCA shall be looked into in the combined meetings of advisors, HoD, course faculty, and the students concerned.
 - ii. If the concerns are not resolved at the advisor's level, the same can be referred to the properly constituted department-level grievance redressal committees
 - iii. The HOD shall ensure the proper redressal of the concerns raised by the

students regarding CCA.

- iv. If the students raise further concerns about the issue, the Principal shall refer the issue to the College-level grievance committee with proper documents and minutes of all the committees.
- xi. The FA/SFA shall be the custodian of the minutes and action taken reports of the advisory meetings. The SFA shall get the minutes and action taken reports of advisory meetings approved by the Head of Department and the Principal. It shall be the duty of the HoD and the Principal to produce them before the Governing body of the College as and when required.
- xii. The Principal shall inform/forward all regulations, guidelines, communications, announcements, etc. issued by the University regarding student academic and other matters to the HODs/ SFA for information and timely action.
- xiii. It shall be the official responsibility of the Principal to extend the required administrative and financial support to the HODs, SFAs and FAs to arrange necessary orientation programmes for students regarding student counselling, the prevailing College norms, regulations, guidelines and procedures on all academic and other College related matters.
- xiv. An integrated educational planning and administration software will be made available by the College to manage the academic information of all students. Which include student admissions and registration, managing student personal and academic information, course registrations, attendance management, all process related to assessments including regular & online examinations, grading, publishing of results, supplementary examinations, LMS, stakeholders' feedback, etc.
- xv. Faculty, staff, students, and parents shall be allowed to access this software system over a highly secure authenticated mechanism from within the campus and outside the campus.

7. Course Registration

- i. Each department shall publish well in advance the relevant details of courses offered, such as the name, academic level, expected outcomes, time slot, and course faculty members.
- ii. Students shall be allowed to visit and interact with respective faculty members during the first week of each semester, to gather more information about the courses and the availability of seats.
- iii. Based on consultations and advice from the faculty adviser, each student shall

complete course registration within one week from the commencement of each semester.

- iv. The number of credits that a student can take in a semester is governed by the provisions in these Regulations, subject to a minimum of 16 and a maximum of 30 Credits.
- v. A student can opt out of a Course or Courses registered, subject to the minimum Credit/ Course requirement, if he/she/they feel that he/she/they has registered for more Courses than he/she/they can handle, within 30 days from the commencement of the semester. An option can be given to the student to convert this course as audit course if he/she/they wishes to do so.
- vi. The college shall publish a list of the students registered for each course including audit course, if any, along with the chosen Programmes, repeat/reappearance courses, if any, and shall forward the same to the university.
- vii. The higher education institutions shall admit candidates not only for programmes, but also for courses.

8. Re-admission and Scheme Migration

- i. Students who opt out before the completion of the third year shall be provided with a 'Course cum Credits Certificate' after the successful completion of a semester as proof for re-entry to another institution.
- ii. Students who have successfully completed a particular programme pathway maybe permitted to take an additional minor or second major.
- iii. Those students who are opting for a second major are eligible for getting certain credit transfer/ credit exemption from their previous minor programs of study, subject to the prior recommendation of the BoS that, those credits are relevant for the present major programme of study.

9. Duration of Programmes, Credits Requirements and Options

- i. Students will be offered the opportunity to take breaks during the programme and resume after the break, but the total duration for completing the FYUG programme shall not exceed 7 years.
- ii. Students who wish to complete the undergraduate programmes faster may do so by completing different courses equivalent to the required number of credits and fulfilling all other requirements in N-1 semesters, where N is the number of semesters in the FYUGP.

- iii. Provided further that the students may complete the undergraduate programme in slower pace, they may pursue the three years or six semester programme in 4 to 5 years (8 to 10 semesters), and four years, or eight semester programme in 5 to 6 years (10 to 12 semesters) without obtaining readmission.
- iv. For students who crossed 6 semesters at a slower space, the requirement of 16 credits per semester from the institutions where they enrolled may be relaxed.

10. Credit Structure

The proposed number of credits per course and the credit distribution of them for the FYUG Programmes are given below-

- i. An academic year shall consist of 200 working days; one semester consists of 90 working days; and an academic year consists of two semesters.
- ii. Ten working days in a semester shall be used for extracurricular activities. One semester consists of 18 weeks with 5 working days per week. In each semester, 15 days (3 weeks) should be kept aside for End Semester Evaluation (ESE) and CCA.
- iii. The maximum number of available weeks for curriculum transactions should be fixed at 15 in each semester. A minimum of 5 teaching or tutorial hours could be made available for a day in a 5-day week.
- iv. A course that includes one hour of lecture/ tutorial or two hours of lab work/practical work/fieldwork/practicum per week is given one credit hour.
- v. One credit in a semester should be designed for 15 hours of lectures/ tutorials or 30 hours of lab work/ practical work/ field work/ practicum and 30 hours of learner engagement in terms of course-related activities such as seminar preparation, assignment submission, etc.
- vi. A one-credit seminar or internship or studio activities or field work/ projects or community engagement and service will have two-hour engagements per week (30 hours of engagement per semester).
- vii. A course can have a combination of Lecture (L)/ Tutorial (T)/ Practicum or Practical (P)/ & Others (O) credits.
- viii. Minimum credit for one Course should be 2 (Two), and the maximum credit should be 4 (Four).
- ix. All Discipline Specific Major/Minor Courses shall be of 4 (Four) credits.
- x. For all Discipline Specific Major/Minor Courses, there may be practical/practicum.

- xi. All Courses under the Multi-Disciplinary, Ability Enhancement, Value Addition and Skill Enhancement categories are of 3 credits. Practical/Practicum credits can also be included in this category.
- xii. Summer Internship, Apprenticeship, Community Outreach activities, etc. may require sixty hours (or as appropriate) of engagement for acquiring one credit.
- xiii. A student shall be able to opt for a certain number of extra credits over and above the requirements for the award of a degree.
- xiv. Maximum number of credits that a student can earn per semester shall be restricted to 30. Hence, a student shall have the option of acquiring credits to a maximum of 180 credits for a 3-year (6-semester) UG programmes and 240 credits for a 4-year (8-semester) programmes.
- xv. Each faculty member shall offer a maximum of 16 credits per semester. However, those who are offering both practical and theory courses shall offer a maximum of 12-16 credits per semester.
- xvi. For a four-credit theory course, 60 hours of lecture/ tutorial class shall be assured as a mandatory requirement for the completion of that course.

11. Course Structure of the SACA-UGP Programmes

The SACA-UGP consists of the following categories of courses and the minimum credit requirements for pathway option-one shall be as follows:

Sl. No.	Categorization of Courses for all Programmes	Minimum Number of Credit Required	
		3-yearUG	4-yearUG
1	Major	68	88
2	Minor	24	24+12*
3	Multi-Disciplinary Courses (MDC)	9	9
4	Skill Enhancement Courses (SEC)	9	9
5	Ability Enhancement Courses (AEC)	12	12
6	Value Addition Courses (VAC)	9	9
7	Summer Internship, field-based learning etc.	2	2
8	Research Project/Dissertation		12**
	Total Credits	133	177

*The students can acquire advanced/capstone level courses with 12 credits from their DSC/ DSE/ Minor courses depending upon their pathway choice. The Minor courses can be of level 300 or above.

** The students pursuing the 4-year honours with research have to complete a capstone project with 12 credits and for the 4-year honours degree students have to complete a project with 12 credits. Those honours students who are not doing capstone project shall do three courses at the level 400 or above or three vocational training courses or internships for 12 credits.

- i. 20% syllabus of each course will be prepared by the teacher as 'Teacher Specific Content' and will be evaluated under CCA.
- ii. In case of MDC, SEC, VAC courses coming under 3rd & 4th semester, college should make necessary arrangements to give adequate preference to courses designed by language departments. MDC in the 3rd semester can be Kerala Specific Content.

12. Academic Levels of Pathway Courses

Semester	Difficulty level	Nature of Course
1&2	100-199	Foundation level or introductory courses
3&4	200-299	Intermediate level courses
5&6	300-399	Higher level courses
7&8	400-499	Advanced/Capstone level courses

13. Signature Courses

- i. With a prior recommendation of BoS and the approval of academic council, each faculty member can design and offer at least one signature course in every semester, which may be offered as DSE/SEC/VAC.
- ii. College may publish a list of their signature courses in DSE/ SEC/ VAC offered by their faculty members with a prior recommendation of BoS and the approval of Academic Council.
- iii. College may empanel distinguished individuals who have excelled in their field of specialization like science and technology, industry, commerce, social research, media, literature, fine arts, civil services etc. as adjunct faculty as per the UGC guidelines with the approval of the University/College. With a prior recommendation of BoS and the approval of academic council, the adjunct faculty can offer SEC/VAC as signature course.
- iv. Adhoc/ Guest faculty/ Visiting faculty/ Visiting Scholars can also offer DSE/SEC/

- VAC as signature courses with a prior recommendation of BoS and the approval of academic council.
- v. The faculty concerned may design the particular course and it should be forwarded to the BoS after the approval of department council.
 - vi. The examinations and evaluation of the signature courses designed by the faculty shall be conducted by the faculty themselves and an external expert faculty chosen by the college from a panel of experts submitted by the faculty and recommend by the BoS concerned.

14. Programme Pathways and Curriculum Structure

Students who have joined for any programme under these regulations shall have the option to choose the following pathways for their UG degree and Honours programme.

- i. **Degree with single Major:** A student pursuing the FYUG programme in a specific discipline shall be awarded a Major degree if he secures at least 50% of the total credits in the specific discipline required for the award of the Degree in that Discipline.
Example: Physics Major/Economics Major/Commerce Major
- ii. **Degree Major with Minor:** If a student pursuing the FYUG Programme is awarded a Major Degree in a particular discipline, he/she/they are eligible to be awarded a Minor in another discipline of his choice, if he earns a minimum of 32 credits (approximately 25% of credit required for the three-year programme) from 8 pathway courses in that discipline.
Example: Physics Major with Chemistry Minor/ Chemistry Major with English Minor/ Commerce Major with Economics Minor/ English Major with Functional English Minor/Hindi Major with Malayalam Minor etc.
- iii. **Major with Multiple Disciplines of Study:** This pathway is recommended for students who wish to develop core competencies in multiple disciplines of study. In this case, the credits for the minor pathway shall be distributed among the constituent disciplines/ subjects. If a student pursuing FYUG Degree Programme is awarded a major Degree in a particular discipline, he/she/they are eligible to get mentioned his core competencies in other disciplines of his choice if he has earned 12 credits from the pathway courses of that discipline.
Example: Physics Major with Minors in Chemistry and Mathematics, Economics Major with Minors in History and English, Commerce Major with Minors in Economics and Statistics.
- iv. **Interdisciplinary Major:** For these programme pathways, the credits for the major and minor pathways shall be distributed among the constituent disciplines/subjects to attain core competence in the inter disciplinary programme.

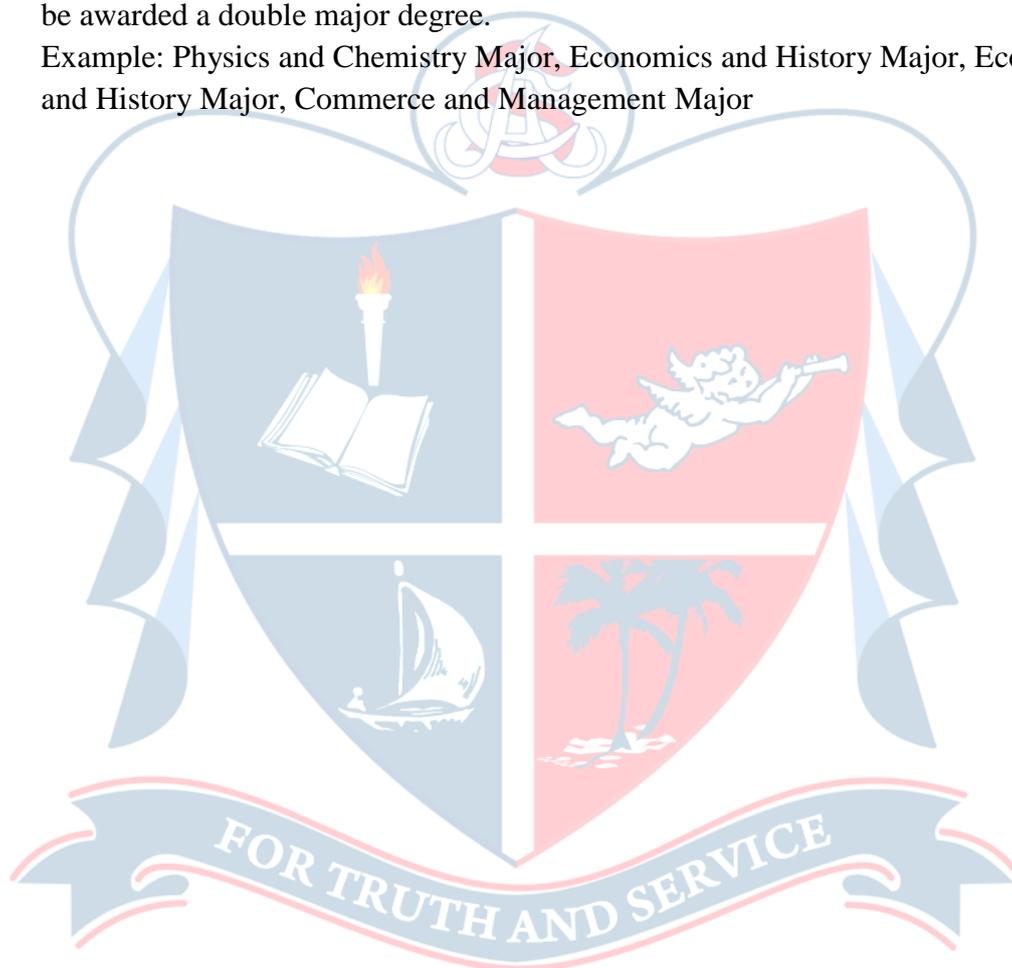
Example: Econometrics Major, Global Studies Major, Biostatistics Major.

- v. **Multi-Disciplinary Major:** For multidisciplinary major pathways, the credits for the major and minor pathways will be distributed among the broad disciplines such as Life Sciences, Physical Sciences, Mathematical and Computer Sciences, Data Analysis, Social Sciences, Humanities, etc.

Example: Life Science, Data Science, Nano Science.

- vi. **Degree with Double Major:** A student who secures a minimum of 50% credits from the first major will be awarded a second major in another discipline if he could secure 40% of credit from that discipline for the 3-year/ 4-year UG degree to be awarded a double major degree.

Example: Physics and Chemistry Major, Economics and History Major, Economics and History Major, Commerce and Management Major



Pathway Option1-Degree Major or Major with Multiple Disciplines of Study

Course Components	No. of Courses											Total	
	Semester 1	Semester 2	Semester 3	Semester 4	Internship of 2 Credits	Semester 5#	Semester 6#	Total	Remarks	Semester 7	Semester 8		Total
DSCA (4 Credit/ Course)	1(P)	1(P)	3 (2P)	3 (2P)			5	4	17	7 Out of 17 can be opted as DSE	3	2	22
DSCB&C (4 Credit/ Course)	2(P)	2(P)	1(P) (BorC)	1(P) (CorB)					6		3		9
Multidisciplinary Courses (MDC) (3 Credit/ Course)	1(P)	1(P)	1*						3	*Cannot opt from DSC			3
Ability Enhancement Courses (AEC) (3 Credit/ Course)	1 (English) 1 (OL)	1 (English) 1 (OL)							4				4
Skill Enhancement Courses (SEC) (3 Credit/ Course)				1*			1**	1**	3	*Cannot opt from DSCA **From DSCA only			3
Value Addition Courses (VAC) (3 Credit/ Course)			1*	1*				1**	3	*Cannot opt from DSCA **From DSCA only			3
Project/ Dissertation 12 credits for Honours with Research & 8 for Honours												12 (1 DSC /DSE for Honours)	
Total Courses	6	6	6	6			6	6	36		6	2+1	
Total Credits	21	21	22	22		2	23	22		Total Credits 133	24	20	Total Credits 177
Total Hours per Week	25	25	25	25		25	25		Exit option available	25	25		

Pathway Option 2 – Major with Minor

Course Components	No. of Courses											Total	
	Semester 1	Semester 2	Semester 3	Semester 4	Internship of 2 Credits	Semester 5#	Semester 6#	Total	Remarks	Semester 7	Semester 8		Total
DSCA (4Credit/ Course)	1(P)	1(P)	3 (2P)	3 (2P)			4	3	15	7 Out of 15 can be opted as DSE	3	2	22
DSCB (4Credit/ Course)	2(P)	2(P)	1(P)	1(P)			1	1	8	1 Out of 8 can be opted as DSE	3		11
Multidisciplinary Courses (MDC) (3Credit/ Course)	1(P)	1(P)	1*						3	*Cannot opt from DSC			3
Ability Enhancement Courses (AEC) (3Credit/ Course)	1 (English) 1 (OL)	1 (English) 1 (OL)							4				4
Skill Enhancement Courses (SEC) (3Credit/ Course)				1*			1**	1**	3	*Cannot opt from DSCA **From DSCA only			3
Value Addition Courses (VAC) (3 Credit/ Course)			1*	1*				1**	3	*Cannot opt from DSCA **From DSCA only			3
Project/ Dissertation 12 credits for Honours with Research & 8 for Honours												12 (1DSC/ DSE for Honours)	
Total Courses	6	6	6	6			6	6	36		6	2+1	
Total Credits	21	21	22	22		2	23	22		Total Credits 133	24	20	Total Credits 177
Total Hours per Week	25	25	25	25		25	25		Exit option available	25	25		

Pathway Option 3 – Double Major

Course Components	No. of Courses											Total	
	Semester 1	Semester 2	Semester 3	Semester 4	Internship of 2 Credits	Semester 5#	Semester 6#	Total	Remarks	Semester 7	Semester 8		Total
DSC A (4 Credit/ Course)	1(P)	1(P)	2(2P)	2(1P)			4	3	13	7 Out of 13 can be opted as DSE	3	2	18
DSC B (4 Credit/ Course)	2(P)	2(P)	2(1P)	2(2P)			1	1	10	2 Out of 10 can be opted as DSE	3		13
Multidisciplinary Courses (MDC) (3 Credit/ Course)	1(P)	1(P)	1*						3	*Cannot opt from DSC			3
Ability Enhancement Courses (AEC) (3 Credit/ Course)	1 (English) 1 (OL)	1 (English) 1 (OL)							4				4
Skill Enhancement Courses (SEC) (3 Credit/ Course)				1			1	1	3				3
Value addition Courses (VAC) (3 Credit/ Course)			1	1				1	3				3
Project/Dissertation 12 credits for Honours with Research & 8 for Honours											12 (1 DSC/DSE for Honours)		
Total Courses	6	6	6	6		6	6	36		6	2+1		
Total Credits	21	21	22	22	2	23	22		Total Credits 133	24	20	Total Credits 177	
Total Hours per Week	25	25	25	25		25	25		Exit option available	25	25		

15. Guidelines for Acquiring Credit from Other Institutions/Online/Distance Mode

- i. A student shall register to a minimum of 16 credit per semester from the college/ department where he/ she/ they is officially admitted for a particular programme. However, students enrolled for a particular programme in one institution can simultaneously enrol for additional credits from other HEIs within the University or outside the University subject to a maximum of 30 credits per semester including the 16 institutional credits.
- ii. The College shall publish a list of courses that are open for admission for students from other institutions well in advance before the commencement of each semester.
- iii. Each BoS shall prepare and publish a list of online courses at different levels before the commencement of each semester offered in various online educational platforms recognized by the academic council of the College, which can be opted by the students for acquiring additional credits.
- iv. Each BoS shall prepare and publish a list of allied/relevant pathway courses before the commencement of each semester offered by other Board of Studies that can be considered as pathway courses for major/minor for their disciplines at different levels.
- v. At the end of each, the semester College will include the credit acquired by the student through online courses in their semester grade cards subject to a maximum of 30 credits.

16 Attendance

- i. A student shall be permitted to register for the end-semester evaluation of a specific course to acquire the credits only if he/ she has completed 75% of the prescribed classroom activities in physical, online, or blended modes, including any other activities as specified by the faculty coordinator of that particular course.
- ii. A student is eligible for attendance as per the existing university and government orders which includes participation in a meeting, or events organized by the college or the university, a regularly scheduled curricular or extracurricular activity prescribed by the college or the university. Due to unavoidable or other legitimate circumstances such as illness, injury, family emergency, care-related responsibilities, bad or severe weather conditions, academic or career-related interviews, students are eligible for authorized absence. Apart from this, all other eligible leave such as maternity leave, and menstrual leave shall also be treated as authorized absences.
- iii. The condonation facility can be availed as per the College norms.

17. Workload

- i. The workload of a faculty who offers only lecture courses during an academic year shall be 32 credits.
- ii. The workload of a faculty offering both practical courses and theory courses may be between 24-32 credits per academic year.
- iii. An academic year shall consist of two semesters.
- iv. To protect the existing language workload, college should make necessary arrangements to give adequate preference to those courses designed by language departments coming under MDC, SEC and VAC of 3rd & 4th semester.
- v. Programme wise workload calculation will be as per the FYUGP workload ordinance 2024.
- vi. The teachers given the administrative responsibilities in the department and college level may give a relaxation in their workload as specified in the UGC regulations 2018.

18. Credit Transfer and Credit Accumulation

- i. College will establish a digital storage (DIGILOCKER) of academic credits for the credit accumulation and transfer in line with ABC.
- ii. The validity of credits earned shall be for a maximum period of seven (7) years or as specified in the university/UGC regulations.
- iii. The students shall be required to earn at least 50% of the credits from the College.
- iv. Students shall be required to earn the required number of credits as per any of the pathway structure specified in this regulation for the award of the degree

19. Outcome Based Approach

The curriculum will be designed based on Outcome Based Education (OBE) practices. The Graduate Attributes (GA) and Programme Outcomes (PO) are provided in appendix-1. The OBE based syllabus template is provided in appendix-2.

20. Assessment and Evaluation

- i. The assessment shall be a combination of Continuous Comprehensive Assessment (CCA) and an End Semester Evaluation (ESE).
- ii. 30% weightage shall be given for CCA. The remaining 70% weight shall be for the

ESE.

- iii. Teacher Specific Content will be evaluated under CCA.
- iv. CCA will have two subcomponents: Formative Assessment (FA) and Summative Assessment (SA). Each of these components will have equal weightage and must be conducted by the course faculty/course coordinator offering the course.
- v. FA refers to a wide variety of methods that teachers use to conduct in-process evaluations of student comprehension, learning needs, and academic progress during a lesson, unit, module or course. FA is to encourage students to build on their strengths rather than fixate or dwell on their deficits. FA can help to clarify and calibrate learning expectations of students. FA will help students become more aware of their learning needs, strengths, and interests so they can take greater responsibility for their educational growth. FA will be the prerogative of the course faculty/course coordinator based on specific requirement of the student.
- vi. Suggested methods of FA are as follows: (any one or in combination could be followed as decided by the course faculty/course coordinator)
 - a. Practical assignment
 - b. Observation of practical skills
 - c. Viva voce
 - d. Quiz
 - e. Interview
 - f. Oral presentations
 - g. Computerized adaptive testing
 - h. In-class discussions
 - i. Group tutorial work
 - j. Reflection writing assignments
 - k. Home assignments
 - l. Self and peer Assessments
 - m. Any other method as may be required for specific course/student by the Course faculty/course coordinator
- vii. Summative Assessments (SA) are used to evaluate student learning, skill acquisition, and academic achievement at the conclusion of a defined instructional period- typically at the end of a project, unit, module, course or semester. SA may be class tests, assignments, or project, used to determine whether students have learned what they were expected to learn. It will be based on evidence, collected

using single or multiple ways of assessment. The systematically collected evidence should be kept in record by course faculty/course coordinator and the marks should be displayed on the college notice board/ other official digital platforms of the college before the end semester examinations

- viii. The method of SA will be as follows: (any one as decided by the course faculty/course coordinator)
- a. Written test
 - b. Open book test
 - c. Laboratory report
 - d. Problem based assignments
 - e. Individual project report
 - f. Case study report
 - g. Team project report
 - h. Literature survey
 - i. Standardized test
 - j. Any other pedagogic approach specifically designed for a particular course by the course faculty/course coordinator.
- ix. A student may repeat SA only if there are any compulsive reasons due to which the student could not attend the assessment
- x. The prerogative of arranging a CCA lies with the course faculty/course coordinator with the approval of SACA-UGP Academic Committee based on justified reasons
- xi. The course faculty/ course coordinator shall be responsible for evaluating all the components of CCA. However, the university may involve any other person (External or Internal) for evaluation of any or all the components as decided by the Vice-Chancellor/Pro-Vice Chancellor from time to time in case any grievances are raised.
- xii. Written tests shall be precisely designed using a variety of tools and processes (e.g., constructed responses, open-ended items, multiple-choice), and the students should be informed about the evaluation modalities before the commencement of the course.
- xiii. The course faculty may provide options for students to improve their performance through continuous assessment mechanism.
- xiv. There shall be theory and practical examinations at the end of each semester.

- xv. Regarding evaluation, one credit may be evaluated for 25 marks in a semester; thus, a 4-credit course will be evaluated for 100 marks; and 2-credit courses for 50 marks. However, for tabulation purpose course with 1-credit will be evaluated for 50 marks and will be converted to 25 marks
- xvi. Odd semester examinations will be conducted by the institution and will be evaluated at the institution level. However, even semester examinations will be conducted and evaluated by internal and external faculty.
- xvii. Individual Learning Plans (ILPs) and/ or specific assessment arrangements may be put in place for differently abled students. Suitable evaluation strategies including technology assisted examinations/alternate examination strategies will be designed and implemented for differently abled students.
- xviii. Distribution of CCA & ESE will be as given below

Credit	CCA	ESE
4	30	70
3	25	50
2	15	35

21. Practical Examination

- i. The end semester practical examination will be conducted and evaluated by the institution.
- ii. There shall be a CCA of practical courses conducted by the course faculty course coordinator.
- iii. The scheme of evaluation of practical courses will be as given below:

Components for the Evaluation of Practical Courses	Weightage
CCA of practical/practicum.	30%
ESE conducted under the supervision of internal examiner	70%

- iv. Those who have completed the CCA alone will be permitted to appear for the ESE.
- v. For grievance redressal purposes, the university shall have the right to call for all the records of CCA.

vi. Duration of Examination

Questions shall be set as per the defined Outcome. The question setter shall ensure that there will be Time and Mode (T & M) flexibility for all External Examinations. BoS can recommend the T&M from the following list.

Mode	Time (in Hours)	
	Minimum	Maximum
Written Examination	1	2
Multiple Choice	1	1.5
Open Book	1	2
Any Other Mode	1	2

22. Evaluation of Project/Dissertation

The evaluation of project work shall be CCA with 30% and ESE 70%. The scheme of evaluation of the Project is given below

Components of Evaluation of Internship	Weightage	Marks for Internship 2 Credits / 50Marks
CCA	30%	15
ESE	70%	35

The department council may decide any mode for the completion of the Internship. If in case evaluation is not specified in any of the selected internship programme, institution can adopt a proper evaluation method as per the weightage specified in the table above.

23. Letter Grades and Grade Points

A Mark system is followed for evaluating each question. For each course in the semester, letter grades and grade points are introduced in a 10-point indirect grading system as per the guidelines given below,

- i. The Semester Grade Point Average (SGPA) is computed from the grades as a measure of the student's performance in a given semester. The SGPA is based on the grades of the current term, while the Cumulative Grade Point Average (CGPA) is based on the grades in all courses taken after joining the programme of study.
- ii. Based on the marks obtained, the weighted grade point will be mentioned in the student's grade cards.

Letter Grade	Grade Point	Percentage of Marks (Both Internal & External Marks put together)	Class
O (Outstanding)	10	95% and above	First Class with Distinction
A+ (Excellent)	9	Above 85% and below 95%	
A (Very good)	8	Above 75% and below 85%	
B+ (Good)	7	Above 65% and below 75%	First Class
B (Above average)	6	Above 55% and below 65%	
C (Average)	5	Above 45% and below 55%	Second Class
P(Pass)	4	Above 35% and below 45% Aggregate (external and internal put together) with a minimum of 30% in external	Third Class
F(Fail)	0	Below an aggregate of 35% or Below 30% in external evaluation	Fail
Ab (Absent)	0		Fail

- iii. When students take audit courses, they may be given pass (P) or fail (F) grade without any credits

24. Computation of SGPA and CGPA

The following method is recommended to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

- i. The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undertaken by a student in the semester, i.e.

$$SGPA(S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

Where S_i is the SGPA in the i^{th} semester, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

$$\text{SGPA} = \frac{\text{Sum of the credit points of all the courses in a semesters}}{\text{Total Credits in that semester}}$$

Illustration–Computation of SGPA

Semester	Course	Credit	Letter Grade	Grade point	Credit Point (Credit Grade)
I	DSC A	4	A	8	4x8=32
I	DSC B	4	B+	7	4x7=28
I	DSC C	4	B	6	4x6=24
I	MDC	3	B	6	3x6=18
I	AEC 1	3	O	10	3x10=30
I	AEC 2	3	C	5	3x5=15
	Total	21			147
	SGPA				147/21=7

- ii. The CGPA is also calculated in the same manner considering all the courses undertaken by a student over all the semesters of a programme i.e.

$$\text{CGPA} = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

Where S_i is the SGPA in the i^{th} semester, C_i is the total number of credits in the i^{th} semester.

CGPA

$$= \frac{\text{Sum of the credits of all the courses in six/eight semesters}}{\text{Total Credits in Six(133)/Eight(177) semesters}}$$

- iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

25. Committees to be Constituted for the Implementation and Monitoring of SACA-UGP

- i. There shall be a college level SACA-UGP Academic Co-ordinator/Nodal Officer, academic committee and SACA-UGP department committee in each department.
- ii. The tenure of the college level committees will be 4 years.

SACA-UGP Academic Committee

- i. The Principal (Chairman)
- ii. Academic Co-ordinator/Nodal Officer (Convenor)
- iii. All the Heads of Departments in the college
- iv. Four teachers of the college representing different discipline nominated by the college council by rotation
- v. Not less than four experts/academicians from outside the college representing areas such as Industry, Commerce, Education, Sciences etc., to be nominated by the college council preferably from the alumni of the college
- vi. Three nominees of the affiliating University (not less than the designation of associate professor in a college/university department)

Functions of SACA-UGP Academic Committee

- i. Scrutinize, approve, and recommend to the University all the proposals submitted by the department committee with regard to the SACA-UGP such as, academic pathway, allowed syllabi enrichment/updation, details of elective courses, Online courses, blended teaching, courses offering to the students of other HEIs, panel of examiners, summative and formative evaluation tools proposed by the concerned course faculty, new courses and syllabus proposed by the faculty members as signature courses etc. The Academic Committee can differ on any proposal, and it shall have the right to return the matter for reconsideration to the concerned Department committee or reject it, after giving sufficient reasons to do so.
- ii. Scrutiny of all documents related to Teacher Specific Content.
- iii. Recommend to the College Governing Body for starting innovative programmes using the flexibility and holistic nature of the SACA-UGP curriculum framework

SACA-UGP Department Committee

- i. Head of the Department concerned (Chairman)
- ii. The entire faculties of the Department
- iii. Two subject experts from outside the college to be nominated by the MGU-UGP Academic Committee
- iv. One representative from industry/ corporate sector/ allied area relating to placement
- v. One meritorious alumnus of the department to be nominated by the department council
- vi. The department council of the SACA-UGP, may with the approval of the principal of the college, co-opt:
 - (a) Experts from outside the college whenever special courses of studies are to be formulated.
 - (b) Other faculty members of the same Faculty within the college

Functions of SACA-UGP Department Committee

- i. Prepare teacher specific content of syllabi for various courses keeping in view the objectives of the SACA-UGP and submit the same for the approval of the academic committee.
- ii. Scrutinize the signature course content and its evaluation techniques.
- iii. Suggest methodologies for innovative teaching and evaluation techniques.
- iv. Suggest panel of examiners to the academic committee.
- v. Coordinate research, teaching, extension and other academic activities in the department/college.

26. Proposed Options for Higher Studies for the Students of SACA-UGP

The following higher studies options at the level of post-graduation/research was described by UGC in the national higher education qualification framework;

- i. The two-year master programme will continue (with an option of having the second year devoted entirely to research) for those who have completed a 3-year UG programme under the SACA-UGP regulations.

- ii. For students who have completed a 4-year honours degree could complete their master programme within one year by acquiring the required credits as per the Post Graduate curriculum framework requirement.
- iii. For enrolling in a PhD programme the candidate should have acquired a master degree or a 4-year honours degree with research.

28. Power to Remove Difficulties

If any difficulty arises in giving effect to the provisions of these Regulations, the Principal may by order make such provisions not inconsistent with the Act, Statutes, Ordinances or other Regulations, which appears to him to be necessary or expedient for removing the difficulty. Every order made under this rule shall be subject to ratification by the Governing body.

29. Modifications to the Regulations

Not with standing anything contained in these Regulations, any amendments or modifications issued or notified by the University Grants Commission or the State Government, from time to time, shall be deemed to have been incorporated into these Regulations and shall constitute an integral part thereof.

Appendix-1

Graduate Attributes (GA) of St. Albert's College (Autonomous)

The fundamental premise underlying the learning outcomes-based approach to curriculum planning and development is that, higher education qualifications are awarded on the basis of demonstrated achievement of outcomes (expressed in terms of knowledge, understanding, skills, attitudes and values) and academic standards expected. The expected learning outcomes are used as reference points that would help formulate graduate attributes, qualification descriptors, programme outcomes and course outcomes which in turn will help in curriculum planning and development, and in the design, delivery and review of academic programmes. The graduate attributes of St. Albert's College (Autonomous) are:

GA1: Critical thinking and Analytical reasoning

Capability to analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories to develop knowledge and understanding; critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.

GA2: Scientific reasoning and Problem solving

Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and

reasoned perspective; capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

GA3: Multidisciplinary / interdisciplinary / trans disciplinary Approach

Acquire interdisciplinary / multidisciplinary / transdisciplinary knowledge base as a consequence of the learning they engage with their programme of study; develop a collaborative – multidisciplinary / interdisciplinary / transdisciplinary-approach to formulate constructive arguments and rational analysis for achieving common goals and objectives.

GA4: Intra and Interpersonal skills

Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team; lead the team to guide people to the right destination, in a smooth and efficient way.

GA5: Digital literacy

Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

GA6: Global citizenship

Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

GA7: Social Competency

Ability to contemplate on the impact of research findings on conventional practices, and a clear understanding of responsibility towards societal needs, and reaching the targets for attaining inclusive and sustainable development.

GA8: Equity, Inclusiveness and Sustainability

Appreciate equity, inclusiveness and sustainability and diversity; acquire ethical and moral reasoning and values of unity, secularism and national integration to enable to act as dignified citizens; able to understand and appreciate diversity (caste, ethnicity, gender and marginalization), managing diversity and use of an inclusive approach to the extent possible.

GA9: Lifelong Learning

Ability to acquire knowledge and skills, including learning how to gain knowledge,

that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of workplace through knowledge / skill development/ reskilling.

Programme Outcomes (PO)

PO1: Critical thinking and Analytical reasoning

Capability to analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories to develop knowledge and understanding; critical sensibility to lived experiences, with self-awareness and reflexivity of both the self and the society.

PO2: Scientific reasoning and Problem solving

Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective; capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

PO3: Multi-disciplinary/interdisciplinary/transdisciplinary Approach

Acquire interdisciplinary/multidisciplinary/transdisciplinary knowledge base, as a result of the learning they engage within their programme of study; develop a collaborative-multidisciplinary/ interdisciplinary/ transdisciplinary-approach to formulate constructive arguments and rational analysis for achieving common goals and objectives.

PO4: Communication Skills

Ability to express thoughts and ideas effectively in writing and in speech; communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.

PO5: Leadership Skills

Ability to work effectively and lead respectfully with diverse teams; setting direction, formulating an inspiring vision, building a team that can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.

PO6: Social Consciousness and Responsibility

Ability to contemplate on the impact of research findings on conventional practices, and a clear understanding of responsibility towards societal needs and reaching the targets for attaining inclusive and sustainable development.

PO7: Equity, Inclusiveness and Sustainability

Appreciate equity, inclusiveness and sustainability and diversity; acquire ethical and moral reasoning and values of unity, secularism and national integration to enable to act as dignified citizens; able to understand and appreciate diversity (caste, ethnicity, gender and marginalization), managing diversity and use of an inclusive approach to the extent possible.

PO8: Moral and Ethical Reasoning

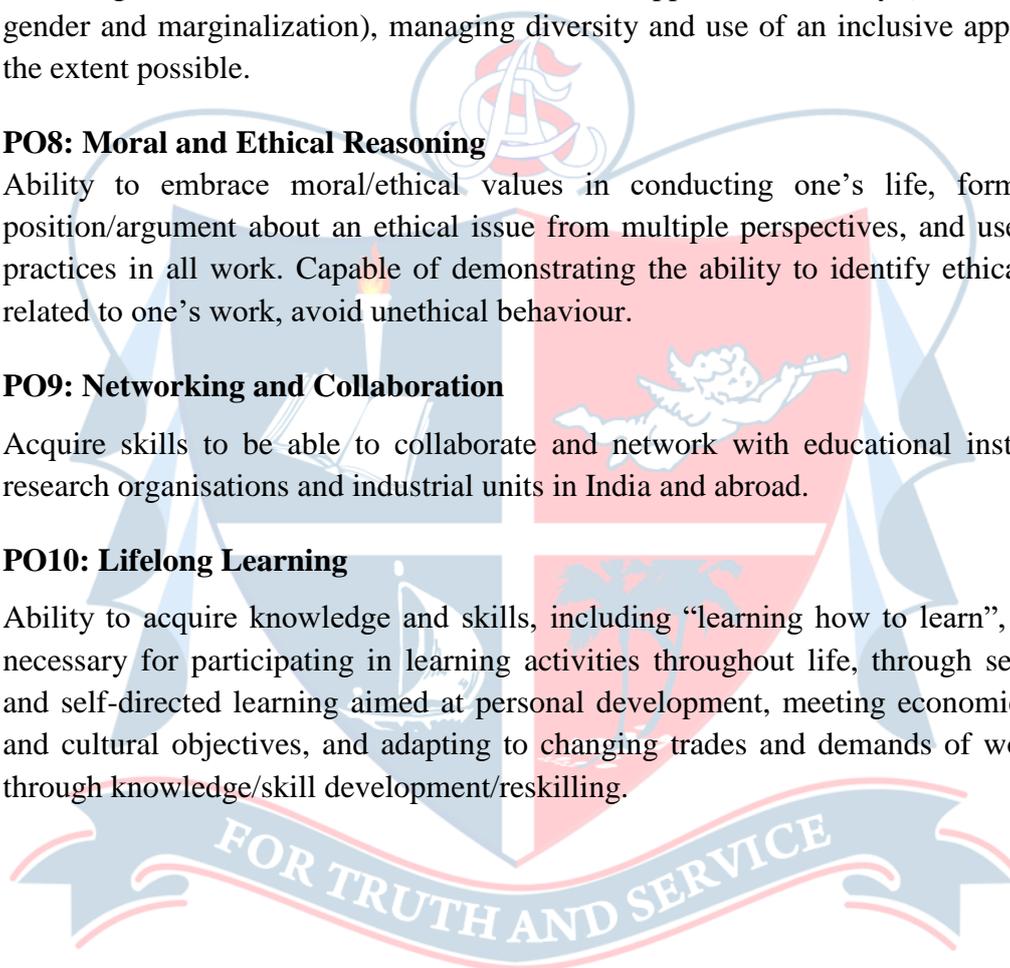
Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour.

PO9: Networking and Collaboration

Acquire skills to be able to collaborate and network with educational institutions, research organisations and industrial units in India and abroad.

PO10: Lifelong Learning

Ability to acquire knowledge and skills, including "learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of workplace through knowledge/skill development/reskilling.



Syllabus Index**SEMESTER 1**

Course Code	Title of the Course		Type of the course	Credit	Hours/Week	Hour Distribution/week			
						L	T	P	O
24SACBOT1DA101	Fascinating world of plant sciences		DSC A	3+1	5		3	2	
24SACBOT1DB101	Environmental Biology	For Environmental science minor	DSC B	3+1	5		3	2	
24SACBOT1DB102	Basic horticulture	For Horticulture minor	DSC B	3+1	5		3	2	
24SACBOT1MD101	Ecotourism		MDC	2+1	4		2	2	

SEMESTER 2

Course Code	Title of the Course		Type of the course	Credit	Hours/Week	Hour Distribution/week			
						L	T	P	O
24SACBOT2DA101	Plant resources and ventures in Botany		DSC A	3+1	5		3	2	
24SACBOT2DB101	Ecology	For Environmental science minor	DSC B	3+1	5		3	2	
24SACBOT2DB102	Plant propagation	For Horticulture minor	DSC B	3+1	5		3	2	
24SACBOT2MD101	Gardening and landscaping		MDC	2+1	4		2	2	

SEMESTER 3

Course Code	Title of the Course		Type of the course	Credit	Hours/Week	Hour Distribution/week			
						L	T	P	O
24SACBOT3DA201	Microbiology and Phycology		DSC A	3+1	5		3	2	
24SACBOT3DA202	Mycology and Plant pathology		DSC A	3+1	5		3	2	
24SACBOT3DE201	Ethnobotany and intellectual property rights	Any one	DSE	4	4		4		
24SACBOT3DE202	Herbal technology			4	4		4		
24SACBOT3DB201	Thallophytes and Archegoniates		DSC B	3+1	5		3	2	
24SACBOT3DB202	Natural resources and conservation	For Environmental Science minor	DSC B	3+1	5		3	2	
24SACBOT3DB203	Floriculture and Olericulture	For Horticulture minor	DSC B	3+1	5		3	2	
24SACBOT3MD201	Agri based micro enterprises		MDC	3	3		3		
24SACBOT3VA201	Bioethics and IPR		VAC	3	3		3		

SEMESTER 4

Course Code	Title of the Course		Type of the course	Credit	Hours/Week	Hour Distribution/week			
						L	T	P	O
24SACBOT4DA201	Archegoniates and ventures in Botany		DSC A	3+1	5		3	2	
24SACBOT4DA202	Plant Anatomy and Reproductive Botany		DSC A	3+1	5		3	2	
24SACBOT4DE201	Food science and quality control	Any one	DSE	4	4		4		
24SACBOT4DE202	Horticulture and post harvest technology		DSE	4	4		4		
24SACBOT4DB201	Introduction to flowering plants and their economic importance		DSC B	3+1	5		3	2	
24SACBOT4DB202	Environmental pollution and management	For Environmental science minor	DSC B	3+1	5		3	2	
24SACBOT4DB203	Fruit science	For Horticulture minor	DSC B	3+1	5		3	2	
24SACBOT4SE201	Biofertilizers and bio-control agents		SEC	3	3		3		
24SACBOT4VA201	Conservation Biology and sustainable development		VAC	3	3		3		
24SACBOT4IN201	Internship			2					

SEMESTER 5

Course Code	Title of the Course		Type of the course	Credit	Hours/Week	Hour Distribution/week			
						L	T	P	O
24SACBOT5DA301	Angiosperm systematics and economic Botany		DSC A	3+1	5		3	2	
24SACBOT5DA302	Plant Cell and Molecular Biology		DSC A	3+1	5		3	2	
24SACBOT5DE301	Plant Breeding and Plant genetic resources	Any one	DSE	4	4		4		
24SACBOT5DE302	Phytogeography, Forestry and Ecotourism		DSE	4	4		4		
24SACBOT4DE303	Plant Biotechnology	Any one	DSE	4	4		4		
24SACBOT5DE304	Green technology and sustainable development		DSE	4	4		4		
24SACBOT5DE305	Analytical techniques in Plant Sciences	Any one	DSE	4	4		4		

24SACBOT5DE306	Climate change and disaster management- Botanical perspective	DSE	4	4	4		
24SACBOT5SE301	Mushroom production and value addition	SEC	3	3	3		

SEMESTER 6

Course Code	Title of the Course	Type of the course	Credit	Hours/Week	Hour Distribution/ week			
					L	T	P	O
24SACBOT6DA301	Plant Physiology and Biochemistry	DSC A	3+1	5		3	2	
24SACBOT6DA302	Genetics and Evolutionary Biology	DSC A	4	4		4		
24SACBOT6DE301	Bioinformatics in Plant Sciences	Any one	DSE	3+1	5		3	2
24SACBOT6DE302	Plant chemical ecology		DSE	3+1	5		3	2
24SACBOT6DE303	Research methodology and Biometrics	Any one	DSE	3+1	5		3	2
24SACBOT6DE304	Plant Ecology, Conservation and Sustainable development		DSE	3+1	5		3	2
24SACBOT6SE301	Entrepreneurial Botany	SEC	3	3		3		
24SACBOT6VA301	Environmental Science and Human Rights	VAC	3	3		3		

SEMESTER 7

Course Code	Title of the Course	Type of the course	Credit	Hours/Week	Hour Distribution/ week			
					L	T	P	O
24SACBOT7CC401	Research methodology and Biostatistics	DCC	4	4		4		
24SACBOT7CC402	Advances and applications in Plant Science - Thallophytes	DCC	3+1	5		3	2	
24SACBOT7CC403	Advances and applications in Plant Science – Archegoniates	DCC	3+1	5		3	2	
24SACBOT7DE401	Agronomy, Horticulture and Agroforestry	DCE A	4	4		4		

24SACBOT7DE402	Plant Genomics		DCE A	4	4		4	
24SACBOT7DE403	Seed technology		DCE A	4	4		4	
24SACBOT7DA301	Ecology and Ecotourism	For Botany Minor	DSE B	4	4		4	
24SACBOT7DA302	Biological approaches and evolutionary trends in plants		DSE B	4	4		4	
24SACBOT7DA303	Biotechniques		DSE B	4	4		4	
24SACBOT7DA401	Environmental legislation and management	For Environmental science Minor	DSE B	4	4		4	
24SACBOT7DA402	Environmental conservation and management		DSE B	4	4		4	
24SACBOT7DA403	Remote sensing, GIS and EIA		DSE B	4	4		4	
24SACBOT7DA404	Medicinal and aromatic plants and spices	For Horticulture Minor	DSE B	4	4		4	
24SACBOT7DA405	Introduction to Soil Science		DSE B	4	4		4	
24SACBOT7DA406	Home gardening		DSE B	4	4		4	

SEMESTER 8

Course Code	Title of the Course	Type of the course	Credit	Hours/ Week	Hour Distribution/ week			
					L	T	P	O
24SACBOT8CC401	Plant metabolism	DCC	3+1	5		3	2	
24SACBOT8CC402	Plant Breeding and Plant propagation techniques					3	2	
24SACBOT8CE401	Phytochemistry and Pharmacognosy	DCE	3+1	5		3	2	
24SACBOT8CE402	Omics in Plant Sciences					3	2	
24SACBOT8CE403	Modern trends in Plant Systematics					3	2	
24SACBOT8CE404	Agroecology					3	2	
24SACBOT8CE405	Forest Botany					3	2	
24SACBOT8CE406	Aquatic Botany					3	2	

24SACBOT8CE407	Plant Bio-analytics and Advanced instrumentation			DCE	3+1	5		3	2	
24SACBOT8PR401	Project					8/12				

SIGNATURE COURSES

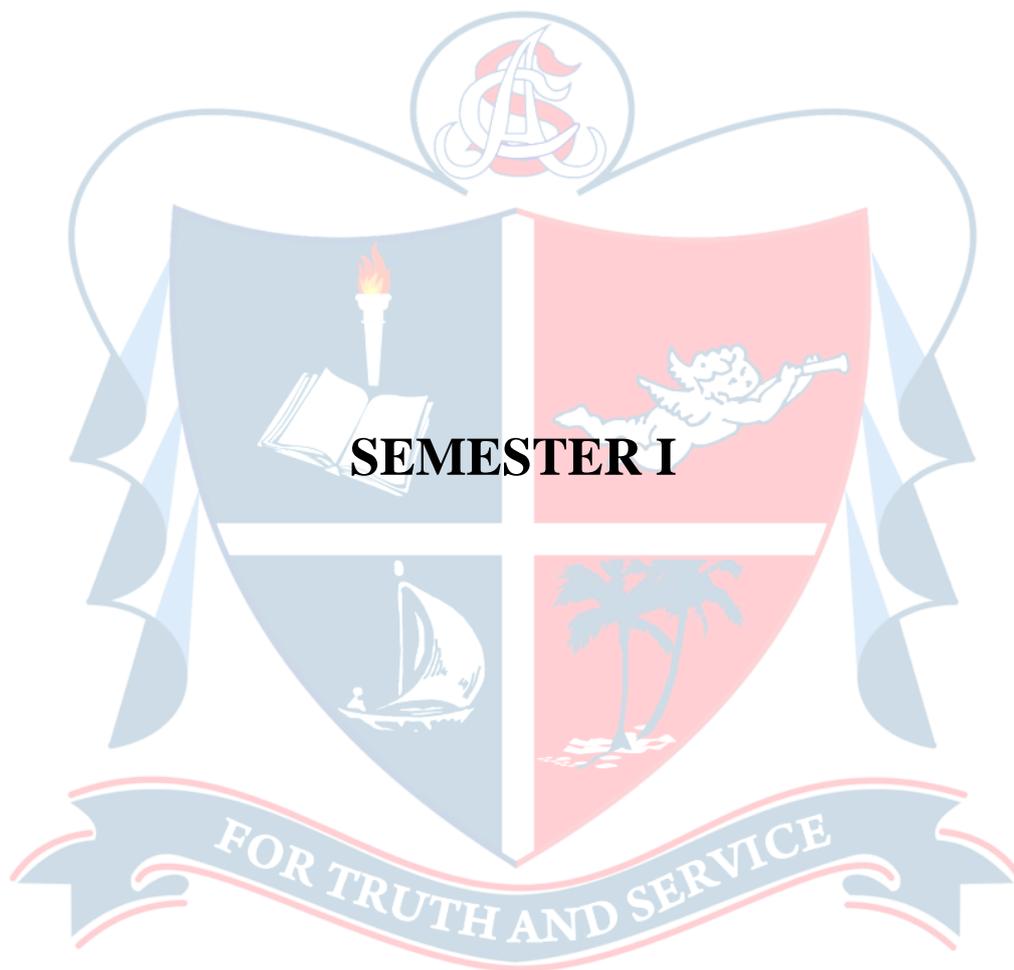
SEMESTER 5

Course Code	Title of the Course	Type of the course	Credit	Hours/Week	Hour Distribution/week			
					L	T	P	O
24SACBOT5DE307	Plant Interactions	DSE	4	4		4		
24SACBOT5DE308	Medicinal Plants for Primary Health Care	DSE	3+1	4		3	1	
24SACBOT5DE309	Plant Development	DSE	3+1	4		3	1	
24SACBOT5DE302	Bio-resources and Eco-technologies for Sustainable Development	SEC	3	3		3		
24SACBOT5SE303	Botanical illustration and Preservation techniques	SEC	4	4		4		

SIGNATURE COURSES

SEMESTER 6

Course Code	Title of the Course	Type of the course	Credit	Hours/Week	Hour Distribution/week			
					L	T	P	O
24SACBOT6DE305	Molecular Taxonomy and Systematics	DSE	3+1	5		3	2	
24SACBOT6DE306	Biological Techniques and Instrumentation	DSE	3+1	4		3	2	
24SACBOT6VA302	Plant Ecology & Essentials of Environmental Studies	VAC	3	3		3		



	<h2 style="margin: 0;">Department of Botany</h2> <h3 style="margin: 0;">St. Albert's College (Autonomous)</h3> <h3 style="margin: 0;">Ernakulam</h3>
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Programme	B.Sc.(HONOURS) BOTANY					
Course Name	FASCINATING WORLD OF PLANT SCIENCES					
Type of Course	DSC A					
Course Code	24SACBOT1DA101					
Course Level	100					
Course Summary	The course entitled 'Fascinating world of plant science and technology' aims to impart an understanding on the significance of plants to the future generation. Students will be familiarized with eminent botanists and their contributions to plant science. They will be introduced to the major plant groups and their uniqueness in terms of size, shape, habitat and associations. Students are expected to develop a passion to explore the plant kingdom as well as to make serious attempts to conserve plants. Knowledge about traditional and modern approaches in plant sciences and major branches related to plant science will also be acquired.					
Semester	I	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any	Should have basic knowledge of Botany and Botanical skills					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Comprehend the relevance of plants, important milestones in the history of botany, and human efforts to realize life on Earth.	U	PO 8, PO 10
2	Illustrate the diversity and evolutionary trends throughout the plant world that lay a solid foundation for the branch of natural philosophy, botany.	An	PO 2, PO 1

3	Develop basic skills on instruments and techniques used in Botanical studies.	A	PO 2, PO 5
4	Facilitate awareness on the areas of research and potentials in the field of plant science.	C	PO 3, PO 4
5	Design experiments and communicate ideas, which would translate into a lasting and practical basis for building a career.	C	PO 10, PO 8, PO 6
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Exploring the Plant Kingdom (15 Hours)				
1	1.1	A Journey Through Botanical History: Vistas in Plant Science / Botany. Contributions of eminent botanists: (a) Theophrastus, (b) Carl Linnaeus, (c) Janaki Ammal (d) Itty Achudan. Brief overview of Botany, citing events that changed the course of world history: Quinine Tree, Coconut, Rice, Sugarcane and <i>Penicillium notatum</i>	4	1
	1.2	Plants and the Planet: Medicine, food and fibre, timber (Natural and Processed), aesthetic value, maintaining ecological balance Learning Activity 1: Group Discussion on <ul style="list-style-type: none"> ●Usefulness and benefits of plants ●Significance of Plants as Purifiers of our planet. 	5	1
	1.3	Distinguishing characters and evolutionary trends in the morphology of major groups of plants: Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms. Learning Activity 2: An explorative nature walk to understand biodiversity of a selected locality: Paddy Field / Wetland ecosystem / Sacred Groves / Any other locality which harbors biodiversity and represents most of the major plant groups.	6	2
Wonders in Plant Kingdom and Traditional Approaches in Plant Science (15 Hours)				
2	2.1	Awe-inspiring members of the plant world: Unusual foods: Fungi (Mushrooms), Lichen (<i>Parmelia</i>), <i>Chlorella</i> as food supplement in aerospace programmes.	7	2

	<p>Psychoactive plants and zoopharmacognosy: Marula plant (<i>Sclerocaryabirrea</i>); Lemurs eating tamarind and fig leaves.</p> <p>Biomimicry: Nature as model: Lotus effect technology in paint industry; <i>Citrus maxima</i> fruit wall inspired design of crash absorbing structures.</p> <p>Special Adaptations: Insectivorous plants, Heliotropism in sunflowers, Pseudocopulation strategy in orchids.</p> <p>Gigantic plants: e.g. <i>Sequoiadendron giganteum</i>.</p> <p>Plants that live in extreme environments: volcanoes: Haleakala silversword, desert: Saguaro cactus, arctic: Arctic poppy.</p>		
2.2	<p>Traditional approach and methods:</p> <p>(A) Exploration: Field Visit. (B) Collection of plant material: significance & tools used. (C) Preservation: Killing Agent: (Formalin), Fixing Agent: (FAA). Wet Preservation: Museum jar preservation. dry preservation: herbarium. (D) Free-hand sectioning: Transverse section (TS), Longitudinal section (LS)</p>	5	3
2.3	<p>(E) Description: Description of plants. (F) Classification: Artificial, Natural and Phylogenetic (Definition and One Example Each). (G) Documentation: Significance of scientific diagrams and field books.</p>	3	3
Modern Approaches and Scope of Plant Science (15 Hours)			
3	<p>3.1</p> <p>Modern Approaches:</p> <p>(A)Sectioning: Microtomy (Definition and purpose of rotary microtome, sledge microtome and ultramicrotome). (B) visualization techniques: parts and applications of simple & compound microscope, applications of electron microscope (SEM & TEM). (C) Separation techniques (Principle and Application): (i) Chromatography: TLC and Paper chromatography. (ii) Centrifugation: tabletop centrifuge and ultracentrifuge. (iii) Electrophoresis: agarose gel electrophoresis (AGE).</p>	6	3
	<p>3.2</p> <p>A few current approaches and applications:</p> <p>(A) Molecular techniques (General Account and Applications): PCR, DNA barcoding (B) Remote Sensing (Brief Account): Application of Remote sensing and GIS for mapping of natural resources. (C) Use of Internet of Things (IoT), Deep learning and artificial intelligence (AI): Detection of water stress and disease detection in smart/precision Farming.</p> <p>Learning Activity 3: Visit to a laboratory to familiarize</p>	5	3,5

		with a few of the instruments mentioned above.		
	3.3	Brief account and research potential in: Plant systematics, Ecology, Plant anatomy, Plant physiology, Genetics, Ethnobotany, Crop improvement & Plant genetic engineering	4	4,5
	Practical (30 hours)			
	4.1	Field Activities (Mandatory) Conduct a two days field trip and survey, to appreciate the diversity of plant kingdom and to identify plants belonging to all the major groups discussed in theory. Prepare a set of 12 geo-tagged photographs containing at least one representative from each Major group.	15	2
4	Laboratory Activities (Conduct Any Three)			
		Prepare a report and presentation on Botanists who made significant contributions to science.	2	1
		Familiarize students with a compound microscope and dissecting / simple microscope. Assess the magnifications of the microscope you are examining. Compare the real image (Naked eye) with the magnified virtual image of an appropriate plant specimen and make illustrations of magnified specimens.	3	3,5
	4.2	Prepare temporary, single stained hand sections (TS and LS; one each) of appropriate plant specimens for light microscopic studies.	2	3
		Design a working model for detecting Moisture of Soil / Temperature and Humidity of Air, utilizing Arduino microcontroller kit/ Raspberry pi or other microcontroller boards and appropriate sensors. Possibilities to utilize IoT, as part of the model may be explored, if needed.	4	3,5
	Prepare an extract of leaves of appropriate plant material and perform centrifugation using a table top centrifuge, decant to separate the pigments (Supernatant) from the debris (Pellet).	4	3	

Teaching and Learning Approach	Classroom Procedure (Mode of transaction)
	Classroom Procedure (Mode of transaction)
	Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.

Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks Involvement and responses in class room transactions Home Assignments/preparedness Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty</p>
	<p>B. Semester End examination</p> <p>Theory: 50 marks MCQ (20 out of 20): $20 \times 1 = 20$ Short Essay (4 out of 6): $4 \times 5 = 20$ Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks Practical based assessments: 30 marks Record: 5 marks</p>

References

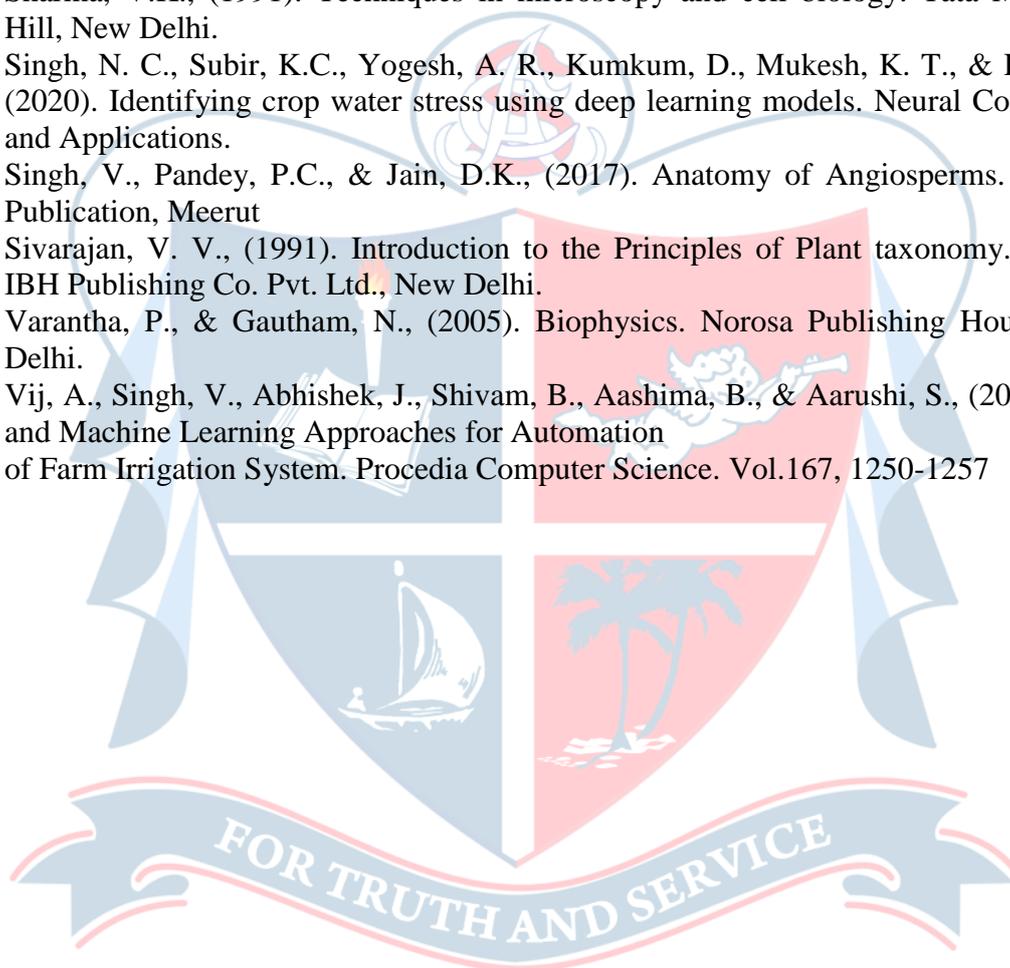
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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	B.Sc.(HONOURS) BOTANY					
Course Name	ENVIRONMENTAL BIOLOGY					
Type of Course	DSC B					
Course Code	24SACBOT1DB101					
Course Level	100					
Course Summary	This course provides students with an understanding on diverse group of plants, their survival and their interactions in different environments. Throughout the course, students will engage in discussions aimed at understanding the intricate relationships between living organisms and their environment, and the importance of sustainable practices to protect our planet's ecosystems.					
Semester	I	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the principles, scope and history of environmental science.	K, U	PO8, PO10
2	Compare the structure, function and characteristics of different types of ecosystems.	U	PO1, PO2
3	Analyze the biogeochemical cycles, trophic relations and productivity.	U, An	PO7, PO10

4	Describe various types of biodiversity and composition.	K, U	PO8, PO10
5	Define the various indicator species based on their status. Distinguish between biodiversity in-situ and ex-situ conservation. Analyze the depletion-causes and consequences of biodiversity.	U, An	PO2, PO8, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

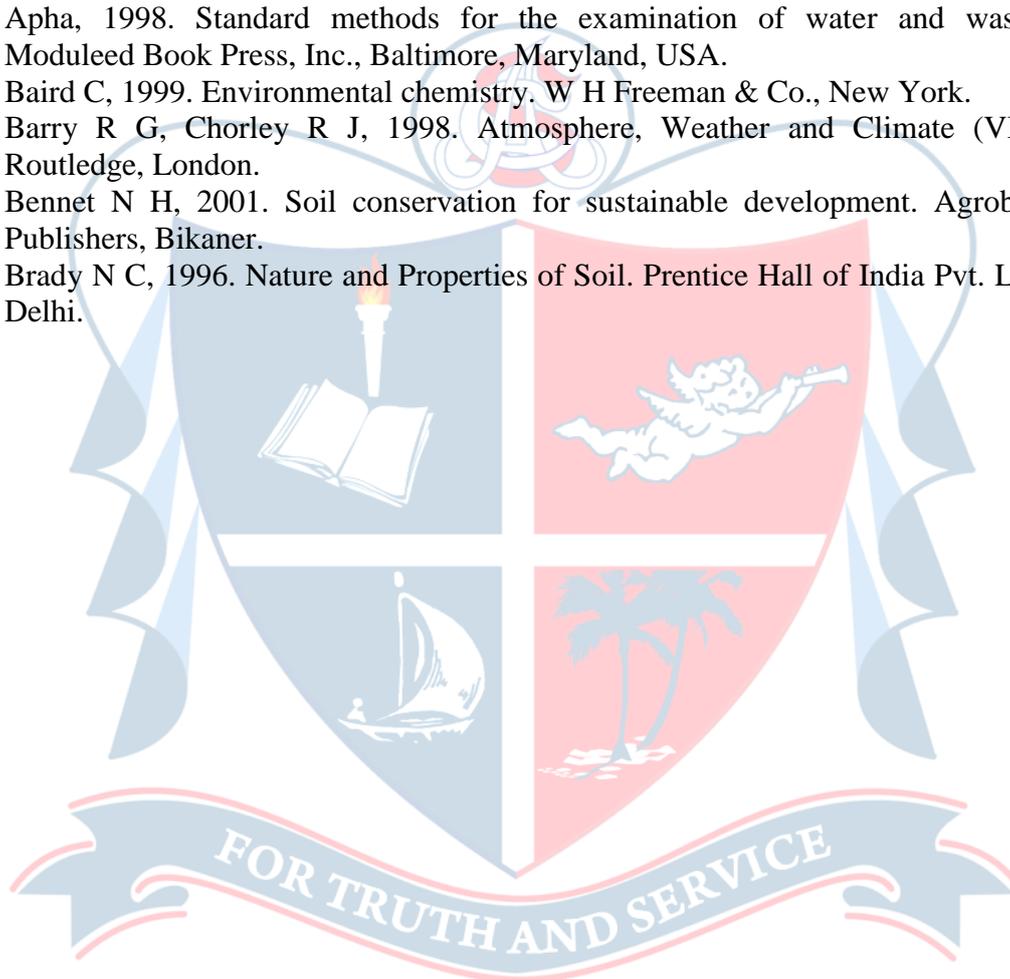
Module	Units	Course description	Hrs	CO No.
Environment and Ecology (15 hours)				
1	1.1	Definition, principles and scope of environmental science. History of ecology, subdivisions of ecology - autoecology and synecology.	5	1
	1.2	Ecosystems Definition, components, structure, function and size of ecosystems Types of ecosystems - aquatic and terrestrial ecosystems.	5	1
	1.3	Structure, function and characteristics of forest ecosystem - temperate and tropical forests, arctic and alpine forests, tundras. Grassland ecosystems – tropical and temperate. Desert ecosystem. Freshwater and marine ecosystem. Wetland ecosystem, mangrove ecosystem, estuarine ecosystem.	5	2
Ecosystem processes (15 hours)				
2	2.1	Nutrient cycles, energy flow, homeostasis in the ecosystem.	5	2
	2.2	Biogeochemical cycles (gaseous - C, N, O; sedimentary cycles – S, P).	5	2

	2.3	Trophic relations, food chain, food-web and ecological pyramids, concept and measurement of productivity.	5	2
3	Biodiversity and conservation (15 Hours)			
	3.1	Biodiversity Introduction, definition, types of biodiversity - species, genetic and ecosystem diversity.	5	3
	3.2	Biodiversity conservation Key stone species, flag ship species, endemic species, endangered species - flora and fauna, ecological foot prints, red data book.	5	3
	3.3	Biodiversity hotspots, biodiversity depletion-causes and consequences. Conservation of biodiversity – in-situ, ex-situ.	5	3
4	Practical (30 hours)			
	4.1	Aquatic ecosystems - survey, mapping, preservation, identification and abundance estimation of macrophytes, biomass and primary productivity; dissolved oxygen and pH.	8	
	4.2	Demonstration of various ecosystems.	7	
	4.3	Conservation Action Plan: Develop a proposal for a conservation initiative addressing a local biodiversity issue.	5	
	4.4	Field trip to biodiversity hotspot: Organize a visit to a local biodiversity-rich area (e.g., national park, wetland, or protected reserve) to observe and document various species, ecosystems, and their interdependencies.	10	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <p>Involvement and responses in class room transactions Home Assignments/preparedness Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks</p> <p>Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty</p> <hr/> <p>B. Semester End examination</p> <p>Theory: 50 marks</p> <p>MCQ (20 out of 20): $20 \times 1 = 20$ Short Essay (4 out of 6): $4 \times 5 = 20$ Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks</p> <p>Practical based assessments: 30 marks Record: 5 marks</p>

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Programme	B.Sc.(HONOURS) BOTANY					
Course Name	BASIC HORTICULTURE					
Type of Course	DSC B					
Course Code	24SACBOT1DB102					
Course Level	100					
Course Summary	Basic Horticulture is an introductory course designed to provide students with foundational knowledge and practical skills in plant cultivation, propagation, and care. The course covers essential concepts of plant biology, gardening techniques, and horticultural practices applicable to various plant types.					
Semester	I	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand horticulture and its branches, modern trends in horticulture	K	PO3
2	Differentiate living and non living components of a garden and different zones of India	U	PO2
3	Demonstrate garden operations	U	PO1
4	Illustrate recent trends in horticulture	A	PO4,PO5
5	Illustrate various propagation methods, including cutting, grafting, and division, showcasing	A	PO4,PO5

competence in plant propagation.	
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)	

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Introduction to Horticulture (5 Hours)			
1	1.1	Horticulture and its Importance	1	1
	1.2	Nature and scope. Objectives of horticulture. Branches of horticulture	2	1
	1.3	Fruit and vegetable zones of India. Career opportunities in horticulture	2	2
	Garden components and plant growing structures(15 Hours)			
2	2.1	Garden and its parts – Living and non-living components. Garden implements and tools.	5	2
	2.2	Gardening - different styles of gardening, Designing of Garden	5	2
	2.3	Plant growing structures – Greenhouse, Polyhouses, Hotbeds, Rain shelters - Structure and functions	5	2
	Garden operations and Recent trends in horticulture(20 Hours)			
3	3.1	Propagation – Cutting, Grafting, Layering, Budding, Micro propagation, Seedage	5	3
	3.2	Irrigation – Principles and methods	5	3
	3.3	Nutrient management – Principles and methods	2	3
	3.4	Modern tools in horticulture – Tractors, tillers, Lawn mower, Digger,	2	5

	3.5	Application of Artificial Intelligence in horticulture	2	5
	3.6	Modern Trend in horticulture- Aquaponics, Hydroponics, Aeroponics, Nutrient Film Technique.	4	5
	Practical (30 hours)			
4	4.1	Hands on training in Budding, layering and grafting Methods Preparation of potting Mixture Visit to well established plant nursery Visit to a well established garden	30	5
	4.2	Submit a report on different types of plant growing structures with photographs		
	4.3	Submit a photographed list of garden tools and its uses. Submit different types of garden designs.		

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Lecturing Assignment Group discussion Field visit</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks Involvement and responses in class room transactions Home Assignments/preparedness Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty</p>

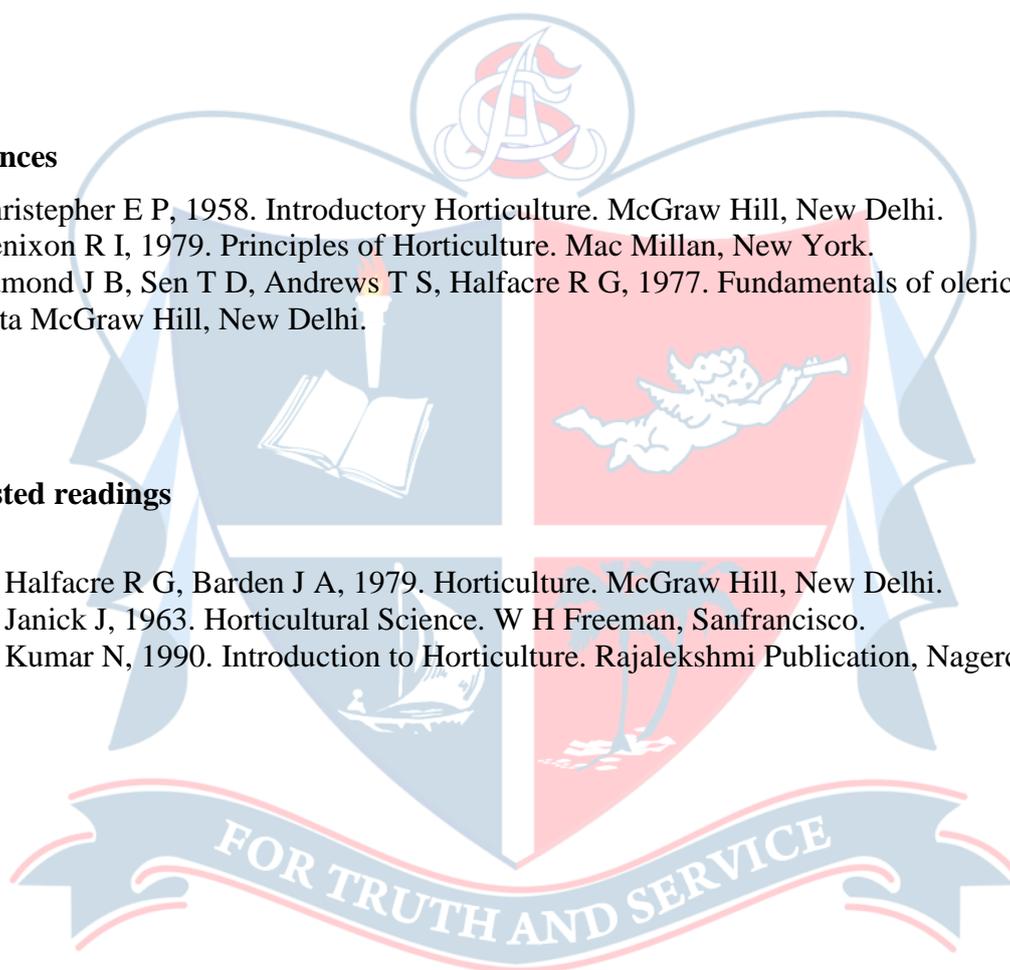
	<p style="text-align: center;">B. Semester End examination</p> <p>Theory: 50 marks MCQ (20 out of 20): 20 x 1=20 Short Essay (4 out of 6): 4 x 5= 20 Essay (1 out of 2) : 1x 10= 10</p> <p>Practical: 35 marks Practical based assessments: 30 marks Record: 5 marks</p>
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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	B.Sc.(HONOURS) BOTANY					
Course Name	ECOTOURISM					
Type of Course	MDC					
Course Code	24SACBOT1MD101					
Course Level	100					
Course Summary	The course titled "Ecotourism" provides a comprehensive exploration of sustainable tourism practices and their impact on the environment. The course describes the principle, scope, and role of ecotourism in achieving conservation goals, community engagement and benefits, ecotourism resources, planning steps of ecotourism and the role of international non-governmental organizations in ecotourism.					
Semester	I	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	-	1		60
Pre-requisites, if any	There are no specific prerequisites for this course.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the fundamental principles and concepts of ecotourism	U	PO1, PO10
2	Summarize the components of ecotourism and the role of NGOs in ecotourism	U	PO1, PO 8
3	Examine the characteristics and functioning of various centers of ecotourism in India	An	PO 4
4	Explain the role of ecotourism in livelihood security	E	PO 2, PO 6

5	Design an ecotourism plan and management of ecotourism initiatives from case studies from successful ecotourism projects.	C	PO 3, PO 4, PO 9
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

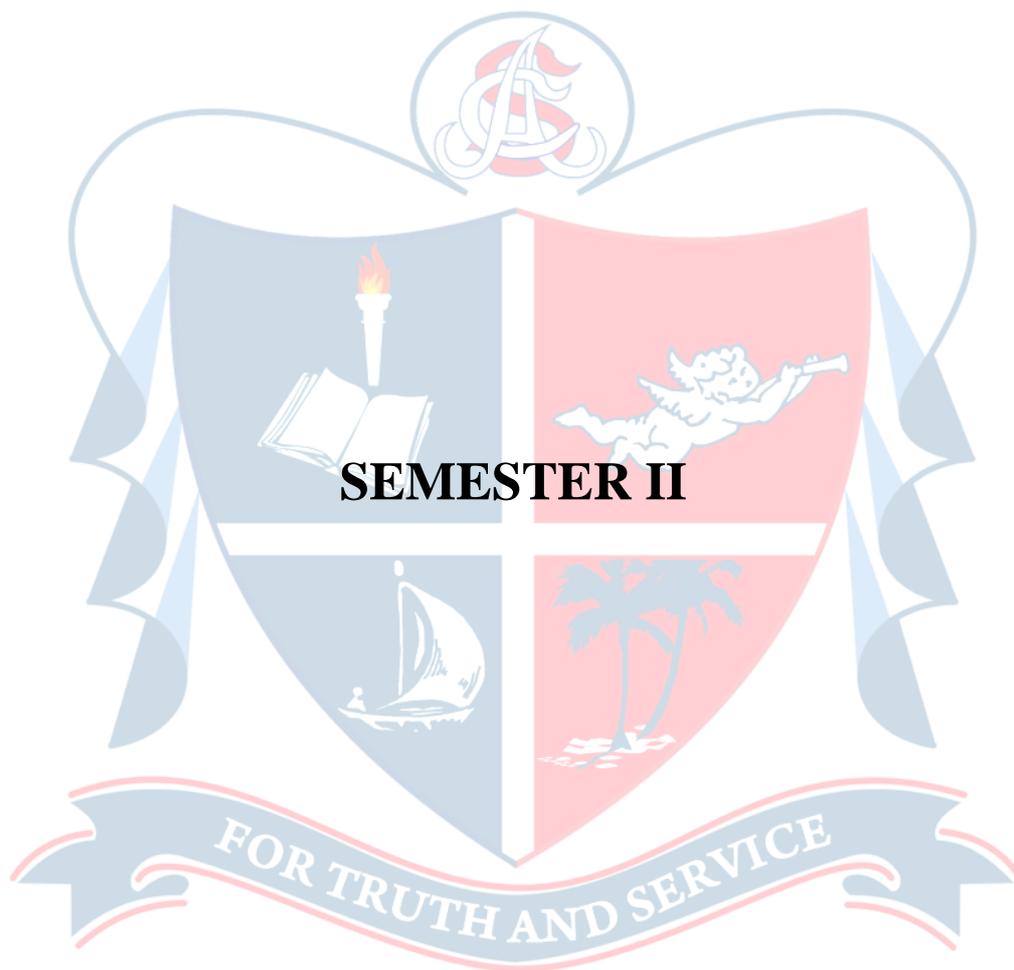
Module	Units	Course description	Hrs	CO No.
Introduction to Ecotourism and Biodiversity Conservation (15 hours)				
1	1.1	Definition, concept, principles, relevance and scope, do's and don'ts of tourists in ecotourism, ecotourism impact on the environment. Eco-friendly practices, responsible tourism, sustainable tourism.	3	1
	1.2	Components of ecotourism-biodiversity conservation, education, local people, environmental awareness, cultural diversity and respect, responsible marketing, economic and social benefits.	3	1
	1.3	Ecotourism Resources – Natural, Geographical, cultural, festivals, events and Natural heritage sites. Terms associated with ecotourism - Adventure tourism, geotourism, wildlife tourism, canopy walkway, ecolabelling, greenwashing, hydel tourism, Eco-lodges.	3	1,3
	1.4	Ecotourism activities -Adventure sports, cultural activities, educational workshops, Photography, community development.	2	3
	1.5	Biodiversity and its conservation – significance of in situ conservation, Protected areas – national parks, wildlife and bird sanctuaries, forest reserves, marine national park (Gulf of Mannar). Endemism and biodiversity Hotspots - Western Ghats as a source of Ecotourism	4	3
2	Ecotourism Prospects, Potential and Planning (15 hours)			
	2.1	Ecotourism prospects and potential of India, Ecotourism resources in India -Scope and destinations -Sundarbans, KazirangaNational Park.	3	3

	2.2	Ecotourism in Kerala, Ecotourism centres in Kerala, Wildlife tourism,	3	3
	2.3	Ecotourism Planning: Steps of Ecotourism Planning- Preliminary assessment, stakeholder engagement, ecotourism Goals and Objectives, carrying capacity, Infrastructure, visitors management, conservation of ecosystem in the area, community involvement and benefits.	4	4,5
	2.4	Ecotourism and livelihood security- Community-based ecotourism(CBET) a tool for conservation, challenges in CBET, Joint Forest Management	2	4
	2.5	Role of NGOs: Role of international agencies in ecotourism – The International Ecotourism Society (TIES), World Wide Fund for Nature (WWF) and United Nations World Tourism Organization (UNWTO).	3	
	Practical/ Field visits (30 hours)			
	3.1	Case study on Thenmala Ecotourism and Periyar Wildlife Sanctuary.	6	1, 3, 4,5
3	3.2	Field visit to an ecotourism site, observe and analyse the sustainable practices and submit a detailed report.	15	1,3,4,5
	3.3	Identify and prepare a checklist of some plant species, birds and animals having economic, ecological and cultural significance as an ecotourist attraction	4	1,3
	3.4	Examine the current state of natural resources and develop suitable messages and appropriate media for educating different target groups	5	1,4
4	Teacher-specific course components			
Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based studies and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.			

Assessment Types	MODE OF ASSESSMENT
	<p style="text-align: center;">A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks Involvement and responses in class room transactions Home Assignments/preparedness Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty</p> <hr/> <p style="text-align: center;">B. Semester End examination</p> <p>Theory: 35 marks MCQ: $10 \times 1 = 10$ Short Essay (3 out of 5): $3 \times 5 = 15$ Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks Practical based assessments: 30 marks Record: 5 marks</p>

References

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Department of Botany
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Programme	B.Sc.(HONOURS) BOTANY					
Course Name	PLANT RESOURCES AND VENTURES IN BOTANY					
Type of Course	DSC A					
Course Code	24SACBOT2DA101					
Course Level	100					
Course Summary	The course aims to impart knowledge on the importance of plants and plant based products in everyday life. Several plant resources based industries are successfully established in our society. Plethora of opportunities and innovations in plant science research are also discussed. Plant crafting and plant architect opportunities are explored. The course is designed to equip students with technical knowhow on business prospects and develop skills needed to successfully convert them into entrepreneurial ventures. On completion, learners will be able to develop ideas and enable them to be professionally competent so as to convert their ideas to successful business opportunities. This course aims at molding a successful entrepreneur through various avenues of Plant Science.					
Semester	II	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any	Should have basic knowledge on plants resources and its importance in everyday life					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify and assess plant resources in various contexts.	U	PO1, PO 3, PO 4, PO 6
2	Understand the problems and approaches in agriculture, health and in environmental contexts critically	U	PO 2, PO 3, PO 4, PO 6

3	Summarize the foundational knowledge about sustainable agriculture, horticultural activities, organic farming, nursery management and mushroom cultivation to human welfare.	U	PO 6, PO 7, PO 10
4	Develop an understanding of entrepreneurial opportunities in plant science and fostering an entrepreneurial mindset	C	PO 1, PO 2, PO 3, PO 5, PO 8
5	Reframe the significance of the plant world, gain insights into the potentials of personal prosperity and career opportunities in plant science.	E	PO 1, PO 2, PO 6, PO 10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to Plant Resources (15 Hours)				
1	1.1	Plants in everyday life: Importance as food, Source of medicine, Cultural and aesthetic value. Role of plants in maintenance of air water and soil quality, Plants as ecological indicators, Bio-control agents, Plant based bio manure, Plant-based bioplastics and Plant based biofuels.	2	1
	1.2	Plants as resource: A. Drug yielding plants: (General account with special reference to the following): Sarpagandha, Vinca and Pacific yew. B. Plant as staple food: Special reference to Rice, Cassava C. Plant as source of fiber: Cotton and Coir. D. Rubber yielding plants: India rubber figand Pará rubber tree. E. Plants yielding essential oils: Eucalyptus and lemongrass F. Plants in herbals and cosmetic formulations: Bhringaraj, Hibiscus, Red Sanders (Petrocarpussantalinus) G. Vegan Cosmetics: Cleanser: Neem, Cucumber, Rose Hair and Skin care products: Amla, Henna, Neem, Tulsi, Sandalwood, Turmeric H. Plant based Milk alternatives : Green Milk Prospects of Research and entrepreneurship	10	1

	1.3	Plant-based industries: Fruit production and processing: Dry Fruits and Canning. Fruit and Vegetable-based products: Squash, Syrup, Pulp, Paste, Ketchup, Soup, Vegetable Sauces, Jam and Jellies. Bamboo and Cane-based products. Production of Nutraceuticals.	3	1
	Exploring Plant Science Research and Plant Crafting (15 Hours)			
	2.1	Introduction to plant science research: Significance in addressing global challenges like: Climate change, Food Security, Biodiversity conservation	2	2
	2.2	Innovation in plant Science: (Mention only) Crop improvement-Flood resistant rice, Green Revolution (Norman Borlaug- high Yielding Wheat), Genetic engineering- Bt. Cotton, gene editing for disease resistance, Synthetic biology	2	2
2	2.3	Brief account on research institute in India, which identifies plant science / botany as a thrust area for investigation. Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), National Rice Research Institute (NRI), Indian Institute of Sugarcane Research (IISR), Institute of Forest genetics and Tree Breeding (IFGTB), Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), Kerala Forest Research Institute (KFRI), Central Plantation Crops Research Institute (CPCRI), Central Tuber Crops Research Institute (CTCRI), Rubber Research Institute of India (RRI) and various national and state Universities	2	2
	2.4	Introduction to Farming, gardening and Horticulture, Mushroom cultivation	2	3
	2.5	Basics of Organic Farming, gardening, garden types and components, Plant Propagation- Natural and Artificial; Budding Grafting and Layering, Floriculture and Flower arrangement	3	3
	2.6	Hands-on Training (Any Two): ●Mushroom cultivation	4	3

	<ul style="list-style-type: none"> ●Ornamental Plant Production (Budding / Grafting / Layering)/ ●Development of an artificially propagated plant and submit for valuation. ●Culturing of <i>Spirulina</i>. ●Tissue Culture. ●Flower arrangement <p>Activity 1 (Optional): Industrial Visit / Flower Show / Agricultural Fest / Farm Visit / Food or a Center that utilizes Post Harvest Processing</p>			
3	Insights into Botanical Entrepreneurship and Green Future (Towards Sustainable Future) (15 Hours)			
	3.1	Introduction to entrepreneurship: Definition and significance in the context of plant science. Basic traits and skills for entrepreneurs. Brief exploration of successful plant based startups and their impact- grow the Funguy, Vgrow, Jackfruit 360, Synthite, etc	3	4
	3.2	Identifying problems or opportunities within the plant science domain. Steps in the entrepreneurial journey: Overview of market assessment, enterprise selection, and resource mobilization. Schemes for Financial Assistance. Brief introduction to IPR, copyrights and GI tags.	4	4
	3.3	Role of Botanist in a Sustainable World: Who is a Botanist? How to Become a Botanist? Contrasting the life of a Botanist with a regular person? Roles of a Botanist. Skills of a Botanist (Understanding of Industry practice, Knowledge of the Core Subject, Teamwork, Problem-Solving, Analytical Skills, Domain Knowledge, Decision-Making skills, Research Abilities)	2	5
	3.4	Career paths in Botany: Few of the industries where a botanist can work: Research Lab/Institutions, Chemical Industry, Food Companies, Arboretum, Forest Services, Biotechnology Firms, Oil Industry, Land Management Agencies, Seed and Nursery Companies, Plant Health Inspection Services, National Parks, Biological Supply Houses, Plant Resources Laboratory and Educational Institutions	2	5
	3.5	Opportunities in Green World: General – (Scientific assistant, Plant geneticist, Computational biologist, Field botanist, Naturalist, Biotechnologist, Molecular Biologist, Nursery Manager, Plant Researcher, Teacher/Professor, Plant Pathologist, Ecologist, Plant Biochemist, Environmental Conservationist, Plant	4	5

		Microbiologist, Environment Consultant, Horticulturist, Plant explorer, Taxonomist, Cytologist, Biological Technician, Park Ranger, Nursery or GreenHouse manager, Farming consultant, Paleobotanist) Government opportunities: Staff Selection Commission (SSC), Institute of Banking Personnel Selection (IBPS) and State bank of India (SBI), Kerala Public Service Commission (PSC), Union Public Service Commission (UPSC)/Civil services, CDS exam, Junior research fellowship (JRF), senior research fellowship (SRF), National Eligibility Test (NET) and Indian Forest Service exam Activity 2: Conduct a one-day workshop for students to confer awareness on academic progression, research, career and entrepreneurial prospects and opportunities in Botany.		
Practical (30 hours)				
	4.1	Field Activities (Mandatory) ❖ Conduct one day industrial visit: To plant-based industry in your near vicinity. Prepare a detailed report on functioning, products and marketing with the support of proper evidence and Geo-tagged photographs	10	3
4	Laboratory Activities (Conduct five Two)			
		Make collections of plant products specified in the syllabus and submit	3	1
		Polybag cultivation of mushroom	2	3
		Demonstrate Air layering, T-budding and patch budding	2	3
	4.2	Select any start up initiative and prepare a report or present a mock up idea for an plant based entrepreneurship	2	4
		Culturing of <i>Spirulina</i> .	2	3
		Demonstration of tissue culture techniques: culture media, surface sterilization and inoculation of explants.	3	3
		Flower arrangement – fresh and dry	4	3
	Sample synopsis	2	5	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based studies and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks Involvement and responses in class room transactions Home Assignments/preparedness Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty</p>
	<p>B. Semester End examination</p> <p>Theory: 50 marks MCQ (20 out of 20): $20 \times 1 = 20$ Short Essay (4 out of 6): $4 \times 5 = 20$ Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks Practical based assessments: 30 marks Record: 5 marks</p>

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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	B.Sc.(HONOURS) BOTANY					
Course Name	ECOLOGY					
Type of Course	DSC B					
Course Code	24SACBOT2DB101					
Course Level	100					
Course Summary	The course aims to impart knowledge on the importance of plants and plant based products in everyday life. Several plant resources based industries are successfully established in our society. Plethora of opportunities and innovations in plant science research are also discussed. Plant crafting and plant architect opportunities are explored. The course is designed to equip students with technical knowhow on business prospects and develop skills needed to successfully convert them into entrepreneurial ventures. On completion, learners will be able to develop ideas and enable them to be professionally competent so as to convert their ideas to successful business opportunities. This course aims at molding a successful entrepreneur through various avenues of Plant Science.					
Semester	II	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any	Should have basic knowledge on plants resources and its importance in everyday life					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the definition, structure and characteristics of population. Describe the factors affecting population and population regulation.	K, U	PO1, PO3
2	Describe the concepts, structure, and gradients of community.	U, A	PO1, PO2

	Distinguish between the qualitative and quantitative characters of community.		
3	Understand the definition, classification, processes, and kinds of succession. Understand the concept of climax, theories and its significance. Relate different types of interactions between species.	U, A	PO1, PO10
4	Understand the definition of Evolution and Darwin's postulates.	U	PO1, PO3
5	Distinguish between various Environmental Factors.	U, An	PO1, PO6, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to Plant Resources (15 Hours)				
1	1.1	Definition, structure and measurements - density, growth, natality, mortality. Population dispersal and distribution, population growth.	5	1
	1.2	Factors affecting population, carrying capacity, population regulation.	2	1
Community Ecology (13 hours)				
2	2.1	Concepts of community, structure, community gradients - ecotone, edge effect, ecological niche, ecological equivalents, ecotypes.	4	2
	2.2	Characters of community: qualitative characters - floristic composition, stratification and periodicity.	4	2
	2.3	Quantitative characters - density, abundance and species diversity. Analysis - quadrat and transect method.	5	2
Ecological Succession (15 Hours)				
3	3.1	Definition, classification, processes - nivation, invasion or migration, competition, climax.	3	3
	3.2	Concept of climax, theories and significance. Kinds of succession - hydrosere and xerosere.	6	3

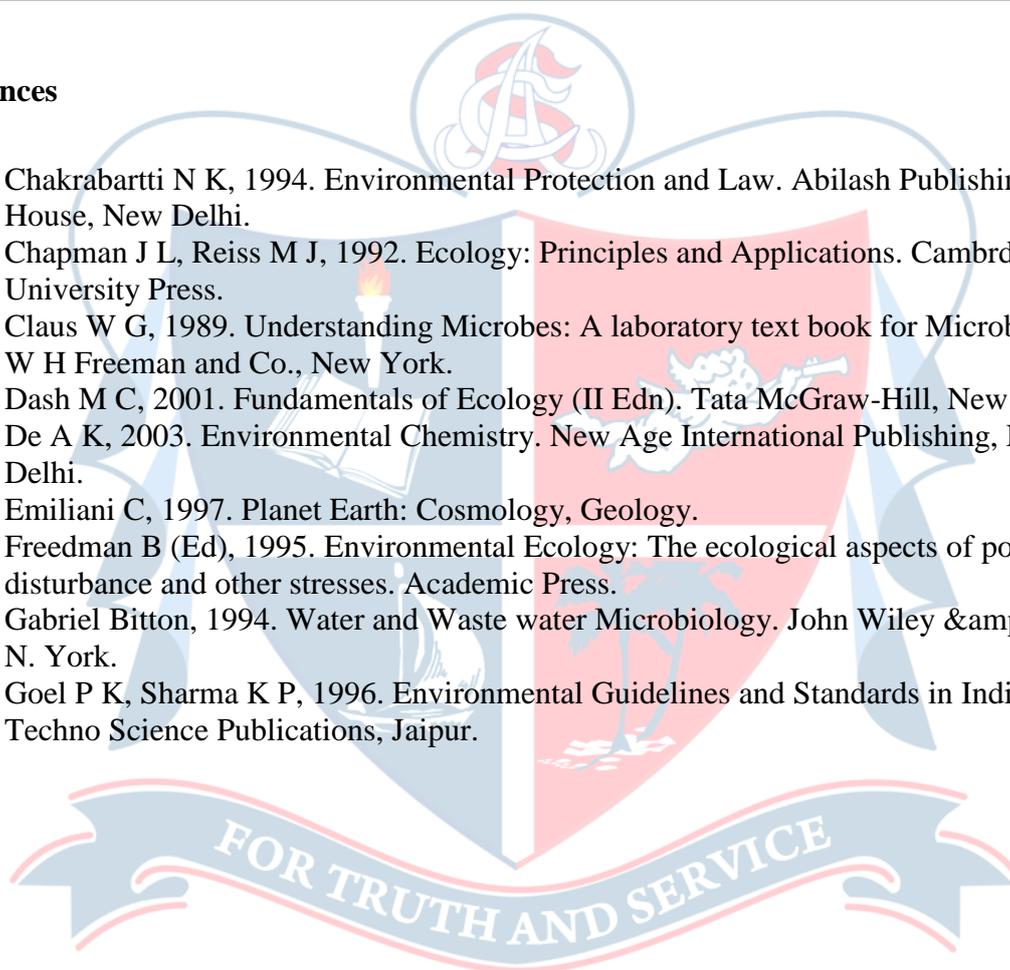
	3.3	Interactions between species: competition, predation, mutualism, commensalism, parasitism and allelopathy.	6	3
	Practical (30Hours)			
4	4.1	Vegetation analysis -association, diversity, frequency, density, productivity (primary) indirect estimation of standing crop.	10	
	4.2	Visit a conservation area (e.g. National park, wildlife sanctuary).	10	
	4.3	Demonstration of succession patterns.	10	
5	Teacher Specific component			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based studies and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <p>Involvement and responses in class room transactions Home Assignments/preparedness Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks</p> <p>Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty</p>

	<p style="text-align: center;">B. Semester End examination</p> <p>Theory: 50 marks MCQ (20 out of 20): 20 x 1=20 Short Essay (4 out of 6): 4 x 5= 20 Essay (1 out of 2) : 1x 10= 10</p> <p>Practical: 35 marks Practical based assessments: 30 marks Record: 5 marks</p>
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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	B.Sc.(HONOURS) BOTANY					
Course Name	PLANT PROPAGATION					
Type of Course	DSC B					
Course Code	24SACBOT2DB102					
Course Level	100					
Course Summary	The Plant Propagation Techniques course is designed to provide students with comprehensive knowledge and practical skills in propagating plants through various methods.					
Semester	II	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Outline different methods of propagation	R	PO2
2	Select suitable method of plant propagation	U	PO1, PO2
3	Employ the knowledge of plant propagation	A	PO2, PO7
4	Differentiate artificial, natural and micro propagation	A	PO2

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Introduction to plant propagation and natural propagation (15 Hours)				
1	1.1	Introduction to plant propagation- History, Importance, Different methods of plant propagation Natural (vegetative)method- Types, Advantages and disadvantages	5	1,2
	1.2	Propagation facilities: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons nursery - tools and implements.	5	4
	1.3	Identification and propagation by division and separation: Bulbs, pseudobulbs, corms, tubers and rhizomes; runners, stolon, suckers and offsets.	5	3
Artificial propagation (15 Hours)				
2	2.1	Artificial method- Introduction and types	5	2
	2.2	Cutting and layering- Principles and methods. Physiological and bio chemical basis of rooting; factors influencing rooting of cuttings; Use of plant growthregulators in rooting of cuttings.	5	3
	2.3	Budding and grafting- Principles and methods	5	3
Micropropagation (15 Hours)				
3	3.1	Micropropagation- Introduction, History	5	1
	3.2	Laboratory requirements and organization. Sterilization - filter, heat, wet and chemical. Media preparation - inorganic nutrients, organic supplements, carbon source, vitamins, gelling agents, phytohormones and growth regulators; composition of commonly used culture media (MS and Gamborg's)	5	1,2
	3.3	Methods of plant micropropagation- Organized and unorganized methods	5	3
4	Practicals (30 Hours)			

	4.1	Students should submit a report on natural propagules with live or preserved propagules Hands on training in Budding, layering and grafting Methods		
	4.2	Visit to a well established tissue culture lab		
5	Teacher Specific Module			

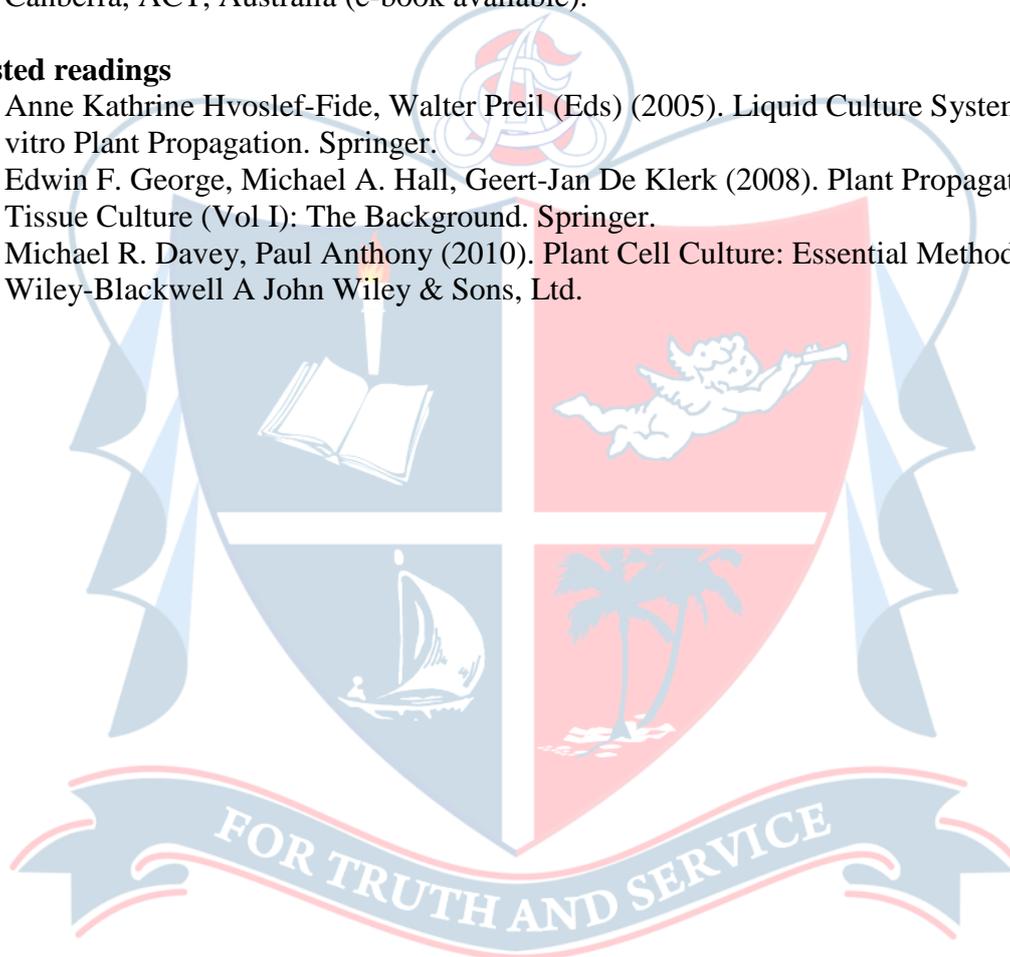
Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Lecturing Assignment Group discussion Field visit</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks Involvement and responses in class room transactions Home Assignments/preparedness Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty</p> <p>B. Semester End examination</p> <p>Theory: 50 marks MCQ (20 out of 20): $20 \times 1=20$ Short Essay (4 out of 6): $4 \times 5= 20$ Essay (1 out of 2) : $1 \times 10= 10$</p> <p>Practical: 35 marks Practical based assessments: 30 marks Record: 5 marks</p>

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3. Methods of Control, 4th edition, rootrot Press 22 Lynch Street, Hughes, Canberra, ACT, Australia (e-book available)
4. Selected Ornamentals, Fruit and Vegetables, 4th edition, rootrot Press 22 Lynch Street, Hughes, Canberra, ACT, Australia (e-book available)
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Suggested readings

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	B.Sc.(HONOURS) BOTANY					
Course Name	GARDENING AND LANDSCAPING					
Type of Course	MDC					
Course Code	24SACBOT2MD101					
Course Level	100					
Course Summary	This course provides a comprehensive exploration of gardening and landscaping principles, equipping students with the knowledge and skill to create and maintain beautiful sustainable outdoor spaces. Students will earn foundational knowledge in nursery management techniques, including propagation and soil preparation. The course will familiarise students with essential tools, components and structures used in garden designing. Exploring eco-friendly practices in garden design can contribute to environmental conservation.					
Semester	II	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	-	1		60
Pre-requisites, if any	Should have basic knowledge of Botany and Botanical skills					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Estimate the basics of ornamental and landscape gardening	An	PO3
2	Review the principles of gardening and nursery management	U	PO3, PO10
3	Recollect the basic knowledge of plant growth structures used in gardening	K	PO3

4	Explain various propagation techniques used in a nursery	U	PO3, PO10
5	Apply the knowledge of gardening and landscaping to design a garden	C	PO3, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to Gardening and nursery techniques (15 hours)				
1	1.1	Introduction to landscaping, gardening and commercial floriculture – importance and prospects	2	1
	1.2	Types of plants in landscaping– Trees, shrubs, climbers, annuals, herbaceous perennials, bulbous crops, palms, ferns, cacti & succulents, aquatic ornamentals.	2	1, 2
	1.3	Types of gardens- fruit garden, ornamental garden, herbal garden, kitchen garden, Kids Garden Indoor plants (Money plant, Snake plant, Monstera, ZZ plant, Aglaonema)	4	1, 2
	1.4	Horticultural practices related to gardening – training, pruning and mulching, its benefits. Nursery bed preparation	2	1, 2
	1.5	Vegetative propagation methods – natural and artificial cuttings – leaf, stem and root, layering–air layering, simple layering, grafting- approach grafting, Tongue grafting, budding- T budding, patch budding	5	4
Tools and structures in gardening and principles of Landscaping (15 hours)				
2	2.1	Nursery layout & structures: Polyhouse, mist chamber, rain shelter, potting shed, composting shed. Sprinkler irrigation.	3	3
	2.2	Gardening tools & implements Garden spade, rake, fork, garden shears, secateurs, grafting & budding knife, pruning saw, mowers, brush cutter, garden tillers	2	2

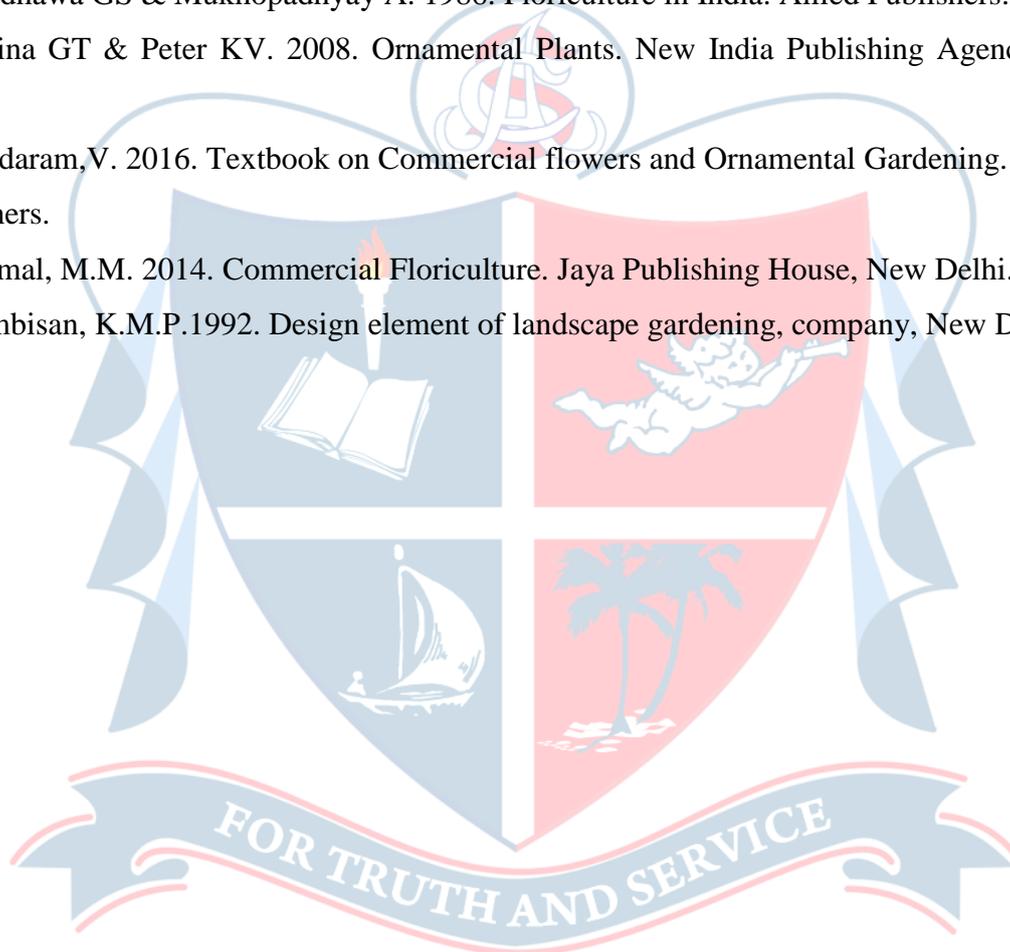
	2.3	Garden components and adornments (brief account only)	2	2
	2.4	Rockery, Terrarium, Kokedema, Bonsai (brief account only)	2	2, 3
	2.5	Elements of art-colour, line, form, scale. Principles of Landscape design- Unity, Balance, transition, proportion, rhythm, focalisation, repetition, simplicity.	3	2, 5
	2.6	Steps in developing a Landscape Design Brief Account Only a) Site analysis- b) Identification of functional requirements; c) site development by exploiting natural forms; d) Elements in landscape design- form, water, garden furniture, lights, paving etc. e) study of plant trees, shrubs and ground cover, indoor plants etc.	3	2, 5
	Practicals (30 hours)			
3	3.1	Visit to a well-established nursery/ Garden and submit a detailed report	8	1,2,3,4,5
	3.2	TTC test for assessing seed viability	2	4
	3.3	Preparation of potting mixture	2	2
	3.4	On-hand training for air-layering, approach grafting and T-budding techniques	6	4
	3.5	Identification of Garden tools and implements.	4	2,3,4
	3.6	Designing of Terrarium	4	3,5
	3.7	Designing of Kokedama balls/ bottle gardens	4	3,5
4	Teacher specific course components			

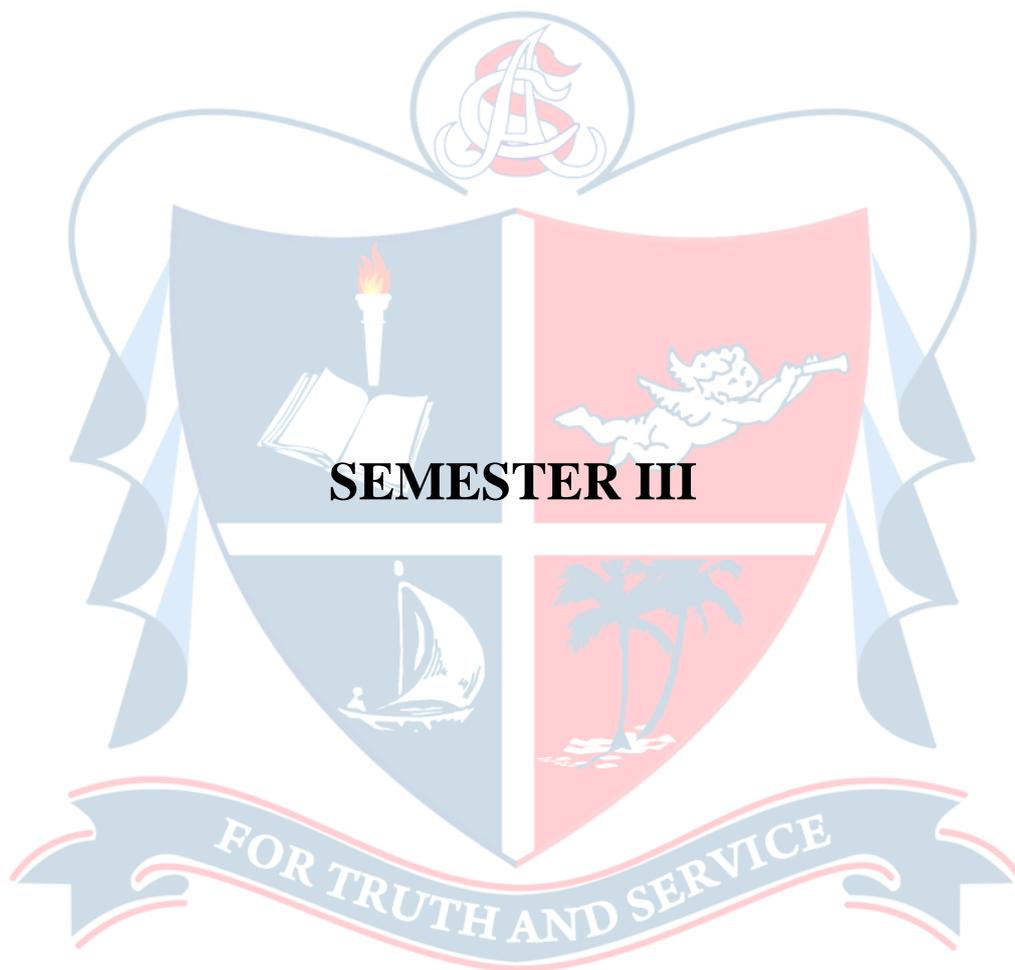
Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks Involvement and responses in class room transactions Home Assignments/preparedness Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty</p> <hr/> <p>B. Semester End examination</p> <p>Theory: 35 marks MCQ: $10 \times 1 = 10$ Short Essay (3 out of 5): $3 \times 5 = 15$ Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks Practical based assessments: 30 marks Record: 5 marks</p>

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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	B.Sc.(HONOURS) BOTANY					
Course Name	MICROBIOLOGY AND PHYCOLOGY					
Type of Course	DSC A					
Course Code	24SACBOT3DA201					
Course Level	200					
Course Summary	The course will give an insight towards the diversity of microbes and algal flora. The study of microbiology provides a comprehensive understanding of microbes, its principles, and its applications in various fields, where as phycology deals with the study of algae. Being the primary produces, both micro and macroalgae plays a significant role in aquatic ecosystems. Students learn its salient/ diagnostic features and its importance to ecosystems. It also focuses on the economic and ecological significance and its applications.					
Semester	III	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any	Basic botanical learning and laboratory skills					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the world of microbes and its significance	U	PO2, PO6, PO7, PO10
2	Examine the range of thallus structure, pigment composition, photosynthetic end products and reproduction in various algal groups.	An	PO2, PO3, PO6, PO10
3	Demonstrate a comprehensive understanding of the economic importance of algae. Examining the ecological significance and research potential of algae	U	PO1, PO2, PO9

4	Analyse the identifying features of microbes and algae	An	PO1, PO2, PO3, PO4, PO5, PO7, PO9, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction and Application of to Microbiology (15 hours)				
1	1.1	Bacteria: General characters and classification based on staining, morphology and flagellation. Ultra structure of bacteria. Reproduction - binary fission. Genetic recombination in bacteria - conjugation, transformation and transduction.	6	1
	1.2	Viruses: General characters of viruses, viroid and prions. Structure of TMV and Bacteriophage (λ). Multiplication of λ phage – lytic and lysogenic cycle.	4	1
	1.3	Microbial interactions in ecosystems, Applications of microbes in industry, agriculture, food and medicine. Microbes in environmental conservation, waste management and as biocontrol agents.	5	1
Introduction to Phycology (15 hours)				
2	2.1	History of algal classification, study of classification by Fritsch (1945); brief introduction to the modern classification by Lee (2016) [up to class].	2	2
	2.2	Distribution, habitat diversity, range of thallus structure, pigment composition and photosynthetic end product in various groups of algae. Reproduction - vegetative, asexual and sexual reproduction. Major life cycle patterns found in algae (outline only).	2	2
	2.3	Salient features and thallus structure of algae in the following groups with special reference to the type(s) mentioned: Cyanophyceae - Nostoc; Chlorophyceae - Volvox, Spirogyra, Cladophora, Chara Bacillariophyceae - Pinnularia; Phaeophyceae – Sargassum; Rhodophyceae – Polysiphonia	11	1

	Economic importance of Algae, Ecology and Perspectives of Algal Research (15 hours)			
3	3.1	Useful aspects of algae: Food, SCP, Biofertilizers, Medicine Exploration of algae as source of valuable commercially important products-carrageenan, agar-agar, alginate, diatomite Harmful effects of algae: Algal blooms, eutrophication, neurotoxins.	5	3
	3.2	Algae as primary producers and ecosystem engineers Algal associations and its significance (Parasitic algae, Symbiotic algae-association of algae with fungi, bryophytes, pteridophytes, gymnosperms, angiosperms, invertebrates) Algae based wastewater treatment for biodiesel production Role of algae as bioremediation agents. Role of algae in N ₂ fixation	8	3
	3.3	Role of algae in scientific research -Chlorella Brief overview on cultivation of macroalgae and microalgae.	2	3
4	Practical (30 hours)			
	Microbiology (10 hours)			
	4.1	Gram staining - curd, root nodules. Isolation of microbes from soil through serial dilution	8	1,4
	4.2	Demonstrate the culture of bacteria.	1	1,4
4.3	Microbes and type of fermentation - vine, vinegar, curd	1	1,4	
	Phycology (20 hours)			
	4.4	Conduct a field visit to any one of the ecosystems rich in algae to experience algal diversity. Submit a report with photographs or Collect algae from diverse habitats, observe through microscope and click photographs and submit a report.	3	2,3,4
	4.5	Make micro preparations of thallus structures of the types mentioned in the syllabus.	16	2,3,4

	4.6	Familiarizing the technique of algal collection and preservation	1	2,3,4
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based studies and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks Involvement and responses in class room transactions Home Assignments/preparedness Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty</p> <p>B. Semester End examination</p> <p>Theory: 50 marks Short answer (10 out of 12): $10 \times 1=10$ Short Essay (6 out of 8) : $6 \times 5= 30$ Essay (1 out of 2) : $1 \times 10= 10$</p> <p>Practical: 35 marks Practical based assessments: 30 marks Record: 5 marks</p>

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	B.Sc.(HONOURS) BOTANY					
Course Name	MYCOLOGY AND PLANT PATHOLOGY					
Type of Course	DSC A					
Course Code	24SACBOT3DA202					
Course Level	200					
Course Summary						
Semester	III	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any	Basic botanical laboratory skills.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Determine the diversity, reproductive behaviour and applications of fungi and Lichens	A	PO2, PO6, PO7, PO10
2	Identify ecological and economical significance of fungi and lichens	U	PO2, PO3, PO6, PO7, PO10
3	Describe the basic aspects of plant pathogen interaction	U	PO1, PO2, PO9

4	Recognize the plant diseases and provide control measures	K	PO1, PO2, PO3, PO4, PO7, PO9, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to Mycology (20 hours)				
1	1.1	Introduction and general characters of fungi. Classification based on Ainsworth (1973); Assembling the Fungal Tree of Life (AFTOL) - a brief account	2	1
	1.2	The thallus and reproductive structures of the genera mentioned in each group; Myxomycotina - General Characters	1	1
	1.3	The thallus and reproductive structures of the genera mentioned in each group; Mastigomycotina – Albugo (Difference between Oomycete and true fungi)	2	1
	1.4	The thallus and reproductive structures of the genera mentioned in each group; Zygomycotina – Rhizopus	1	1
	1.5	The thallus and reproductive structures of the genera mentioned in each group; Ascomycotina: ●Hemiascomycetes - Saccharomyces ●Plectomycetes - Pencillium ●Pyrenomycetes - Xylaria ●Discomycetes – Peziza	8	1
	1.6	The thallus and reproductive structures of the genera mentioned in each group; Basidiomycotina	4	1

		<ul style="list-style-type: none"> ●Teliomycetes - Puccinia ●Hymenomycetes - Agaricus 		
	1.7	The thallus and reproductive structures of the genera mentioned in each group; <ul style="list-style-type: none"> ●Deuteromycotina - Fusarium 	2	1
2	Economic significance of Fungi and Lichenology (12 hours)			
	2.1	Economic importance of Fungi – Beneficial (Food, antiviral, antibiotic) and detrimental aspects (Food spoilage and poisoning, Wood degradation).	2	2
	2.2	Fungi of Agricultural importance – mycoherbicides, myconematicides, mycoparasites, Mycorrhiza – diversity, function, and significance.	2	2
	2.3	Mushrooms- edible and poisonous types. Cultivation technique-Spawn production of Oyster mushroom, cultivation of Oyster mushroom (General Outline)	4	2
	2.4	General account, economic and ecological importance of lichen	1	1,2
	2.5	Classification of lichens based on thallus and its significance	2	1
	2.6	Structure and life cycle of <i>Parmelia</i> .	1	1
3	Plant Pathology (13 hours)			
	3.1	History of plant pathology (Brief study)	1	3
	3.2	Classification of plant diseases based on causative organisms and symptoms	2	3
	3.3	Plant-Pathogen Interaction (general outline)	1	3
	3.4	Defense mechanisms in plants	2	3
		Mechanism of infection, transmission, and dissemination of plant diseases.	1	3
		Prophylaxis - quarantine measures, seed certification; Therapeutic – physical therapy, chemotherapy.	2	4

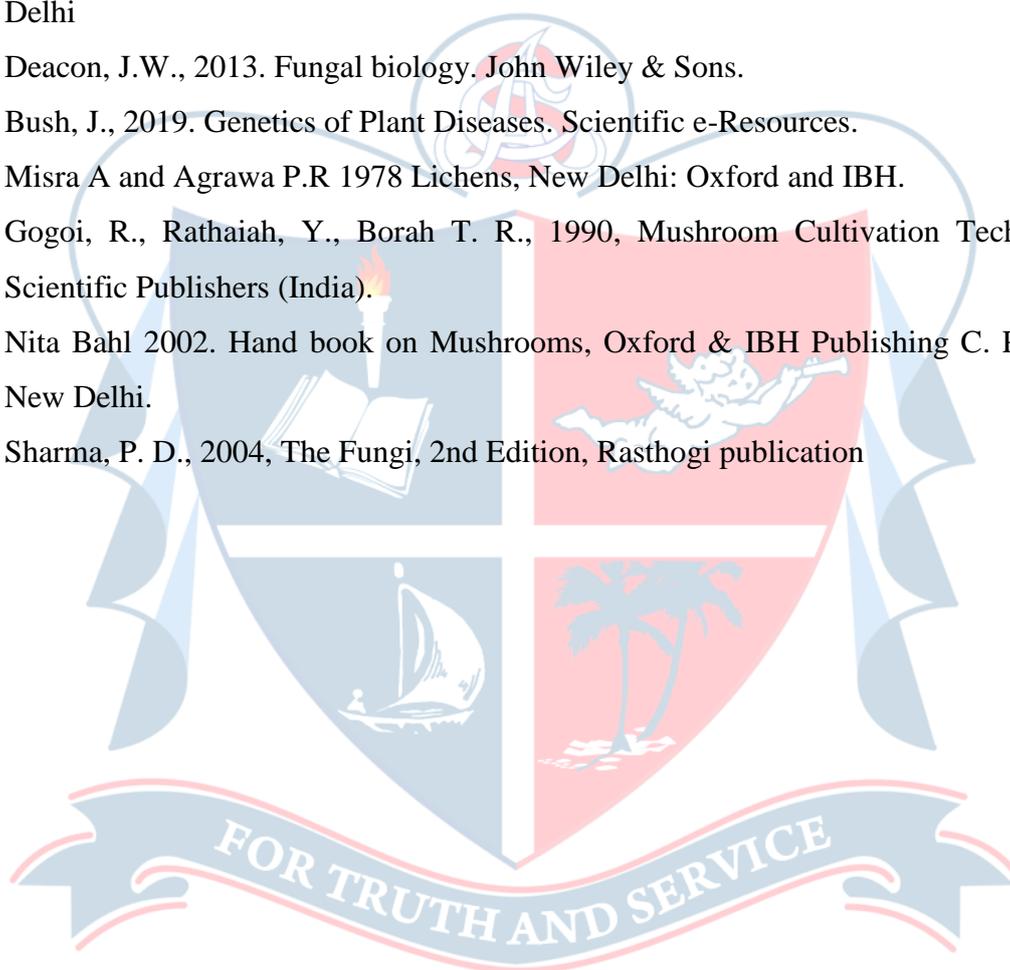
		Biological control of plant diseases	1	4
		Study of following diseases with emphasis on symptoms, cause, and control: <ul style="list-style-type: none"> ● Bunchy top of Banana ● Bacterial blight of Paddy ● Root wilt of Coconut ● Abnormal leaf falls of Rubber ● Leaf mosaic disease of Tapioca ● Quick-wilt of pepper. 	3	3, 4
4	Practical (30 hours)			
	Mycology (20 hours)			
	4.1	Students are expected to identify the following types by making suitable micro preparations and make labelled sketches <i>Albugo, Rhizopus, Saccharomyces, Penicillium, Xylaria, Peziza, Puccinia, Fusarium</i>	8	1
	4.2	Staining of endomycorrhiza or fungus using Trypan Blue.	2	1, 2
	4.3	Collection/identification of common macrofungi (5 types).	10	1, 2
	Plant Pathology (10 hours)			
	4.4	Identify the diseases mentioned in the syllabus with respect to causal organisms and symptoms	5	3
	4.5	Submit specimens/ herbarium preparations of any three of the diseases; Imaging can be done with geo tag and recorded	4	3
4.6	Students should be trained to prepare the fungicides – Bordeaux mixture, Tobacco decoction.	1	3, 4	
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based studies and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks Involvement and responses in class room transactions Home Assignments/preparedness Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty</p> <hr/> <p>B. Semester End examination</p> <p>Theory: 50 marks Short answer (10 out of 12): $10 \times 1 = 10$ Short Essay (6 out of 8) : $6 \times 5 = 30$ Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks Practical based assessments: 30 marks Record: 5 marks</p>

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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	ETHNOBOTANY AND INTELLECTUAL PROPERTY RIGHTS					
Type of Course	DSE					
Course Code	24SACBOT3DE201					
Course Level	200					
Course Summary	This course will deal with the origin, botany, utilization, cultivation, and uses of plants; important firewood and timber-yielding plants and non-wood forest products (NWFPs); traditional herbal medicine; endangered and rare useful plants of Kerala; strategies for conservation of medicinal, spice and other useful plants; research methods in ethnobotany; roles of ethnobotany in biodiversity conservation and socio-economic development, Intellectual Property Rights, and its importance.					
Semester	III	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-		60
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify socially, economically, and culturally useful plants	K	PO1,PO2,PO6
2	Describe ethnobotanical research methods;	U	PO1,PO2
3	Implement ethnobotanical knowledge in biodiversity conservation and socio-economic development.	A	PO1,PO2,PO6,P O7
4	Appreciate the need to conserve floristic and cultural diversity of the region.	Ap	PO2

5	Describe and document Ethnobotanicals for sustainable use of plant resources.	U	PO2,PO7
6	Explain the fundamental aspects of Intellectual property Rights	A	PO2
7	Recognize intellectual property rights and its benefit to people and society who share their knowledge.	AN	PO2,PO4
8	Develop the knowledge on IPR, patents, patent regime in India and abroad and registration	C	PO2,PO4
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction, relevance, scope, and status (8 Hours)				
1	1.1	Introduction, concept, scope, and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context.	2	1
	1.2	Centers of Ethnobotanical studies in India. (FRLHT- Foundation for the Revitalization of Local Health Traditions, JNTBGRI).	3	2
	1.3	Contributions of J.W. Harshberger, E.K.Janakiammal, S.K.Jain&P.Pushpangadan	3	1
Tribal/Folk communities of Kerala and plants of ethnobotanical significance(17 Hours)				
2	2.1	Tribal/Folk communities of Kerala state focusing on customs and beliefs related to Ethnobotany - Kani, Kurichiya, Cholanaikan, Malampandaram (brief study only).	6	1
	2.2	Significance of the following plants in ethnobotanical practices (brief study only) - <i>Cosciniumfenestratum</i> ; <i>Dioscorea</i> sp.; <i>Vitex negundo</i> ; <i>Gloriosa superba</i> ; <i>Calamus rotang</i> ; <i>Pongamia pinnata</i> ; <i>Curcuma longa</i> ; <i>Indigofera tinctoria</i> .	8	1, 4
	2.3	Role of ethnobotany in modern medicine with special reference to <i>Rauwolfia serpentina</i> ; <i>Trichopuszeylanicus</i> ; <i>Withaniasomnifera</i>	3	1, 4
3	Methods and techniques used in Ethnobotany(16 Hours)			

	3.1	Field level activities for data collection- Approach, Documentation (Audio, Video recording, Photographs, Interview – Methods, Questionnaire, and Data sheet), Consent forms, Forest productivity check by analysing the log books of Forest, EDC (Eco Development Committee), VSS (Vana Samarakshana Samithi), Authentication of plant species (Field Book, Herbarium).	10	1, 2
	3.2	Peoples' Biodiversity Register (PBR); legal aspects Ethnobotany as a tool to protect interests of ethnic groups. Benefit sharing of wealth concept with few examples from Kerala (Jeevani).	6	1, 2, 3
	Intellectual Property Rights (IPR) and Patents(20 Hours)			
4	4.1	IPR Brief history, Types of Intellectual Properties, Role of undisclosed information and rationale of patents and licenses.	3	6
	4.2	Benefits of patents. IPR in India and the world. IPR and WTO	3	6
	4.3	Bioprospecting and Bio-Piracy; Geographical Indication (GI) – specific to Kerala	3	6, 7
	4.4	Patent Act 1970 and its amendments. Procedure of obtaining patents, working of patent, Infringement, Industrial Application: Non-Patentable Subject Matter, Registration Procedure, Rights and duties of Patentees.	4	6, 7
	4.5	Protection of traditional knowledge - Objectives, Concept of traditional knowledge, Holders, Issues concerning, Traditional Knowledge Digital Library (TKDL).	4	7, 8
	4.6	Plant varieties protection in India. Rights of farmers, breeders and researchers. National gene bank. Protection of Plant Varieties and Farmers' Rights Act, 2001	3	6
5	Teacher Specific Content			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction)
	Lectures, Group discussion, Field trip and report, List out any 10 GI (Geographical Indication) and Traditional Knowledge Products. Identify and document plant parts used in preparation of crude drugs/herbal formulations

Assessment Types	MODE OF ASSESSMENT
	<p style="text-align: center;">A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty <p style="text-align: center;">B. Semester End examination</p> <p>Theory: 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12) : 2 x 10=20 Marks ● Short Answer (8 out of 10) : 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

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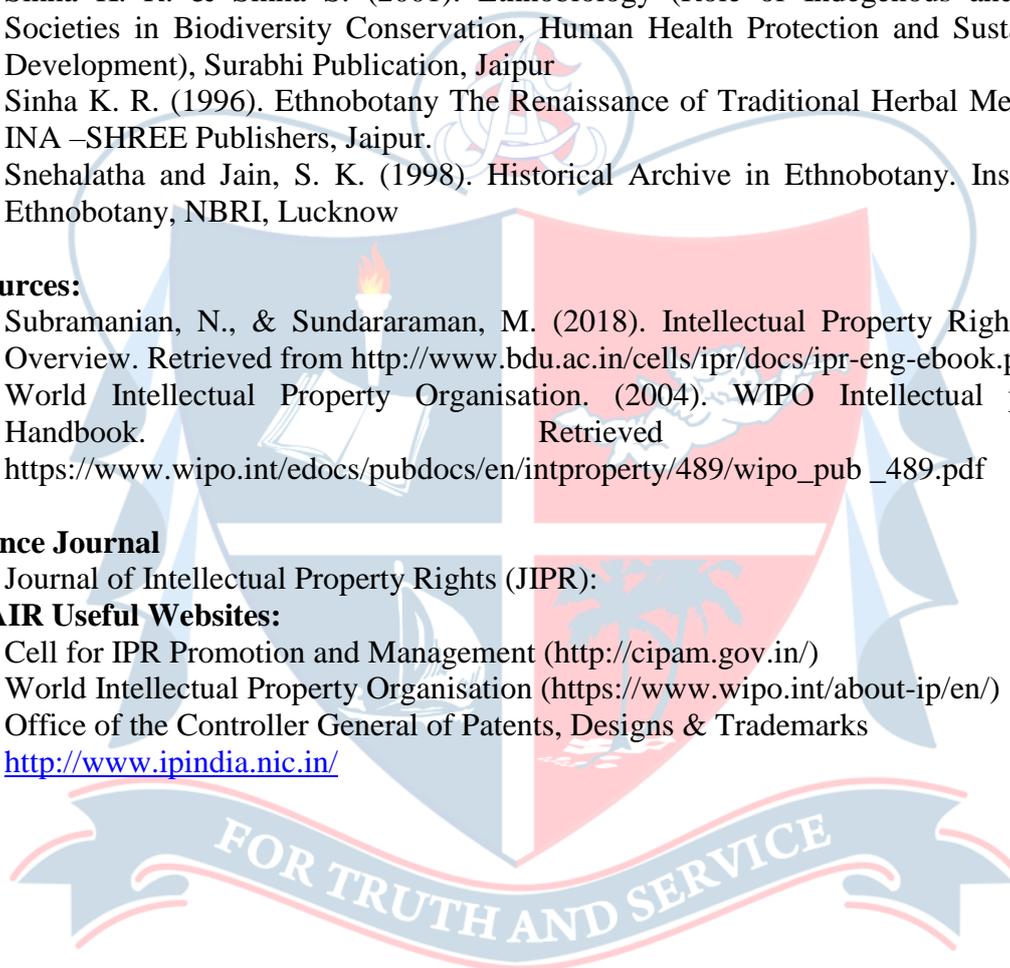
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Reference Journal

1. Journal of Intellectual Property Rights (JIPR):

NISCAIR Useful Websites:

1. Cell for IPR Promotion and Management (<http://cipam.gov.in/>)
2. World Intellectual Property Organisation (<https://www.wipo.int/about-ip/en/>)
3. Office of the Controller General of Patents, Designs & Trademarks
<http://www.ipindia.nic.in/>



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Programme	BSc.(HONOURS) BOTANY					
Course Name	HERBAL TECHNOLOGY					
Type of Course	DSE					
Course Code	24SACBOT3DE202					
Course Level	200					
Course Summary	The present course focuses mainly on common herbal plants in our locality, their morphological peculiarities, nutritive and medicinal properties. This course also aims for the extraction of major active principles of herbal plants in their crude form, their cultivation, conservation practices and applied aspects (Herbal Dyes, Organic pesticides, Biofuels).					
Semester	III	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any	Maintenance of herbal garden under the guidance of Botany Department.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify the common herbal plants in our locality.	U	PO6, PO10
2	Familiarize the cultivation practices and conservation of the herbal plants and home remedies against common diseases.	U	PO6, PO7, PO10
3	Examine the different herbal plants based on the medicinal and nutritive values.	An	PO1, PO3
4	Develop the skills for extracting the various phytochemicals in crude form.	C	PO2, PO9
5	Evaluate the major chemical components present in the	E	PO1

	selected herbal plants.		
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Introduction to herbal technology (6 hours)			
1	1.1	Introduction to herbal technology: Definition, Branches of herbal technology,	3	1
	1.2	Need of herbal gardens in the present scenario (Home Garden, Educational institutions and Research centre), Significance of herbal technology.	3	1
	Herbal resources of practical significance (12 hours)			
2	2.1	A brief classification of medicinal plants based on their secondary metabolites and its uses	2	1, 5
	2.2	Definition, Extraction methods: Types 1. Solvent extraction- a) Alcohol b) acetone c) benzene, d) chloroform e) acid	3	4
	2.3	Aqueous extraction, Supercritical fluid extraction- CO ₂ , Microwave assisted extraction	5	4
	2.4	Relevance and application of herbal dyes	2	4
	Applied aspects of herbal products and Conservation aspects (12 hours)			
3	3.1	Biopesticides- Preparation and applications of Neem decoction, Tobacco decoction	3	4
	3.2	Biofuels- <i>Jatropha curcus</i> (Brief)	1	4
	3.3	Apiculture and pollination enhancement in relation to herbal garden	3	4
	3.4	Conservation and sustainable maintenance (Cultivation practices) of herbal plants in association with botanical garden and home garden	5	2

	Experiential learning (30 hours)			
4	4.1	Visit to a well-maintained herbal garden such as JNTBGRI, Malabar Botanical Garden and other recognized institutes. (1 day)	10	1, 2
	4.2	Visit to scientific labs regarding extraction, identification of phytochemicals. (1 day)	10	1, 2
	4.3	Submit any 5 rooted plants/propagules mentioned in the syllabus.	10	1, 2
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course. <p>Any other method as may be required for specific course / student by the course faculty</p>
	<p>B. Semester End examination (ESE)- 70 marks</p> <ul style="list-style-type: none"> • Very Short Answer (10 out of 12) : 2 x 10=20 Marks • Short Answer (8 out of 10) : 8 x 5= 40 Marks • Essay (1 out of 2): 1x 10= 10marks

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	THALLOPHYTES AND ARCHEGONIATES					
Type of Course	DSC B					
Course Code	24SACBOT3DB201					
Course Level	200					
Course Summary	The course provides a basic overview regarding the evolutionary significance, classification, morphology, and distinguishing characters of thallophytes and archegoniates. It also gives a basic outlook towards the ecological and economic significance of Thallophytes and Archegoniates.					
Semester	III	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	75
Pre-requisites, if any	-					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify Thallophytes and Archegoniates on the basis of morphology.	K	PO1
2	Explain the evolutionary significance of Thallophytes and Archegoniates.	U	PO7
3	Classify Thallophytes and Archegoniates based on their characters.	A	PO2
4	Distinguish between Thallophytes and Archegoniates.	An	PO1
5	Appraise the ecological and economic significance of	E	PO6, PO7

	Thallophytes and Archegoniates.		
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Diversity of Thallophytes (15 hours)			
1	1.1	Introduction to Thallophytes: Evolutionary insight of thallophytes and its ecological role towards the rich biodiversity of our planet.	5	2
	1.2	Algae Introduction: General characters, habitat diversity, range of thallus structure and pigments in algae. Classification up to division (Brief study): by Fritsch (1945). Thallus structure of the following types: <i>Nostoc</i> , <i>Volvox</i> , <i>Oedogonium</i> , <i>Cladophora</i> , <i>Polysiphonia</i> and <i>Sargassum</i> . Economic importance of algae	10	1,3,5
	Fungi and Lichens (10 hours)			
2	2.1	General characters of fungi. Classification of fungi up to class - Ainsworth (1973). Distinguishing characters of <i>Xylaria</i> and <i>Puccinia</i> with special reference to reproductive structures and life cycle. Economic importance of fungi. General characters of Lichens, types. Economic and ecological significance of lichens.	10	1,3,4,5
	Archegoniates (20 hours)			
3	3.1	Introduction, Common traits of Archegoniates; tracing the transition of dominant phase from gametophyte to sporophyte and its significance.	2	2
	3.2	Bryophytes: General characteristics, Classification by Rothmaler (up to family); Morphology, anatomy, and reproduction of <i>Riccia</i> (Developmental details not needed). Ecological and economic importance of bryophytes.	6	1,3,5

	3.3	Pteridophytes: General characteristics; brief account of the classification by Smith up to divisions (2006). Morphology, anatomy and reproduction of <i>Pteris</i> (Developmental details not needed). Heterospory and seed habit in Lycophyte (<i>Selaginella</i>). Ecological and economic importance of Pteridophytes	6	1,3,4,5
	3.4	Gymnosperms: General characteristics, classification Sporne (1965) (up to family). Morphology, anatomy and reproduction of <i>Cycas</i> (Developmental details not needed). Economic importance of Gymnosperms: as food, medicine, in industry and as ornamental plants.	6	1,3,4,5
Practical (30 hours)				
4	Thallophytes, Fungi and Lichens			
	4.1	Conduct a field visit to algal ecosystems and submit a report with geotagged photographs of few collected algae. Make micro-preparations of types mentioned in the syllabus. Collect and submit at least 2 latest research publications on thallophytes. Also submit a summary report	10	5
	4.2	Conduct a field study to familiarize with the habitat of fungi and lichen and submit a report. Collect, identify and submit few thallophytes mentioned in the syllabus	6	1
4	Archegoniates			
	4.3	Document geotagged photos/ images of gametophytes and/or sporophytes of archegoniates mentioned in the syllabus. Field study to familiarize with the habitat of archegoniates.	4	5
	4.4	Collect, identify the genus and submit gametophytes and/or sporophytes of archegoniates. Collect and submit at least 2 latest research publications on archegoniates. Also submit a summarized/comparison report	5	1
	4.4	<i>Riccia</i> – Morphology and anatomy of thallus. <i>Pteris</i> - Morphology of sporophyte and anatomy of stem.	5	1,3,4

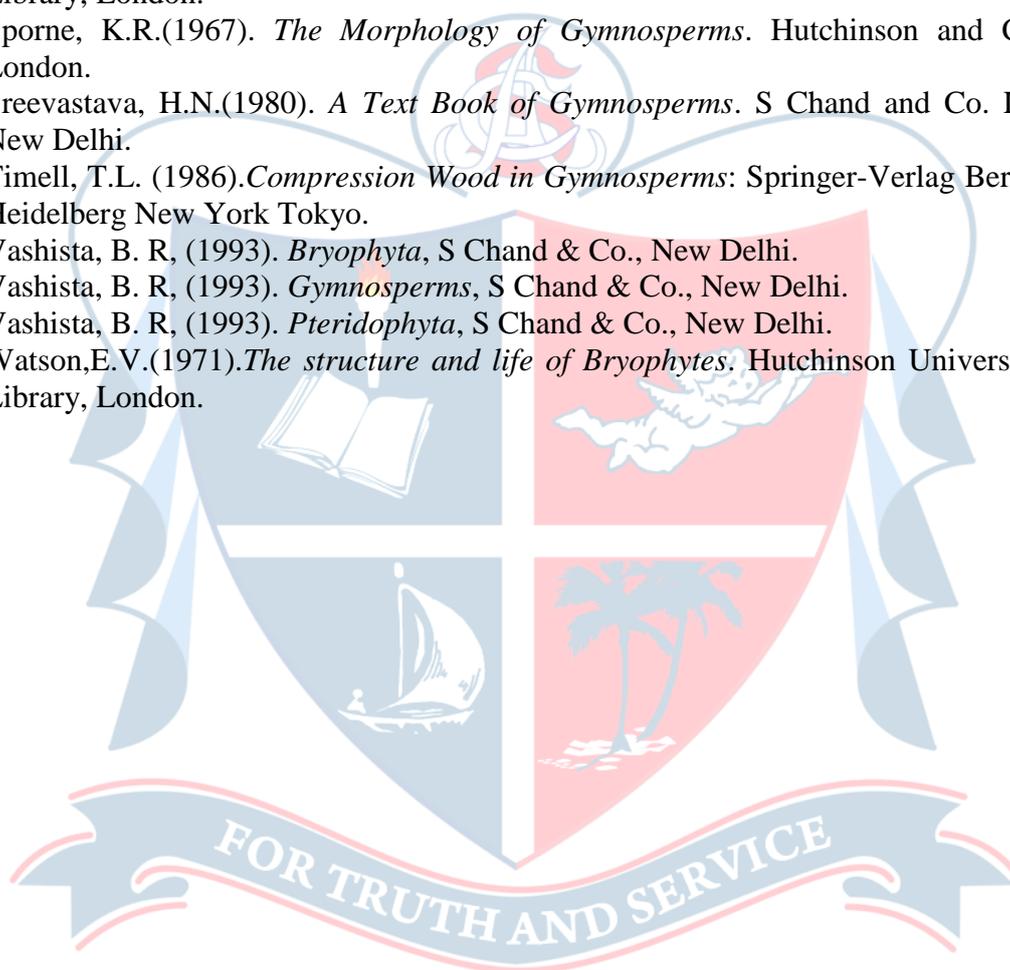
		<i>Cycas</i> - Morphology of coralloid roots and reproductive structures, anatomy of leaflet.		
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course · Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory:50 marks</p> <p>Short answer (10 out of 12): $10 \times 1=10$</p> <p>Short Essay (6 out of 8) : $6 \times 5= 30$</p> <p>Essay (1 out of 2) : $1 \times 10= 10$</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> · Practical based assessments: 30 marks Record: 5 marks

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY						
Course Name	NATURAL RESOURCES AND CONSERVATION						
Type of Course	DSC B						
Course Code	24SACBOT3DB202						
Course Level	200						
Course Summary	This course provides students with an understanding on the concept of natural resources and their classification, the importance of natural resources for ecosystems and human well-being. Throughout the course, students will engage in analyzing the impact of human activities on natural resources and the environment and exploring strategies for the conservation and sustainable management of natural resources.						
Semester	III		Credits			4	Total Hours
Course Details	Learning Approach		Lecture	Tutorial	Practical	Others	
			3	-	1	-	75
Pre-requisites, if any	-						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the definition, classification and importance of natural resources.	U	PO1,PO6, PO7, PO10
2	Understand the importance of water resources and strategies for their conservation.	U	PO1,PO6, PO7, PO10
3	Understand the importance of soil resources and strategies for their conservation.	U	PO1,PO6, PO7, PO10
4	Understand the importance of forest resources and	U	PO1,PO6,

	strategies for their conservation.		PO7, PO10
5	Understand the importance of plants, animal and microbial resources and strategies for their conservation.	U	PO1,PO6, PO7, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to Natural Resources (18 hours)				
1	1.1	Definition and classification of natural resources. Renewable vs. non-renewable resources.	5	1
	1.2	Importance of natural resources for ecosystems and human societies.	3	1
	1.3	Plants and animal resources – Over exploitation, species extinction, control measures.	6	5
	1.4	Mangrove resources, microbial resources and their ecological significance.	4	5
Water Resources (9 hours)				
2	2.1	Overview of global water resources.	2	2
	2.2	Challenges in water availability and quality.	2	2
	2.3	Strategies for water conservation and management. Wet land resources.	5	2
Soil and Forest Resources (18 hours)				
3	3.1	Importance of soil for agriculture and ecosystems.	2	3
	3.2	Soil degradation and erosion.	3	3

	3.3	Soil conservation techniques and sustainable land management practices.	4	3
	3.4	Importance of forests: ecological, economic, and social aspects.	3	4
	3.5	Deforestation and its impacts.	2	4
	3.6	Sustainable forest management and reforestation initiatives.	4	4
	Practicals (30 hours)			
4	4.1	1. Visits to mangrove and inland water ecosystems. 2. Familiarization of forest products, plants and animal resources. 3. Water Quality Assessment Collect water samples from various sources (e.g., rivers, ponds). Conduct water quality tests (pH, dissolved oxygen, nutrient levels) and assess the ecological implications.	30	2,4,5
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course

	<p>·Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks</p> <p>·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty</p>
	<p>B.End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8) : 6 x 5= 30 Essay (1 out of 2) : 1x 10= 10</p> <p>Practical: 35 marks</p> <p>Practical based assessments: 30 marks Record: 5 marks</p>

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Suggested readings

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2. Martha J. Groom, Gary K. Meffe, and C. Ronald Carroll; Principles of Conservation Biology.
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Programme	BSc.(HONOURS) BOTANY					
Course Name	FLORICULTURE AND OLERICULTURE					
Type of Course	DSC B					
Course Code	24SACBOT3DB203					
Course Level	200					
Course Summary	Floriculture and Olericulture course focuses on the science and techniques involved in the production of vegetables and flowers. It covers various aspects of floral and vegetable crop production, including cultivation, harvesting and post-harvest handling.					
Semester	III	Credits			4	Total Hours
Course Details	Learning Approach	Lecture 3	Tutorial -	Practical 1	Learning Approach -	
Pre-requisites, if any	-					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify the components, importance of floriculture	K,U	PO2
2	Describe the methods of production of cut flower and loose flowers	K,U	PO2
3	Identify different methods of olericulture	R	PO2
4	Practice production of different value-added products	A	PO2,PO10

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
	Introduction to Floriculture and Production of Cut Flowers and Loose flowers(20 Hours)			
1	1.1	Floriculture: History and scope of Floriculture. Importance of ornamental plants and flowers. Components of floriculture: ornamental gardening, commercial floriculture, landscape gardening, arboriculture; Commercial floriculture: importance,scope and significance	5	1,2
	1.2	Production Technology Of Cut Flowers and Loose flowers - Scope of cut flowers in global trade, Global Scenario of cut flower production. Cut Crops: Cut rose, cut chrysanthemum, gerbera, gladioli, tuberose, orchids, aster. Loose Crops- Jasmine, marigold, Gomphrena.	5	1,2,3
	1.3	Nursery management- media for nursery, special nursery practices; Growing environment, open cultivation, protected cultivation, soil requirements, artificial growing media, soil decontamination techniques, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and CO ₂ on growth and flowering. Cut flower standards and grades, harvest indices, harvesting techniques, post-harvest handling, Pre- cooling, pulsing, packing, Storage & transportation, marketing.	5	2,3
	1.4	Flower arrangement: principles, different styles: Fresh, dry and artificial. Techniques to prolong the vase life of flowers. Types of value-added products, value addition in loose flowers - garlands, veni, floats, floral decorations. Value addition in cut flowers - flower arrangement, styles, Ikebana, morebana, free style, bouquets, button-holes, flower baskets, corsages, floral wreaths, garlands, etc.; Selection of containers and accessories for floral products and decorations.	5	2
	Introduction to Olericulture(11 Hours)			

2	2.1	Olericulture - Introduction, Classification-botanical, cultural, thermo classification. Food value of common vegetables grown in Kerala. Types of vegetable farming - kitchen, garden, terrace garden, market garden, truck garden.	3	1,2
	2.2	Cultivation-planting season, preparation of soil, seed selection, seeding, transplanting- thinning, mulching. Irrigation, manuring, plant protection methods	3	3
	2.3	Harvesting and post harvesting operations of the following corps. Warm season vegetables: brinjal, chilli, cucumber, bitter gourd, lady's finger, Cephalaria, Amaranth, Coleus, Musa Cool season vegetables: cabbage, carrot, beet, onion, peas and beans. Pre and post-harvest changes in vegetables: role of growth regulators and stimulants in vegetable production: changes during cooking and processing- spoilage of vegetables-factors influencing spoilage-microbial spoilage.	5	3
Value added products (15 Hours)				
3	3.1	Value added products from vegetables. Problems and prospects of vegetable cultivation in Kerala	5	2,3
	3.2	Mushroom as a vegetable: cultivation of edible mushrooms; button, paddy straw and oyster mushroom. Spawn production, utilization of paddy straw and other agro wastes in cultivation, pest and disease control.	5	4
	3.3	Role of government to promote floriculture and olericulture in India. Agencies promoting cultivation of vegetables and flowers. Role of agricultural and flower shows to promote the cultivation	5	1
Practicals (30 Hours)				
4	4.1	1. Identification of commercially important floricultural crops. 2.Propagation technique in Hibiscus/Rose/Chrysanthemum/tuberose.	30	1,3,4

		3. Propagation technique in Gladiolus/ carnation Petunia 4. Sowing of seeds and raising of seedlings of a flowering plant. 5. Training and pruning of rose/Jasminum. 6. Drying and preservation of flowers. 7. Use of chemicals and other compounds for prolonging the vase life of cut flowers. 8. Flower arrangement practices. 9. Preparation of bouquets, garland		
5	Teacher specific module			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Tutorial, Seminars, Demonstration, Hands on training
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course · Any other method as may be required for specific course / student by the course faculty Practical: 15 marks <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty
	B. End Semester Evaluation (ESE) Theory: 50 marks <p>Short answer (10 out of 12): $10 \times 1=10$</p> <p>Short Essay (6 out of 8) : $6 \times 5= 30$</p> <p>Essay (1 out of 2) : $1 \times 10= 10$</p> Practical: 35 marks <ul style="list-style-type: none"> · Practical based assessments: 30 marks · Record: 5 marks

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Programme	BSc.(HONOURS) BOTANY					
Course Name	AGRI-BASED MICROENTERPRISES					
Type of Course	MDC					
Course Code	24SACBOT3MD201					
Course Level	200					
Course Summary	This course is designed to equip participants with the knowledge and skills necessary to establish and manage successful agri-based microenterprises. Focusing on key sectors such as organic farming, horticulture, tissue culture, and mushroom cultivation, the course provides a comprehensive understanding of sustainable and profitable agribusiness practices.					
Semester	III	Credits			3	Total Hours
Course Details		Lecture	Tutorial	Practical	Others	
	Learning Approach	3	-	-	-	45
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Summarize key principles in organic farming, horticulture, tissue culture and mushroom cultivation, fruits and vegetable technology including sustainable practices and business considerations.	U	PO3, PO6
2	Develop hands-on skills in composting techniques, artificial vegetative propagation practices, tissue culture techniques and mushroom cultivation	S	PO3, PO4
3	Apply the skills of organic farming, horticultural practices, tissue culture techniques, fruits and vegetable	A	PO3,PO10, PO9

	technology and mushroom cultivation, as an entrepreneurial venture.		
4	Administer a mushroom cultivation project in a small-scale level	A	PO3,PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Organic farming (7 Hours)				
1	1.1	Introduction to Organic farming- Advantages of Manures over fertilizers. NPK value- Definition and significance	2	1
	1.2	Common organic manures – bone meal, cow dung, poultry waste, oil cakes, Green manure (special reference to major element in the composition) Preparation of compost- vermicompost, vermiwash; familiarize KAMBA compost Biofertilizers-Definition and Types –, <i>Rhizobium</i> , <i>Mycorrhiza</i> , <i>Blue green algae</i> and <i>Azolla</i> . Activity-Hands on training on Vermicomposting Activity-Preparation of compost and establishing a small kitchen garden. Submit a report with geotagged photos	4	1, 2, 3
	1.3	Biological control Agents- <i>Trichoderma</i> , <i>Bacillus</i> ; Biopesticides – Tobacco and Neem decoction. Activity-Prepare and submit any one Biopesticide formulation.	1	1,3
Horticulture and Plant tissue culture (21 Hours)				
2	2.1	Types of soil, preparation of potting mixture, Garden tools and implements Methods of plant	6	1,2,3

		propagation- Sexual (seed propagation) and Asexual; Artificial methods (cutting, grafting, budding and layering); Use of growth regulators for rooting. Hands on training on Artificial methods of propagation - budding and grafting Activity -Demonstration of budding (T and Patch)		
	2.2	Gardening - Types of gardens– Ornamental and Landscape garden, kitchen garden Water garden and aquascaping, Aquarium plants and its propagation Garden components (Brief account only), Bonsai, terrarium, Kokedama. Activity - Submit a self made terrarium/ kokedama/ aquarium (use only natural materials)	3	1,3
	2.3	Concept of totipotency, definition of explant, callus. Infrastructure of a tissue culture laboratory. Solid and liquid media – basic components of tissue culture medium. Sterilization of explants'. inoculation and incubation. Micro propagation: different stages, organogenesis and embryogenesis Visit to a well established tissue culture lab/ nursery/ mushroom cultivation unit	12	1,2,3
	Mushroom cultivation and Fruit and vegetable technology(17 Hours)			
	3.1	Scope and Significance of Mushroom cultivation, Edible and poisonous mushroom. Health benefits	2	1
	3.2	Types of commercially cultivated mushrooms - button mushroom, oyster mushroom and milky mushroom Spawn -Definition.	1	1
3	3.3	Cultivation methodology of Oyster mushroom – using paddy straw and saw dust Layout and set up of a mushroom house (small scale) Processing of mushrooms and Value	4	1,2,3, 4

		added products- mushroom - pickle, candy, dried mushroom		
	3.4	Elementary knowledge on horticultural types of fruits and vegetables, Concept of shelf life and perishable fruits, Ripening and biological ageing, Storage and preservation concerns. Fruits preservation-Room temperature (Juice, syrup, squash), heat treatment(Jelly, jams), Dehydration(sun drying, application of sugar syrup,salt), freezing Vegetable preservation-packaging and storage, dehydration techniques, vegetable products (flakes, chips, dried powder), frozen vegetables, Preservation by Canning and bottling.	2	1
	3.5	<u>Activity-</u> Prepare and submit any one fruit/vegetable product using methods prescribed in the syllabus Visit and submit an audio visual documentary on any one small scale entrepreneurship activity with reference to the skills mentioned in the syllabus Submit a proposal on any plant based entrepreneurship Activity (other than mentioned in syllabus).	8	1,3
4	Teacher specific course component			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
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Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks Involvement and responses in class room transactions Home Assignments/preparedness Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty</p>
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 35 marks MCQ: $10 \times 1 = 10$ Short Essay (3 out of 5): $3 \times 5 = 15$ Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks Practical based assessments: 30 marks Record: 5 marks</p>

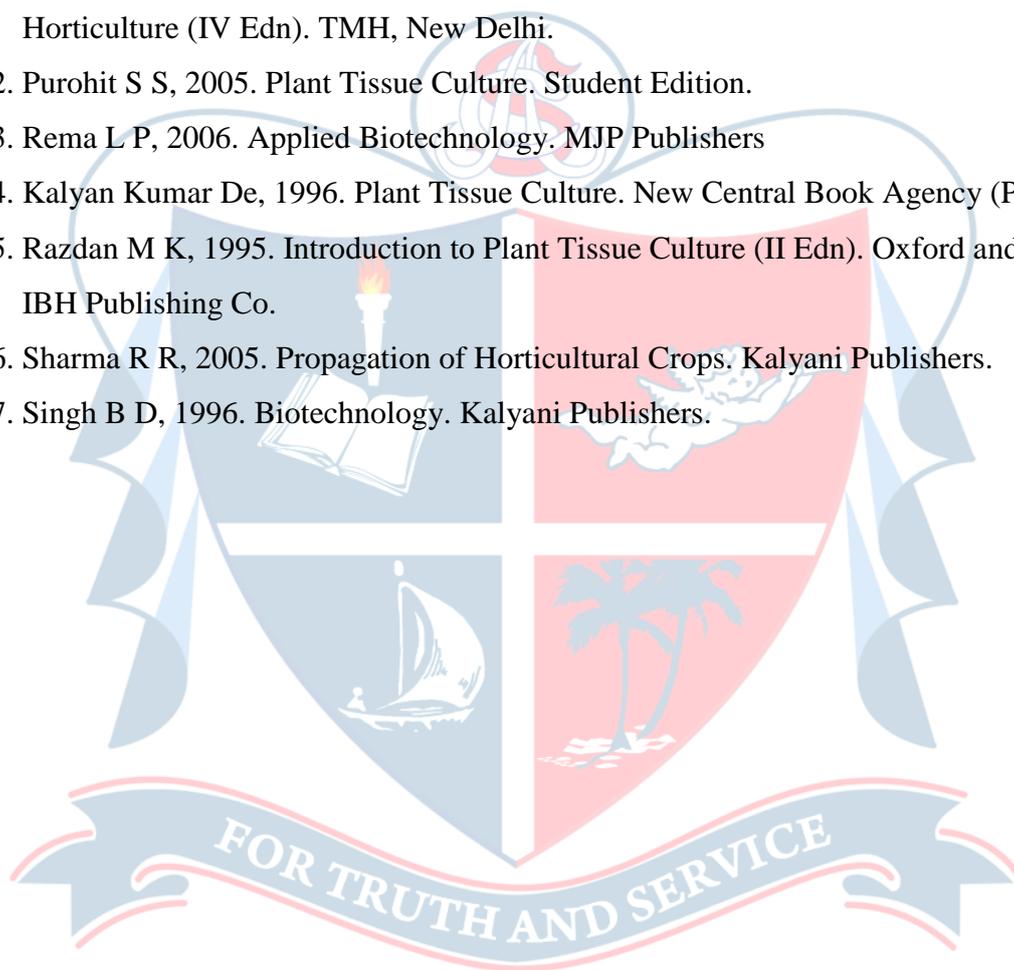
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Programme	BSc.(HONOURS) BOTANY					
Course Name	BIOETHICS AND IPR					
Type of Course	VAC					
Course Code	24SACBOT3VA201					
Course Level	200					
Course Summary	This course focus on systematic outline of the bioethics and Intellectual Property Rights. This will provide the core principles in the interaction of IPR and Bioethics, also give overview of the domestic and international legal regime dealing with intellectual property law.					
Semester	III	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	-	-	45
Pre-requisites, if any	-					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Apply ethical principles in biological research	A	PO8
2	Utilize the intellectual property rights and its benefit to society	K	PO6
3	Choose fundamental aspects of Intellectual Property Rights in development and management of innovative projects	A	PO3
4	Interpret knowledge on IPR, patents, patent regime and registration aspects in India and abroad	U	PO1

5	Appraise the current trends in IPR and Govt. steps in fostering IPR	E	PO1 PO3
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Introduction to bioethics & GMO's, bioethics in research and profession (18 hours)			
1	1.1	Bioethics – Need, issues (social and cultural) and applications; Misuse of modern molecular biology tools and techniques. .	3	CO1
	1.2	Bioethics & Biodiversity: Convention on protecting Biodiversity, Protocols in exchanging biological material across borders	3	CO1
	1.3	Issues and concerns pertaining to genetically modified foods & food crops, Harm to the environment – potential impact of GMOs on the ecosystem.	3	CO1
	1.4	Bioethics in Medicine & Cloning: Protocols of ethical concerns related to prenatal diagnosis, gene therapy, organ transplantation, Xenotransplantation, ethics in patient care, informed consent	3	CO1
	1.5	Patenting biotech inventions: objective, applications, concept of novelty, concept of inventive steps	3	CO1 CO4
	1.6	Use of plants in research, human volunteers for clinical research, moral issues in patenting biotechnological inventions, Ethics related to professional streams.	3	CO1 CO2
	Introduction to IPR (12 hours)			
2	2.1	Meaning of Intellectual Property Rights – Introduction to TRIPS and WTO – IPR in India and the world	3	CO3 CO4

	2.2	Kinds of Intellectual property rights - Copy Right, Patent, Trade Mark, Trade Secret and trade dress	3	CO2 CO4
	2.3	Design, Layout Design, Geographical Indication, Plant Varieties and Traditional Knowledge.	3	CO4 CO5
	2.4	Activity – 1 Geographical Indication - Meaning & significance of GI, How to file GI.	3	CO4 CO5
	Patent Rights (15 hours)			
3	3.1	Origin, Meaning of Patent, Types, Inventions which are not patentable	3	CO3 CO4
	3.2	Registration Procedure, Rights and Duties of Patentee, Patent Infringement.	3	CO4 CO5
	3.3	Copyright - Definition, Terms & Types of Copyright, Piracy. Information technology related IPR (computer software, database and data protection)	3	CO4 CO5
	3.4	Trade Marks - Meaning & Nature of Trade Marks, Types, Infringement & Remedies, Offenses relating to Trade Marks.	3	CO4 CO5
	3.5	Activity – 2 Traditional Knowledge - Meaning, importance of TK, Sources of TK, TKDL (Traditional Knowledge Digital Library).	3	CO4 CO5
4	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 25 Marks</p>

	<p>Involvement and responses in class room transactions</p> <p>Home Assignments</p> <p>Oral presentation/ Viva/Quiz/Open book test</p> <p>Field study, Group discussion on a recent research or review article(<5 years) related to the course</p> <p>Any other method as may be required for specific course / student by the course faculty</p> <p>B. End Semester Evaluation(ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12) : 10 x 1=10</p> <p>Short Essay (6 out of 8) : 6 x 5= 30</p> <p>Essay (1 out of 2) : 1x 10= 1</p>
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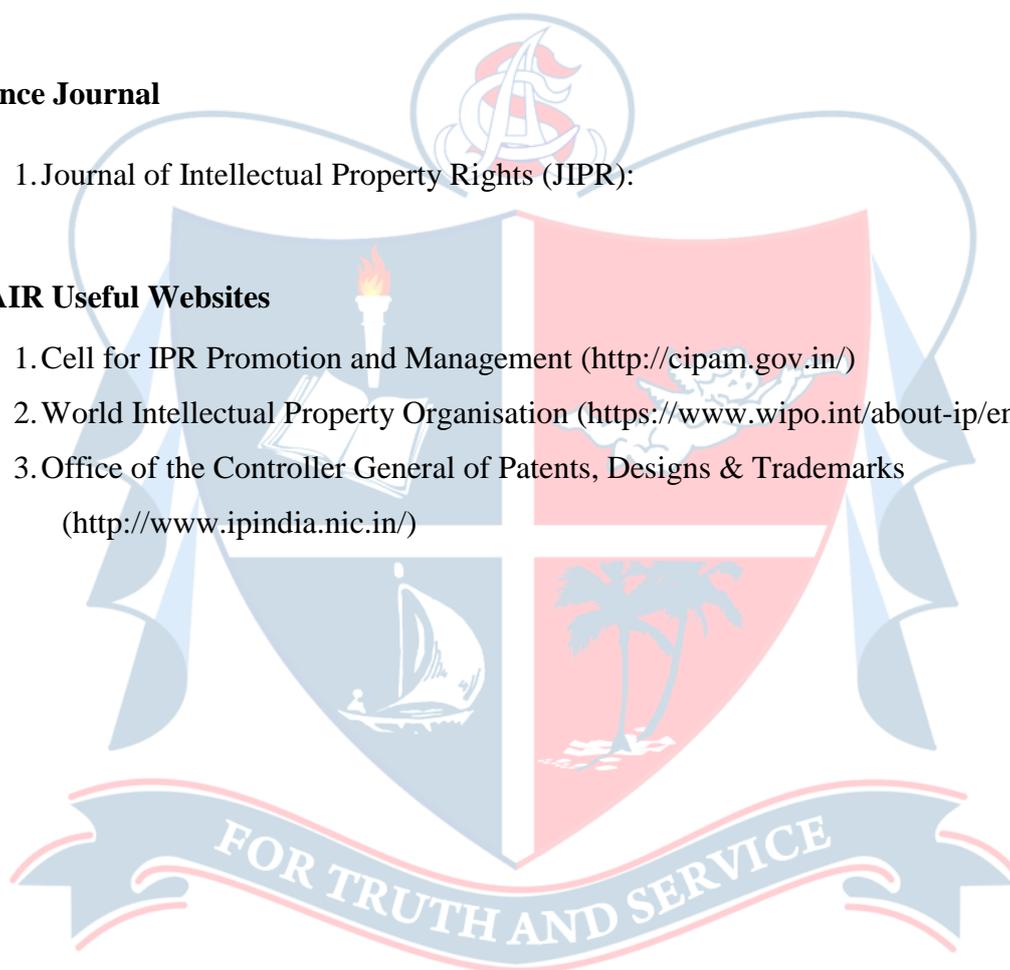
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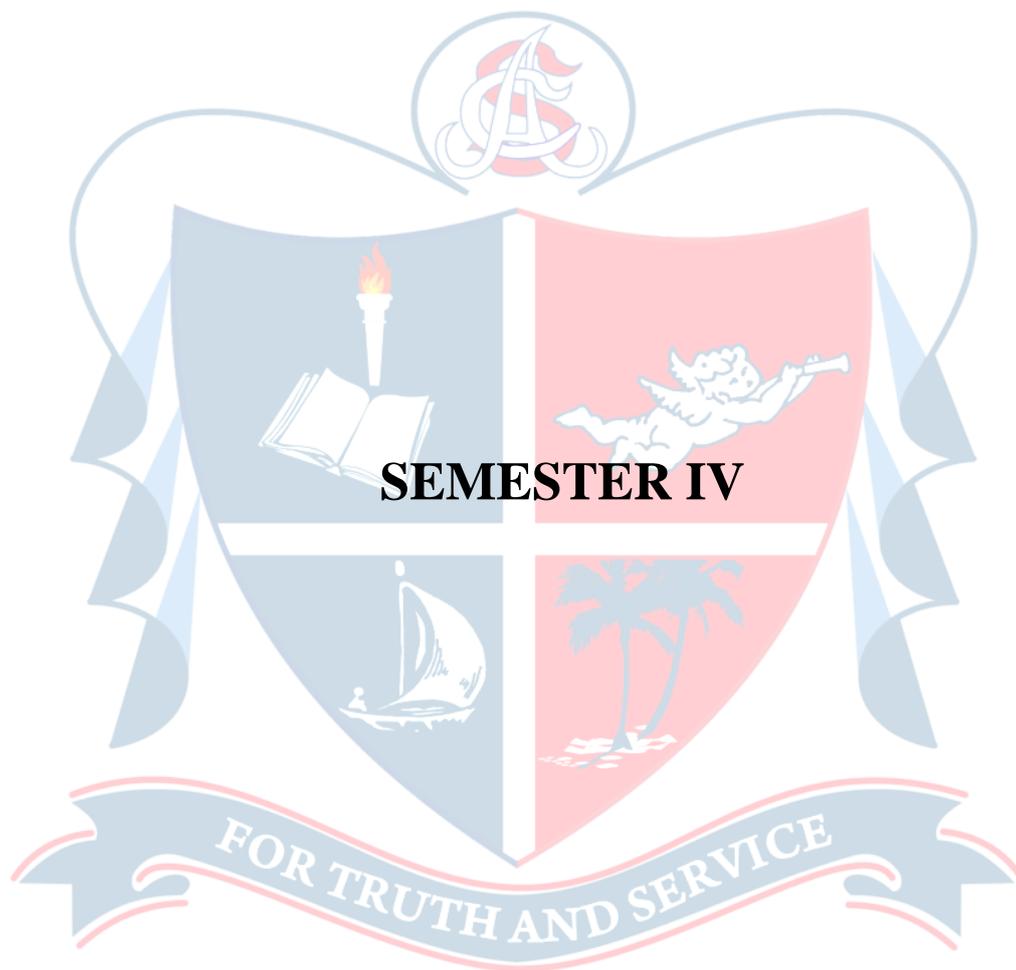
Reference Journal

1. Journal of Intellectual Property Rights (JIPR):

NISCAIR Useful Websites

1. Cell for IPR Promotion and Management (<http://cipam.gov.in/>)
2. World Intellectual Property Organisation (<https://www.wipo.int/about-ip/en/>)
3. Office of the Controller General of Patents, Designs & Trademarks (<http://www.ipindia.nic.in/>)







Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	ARCHEGONIATES					
Type of Course	DSC A					
Course Code	24SACBOT4DA201					
Course Level	200					
Course Summary	The course provides a basic overview regarding the evolutionary significance, classification, morphology, and distinguishing characters of Archegoniates. It also gives a basic outlook towards the ecological and economic significance of Archegoniates.					
Semester	III	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any	Basic botanical laboratory skills					
		3	-	1	-	75

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the general characters of Archegoniates	U	PO4
2	Classify Archegoniates to different plant groups	A	PO1, PO2
3	Compare the structure of gametophyte and sporophyte of Archegoniates	AN	PO1, PO2
4	Assess the economic and ecological significance of Archegoniates	E	PO10
5	Discuss the recent trends in archegoniate research	U	PO4, PO10

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Introduction to Archegoniates (5 hours)				
1	1.1	Unifying features of archegoniates; Transition to land habit; Alternation of generations.	2	1
	1.2	Evolution/ transition of the sporophyte and gametophytic phase of archegoniates	3	1
Bryophytes and Pteridophytes (25 hours)				
2	2.1	General characteristics of Bryophytes Classification of Bryophytes by Rothmaler 1951 (up to family)	2	1
	2.2	Type study: Morphology, anatomy, and reproduction of <i>Riccia</i> , <i>Anthoceros</i> and <i>Pogonatum</i> (Developmental details not needed).	7	1, 2, 3
	2.3	Ecological and economic importance of bryophytes.	1	4
	2.4	General characteristics of Pteridophytes. Classification of Pteridophytes up to classes by Smith (2006) and PPG system (Brief account only)	3	1, 2
	2.5	Morphology, anatomy, and reproduction of <i>Psilotum</i> , <i>Selaginella</i> and <i>Pteris</i> (Developmental details of sex organs and embryo not needed).	7	1, 3
	2.6	Heterospory and seed habit. Stelar evolution in pteridophytes	3	3
	2.7	Ecological and economic importance of Pteridophytes. Ornamental pteridophytes	2	4
Gymnosperms (15 hours)				
3	3.1	General characteristics of Gymnosperms Classification Sporne (1965) (up to family), Brief account of classification by Christenhusz (2011)	4	1
	3.2	Morphology, anatomy, and reproduction of <i>Cycas</i> and <i>Pinus</i> (Developmental details of sex organs not	8	1, 2, 3

		needed)		
	3.3	Economic importance Gymnosperms Ornamental Gymnosperms	3	4
4	Practical (30 hours)			
	4.1	Conduct a survey and submit a report with geo-tagged photos / images of gametophytes and/or sporophytes of archegoniates in your locality.	5	1, 2, 3, 4
	4.2	Collect three research publications (within five years) on archegoniates and submit a comparison report.	2	5
	4.3	Collect, identify the genus, and submit gametophytes and/or sporophytes of any five archegoniates.	5	1, 2, 3
	4.4	<i>Riccia</i> and <i>Anthoceros</i> – Morphology and anatomy of thallus. <i>Pogonatum</i> - Morphology of the sporophyte and gametophyte	6	1, 2, 3
	4.5	<i>Psilotum</i> - Morphology of sporophyte and synangium <i>Selaginella</i> - Morphology of sporophyte, transverse section of the stem. <i>Pteris</i> - Morphology of sporophyte, transverse section of sporophyll	8	1, 2, 3
	4.6	<i>Cycas</i> - Morphology of coralloid roots and reproductive structures; TS of leaflet. <i>Pinus</i> - Morphology of male and female cones; TS of the needle	4	1, 2, 3
	5. Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion- based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course · Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE) Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1 = 10$ Short Essay (6 out of 8) : $6 \times 5 = 30$ Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks Practical based assessments: 30 marks Record: 5 marks</p>

References

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT ANATOMY AND REPRODUCTIVE BOTANY					
Type of Course	DSC A					
Course Code	24SACBOT4DA202					
Course Level	200					
Course Summary	The course Plant Anatomy and Reproductive Botany equips students with a deep understanding of the intricate structures and developmental processes in plants, enabling them to appreciate the complexity and beauty of plant life and its significance in the natural world.					
Semester	IV	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	75
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify and differentiate tissues of plant organs	K, U	PO1
2	Relate the structural complexity of the cell wall and its applications.	U	PO1
3	Differentiate various anatomical changes under developmental stages and habitat conditions.	An	PO2
4	Categorize wood samples based on anatomical features	An	PO10
5	Implement the applied aspects of anatomical studies in other branches of plant science.	A	PO3
6	Describe the structure and development of reproductive parts in angiosperms.	U	PO1 PO4

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Anatomical organization of plant body - Primary structure (14 hours)				
1	1.1	Compound light microscope – parts and working, hand sectioning and slide preparation for microscopy, staining and fixing of specimens.	2	1
	1.2	External secretory tissue - glands and nectaries; Internal secretory tissues – laticifer, Commercial applications – Resins, Gums, Latex .	3	1
	1.3	Cell wall: Definition, Functions, Chemical composition – Polysaccharides, pectic polysaccharides, structural polysaccharides, arabinogalactans, enzymes, minerals. Ultrastructure of the cell wall (detailed study). Structure and function of plasmodesmata, simple and bordered pits, Growth of cell wall - apposition, intussusception.	5	2
	1.4	Cellulose as a source of energy for the future; methods to produce bioethanol from cellulose, challenges, and prospects.	4	2
Anatomical organization of Plant body - Secondary structure (19 hrs)				
2	2.1	Normal secondary growth in dicot stem and root. Steps in secondary thickening: Intrastelar secondary thickening, formation of cambium, structure and function of cambium, activity of cambium, Extra stelar secondary thickening: periderm – structure and development, bark, lenticels; factors affecting cambial activity, Seasonal activity of cambium, annual rings. Dendrochronology.	4	3
	2.2	Anomalous secondary thickening in <i>Bignonia</i> stem.	2	3
	2.3	Types of wood; heartwood, sapwood, hard wood – porous nature, softwood - non porous nature (Detailed study). Reaction wood: tension wood and compression wood.	4	4

	2.4	<p>Identification of wood using anatomical features – physical, microscopic, and macroscopic features.</p> <p>Identification of - fragmentary plant material as adulterants in crude drugs, food adulterants and contaminants, archaeological plant remains and prediction of ancient climatic conditions, forensic investigations evidence, and taxonomic significance characters. Wood modification technologies for industry (Brief account only). Relevance of anatomical studies in crop science.</p>	9	5
Reproductive Botany (12 hrs)				
3	3.1	Flower as a reproductive organ, floral components, and their roles.	1	6
	3.2	Microsporangium and male gametophyte, Microsporangium: structure and development of anther, microsporogenesis, Male gametophyte development, dehiscence of anther, structure of pollen.	2	6
	3.3	Megasporangium and female gametophyte, Megasporangium: types of ovules – anatropous, orthotropous, amphitropous, campylotropous, circinotropous. Megasporogenesis – female gametophyte – structure of a typical embryo sac, types of embryo sacs -monosporic (Polygonum type).	4	6
	3.4	Fertilization: Mechanism of pollination, agents of pollination, Pollinators and global food security, Pollen pistil interaction, germination of pollen grains; double fertilization.	3	6
	3.5	Endosperm and Embryo development: Endosperm: types – cellular, nuclear and helobial. Embryogeny, structure of dicot and monocot embryo, seed formation. Polyembryony; Apospory	2	6
Practical (30 hrs)				

4	4.1	<p>I. Select and conduct any two of the following learning activities a/b/c//d (Individual/Group):</p> <p>a. Submission of an assignment on anatomical organization of the plant body based on the higher secondary level syllabus.</p> <p>b. Collect herbaceous members of dicot and monocot– prepare stained sections of root, stem, leaves, and flower bud.</p> <p>c. Prepare photographs of each and locate – Tissue types, epidermal, ground, and vascular tissue systems.</p> <p>d. Identify locally available plants with secretory tissues and prepare a report/poster/audiovisual document.</p> <p>I. Micro preparation of root (<i>Ficus</i>, <i>Carica papaya</i>, <i>Tinospora</i>) and stem (<i>Vernonia</i>, <i>Chromolaena</i>, <i>Sida</i>) after secondary thickening.</p> <p>II. Micro preparation of <i>Bignonia</i> stem after secondary thickening.</p> <p>III. Identification of commercial wood of Teak, Mahogany (<i>Swietenia</i> spp), <i>Dalbergia</i> (Indian rose wood)</p>	20	1,3,4
	4.2	<p>I. Dissect a flower and document (photograph/illustration)</p> <p>II. Identification of C.S of the anther.</p> <p>III. Identification and documentation of anther dehiscence pattern in five locally available plants.</p> <p>IV. Pollen viability tests – Acetocarmine test / Tetrazolium test</p> <p>V. Pollen germination test - Sugar solution test.</p> <p>VI. Dissection of dicot embryo.</p>	10	6
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test · Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course · Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty <hr/> <p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1 = 10$</p> <p>Short Essay (6 out of 8) : $6 \times 5 = 30$</p> <p>Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks</p> <p>Practical based assessments: 30 marks</p> <p>Record: 5 marks</p>

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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	FOOD SCIENCE AND QUALITY CONTROL					
Type of Course	DSE					
Course Code	24SACBOT4DE201					
Course Level	200					
Course Summary	In this course, students will be familiarized with the components of food and the changes leading to spoilage. They acquire an in-depth understanding of the technologies used to produce safe and nutritious foods as well as the importance of food security. Students will address the functionality of ingredients used in foods, while exploring the basis of nutrition and the role it has on etiology and prevention of key disorders. The course will also provide information about the regulations to be followed in food industries and food-related sectors.					
Semester	IV	Credits			4	Total Hours
Course Details		Lecture	Tutorial	Practical	Others	
	Learning Approach	4	-	-	-	60
Pre-requisites, if any	Basic understanding of the structure of carbohydrates, proteins and fats as components of food					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify the food components and issues relevant to food processing and food quality management systems.	K	PO6
2	Discuss the spoilage and deterioration mechanisms in foods and methods to control spoilage.	U	PO2
3	Evaluate the principles of food science to assure the quality of food products.	E	PO2
4	Employ the principles of food science in practical, real-world situations and problems.	A	PO2,PO3

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Composition and Types of food (14 hours)				
1	1.1	Introduction and scope of Food science Composition of food: <ul style="list-style-type: none"> • Carbohydrates- Major sources and functions. • Proteins-Major sources and functions. • Lipids-Saturated and unsaturated fatty acids, Dietary sources, functions of fats. Fiber – Dietary sources, functions	5	1
	1.2	Minerals-Calcium,Phosphorus,Magnesium,Sodium, Potassium etc Vitamins- fat soluble and water soluble	2	1
	1.3	Enzymes- Amylase,Protease,Lipase,Phytase, Lipoxygenase, Pectic enzyme Pigments-Chlorophylls, Carotenoids	3	1
	1.4	Types of food- Nutraceuticals, Probiotics, Prebiotics, GM food, Organic food, Traditional food, Fermented food	4	1
Food additives, Food adulteration and Food borne diseases (19 hours)				
2	2.1	Food additives: Food colours, Sweeteners, Gelling agents, Flavour enhancers, Surface acting agents, Bleaching agents, Stabilizers, and Thickeners Activity: Carry out a market survey of additives used in different types of foods, classify them based on their role and present your findings as PowerPoint presentations.	5	1,4
	2.2	Food adulteration: Definition, Common adulterants in food, Reasons for adulteration	1	2,3
	2.3	Testing adulteration in milk, ghee, sugar, salt, tea, coffee, chili powder, turmeric powder, sweets, poultry and fish (Brief account) Hands on training on Adulteration testing of milk, chilli powder and tea (market sample)	9	2,3,4

	2.4	Harmful effects of food adulteration	1	2
	2.5	Food borne illness and diseases associated: Food poisoning, Botulism, Ergotism, Staphylococcal intoxication, Mycotoxicosis	3	1, 2
	Food spoilage and preservation (14 hours)			
3	3.1	Food spoilage: reasons for food spoilage, Physical and Chemical changes in food that affect texture, flavour, odour, stability and nutritive value during processing and storage.	2	2
	3.2	Food preservation methods: asepsis, removal of microorganisms, Drying, smoking, low temperature, high temperature, Canning, vacuum filling, UV radiation Activity: Familiarize with different preservation methods employed for preservation of vegetables, fruits, cereals, and pulses- Submission of report	8	3
	3.3	Food Preservatives: Salt, Vinegar, Sugar, Benzoates, Sorbates, Nitrates, Propionates, Antioxidants, Antibiotics, Antifungal preservatives	4	3
	Quality control in Food industry (13 hours)			
4	4.1	Quality control (QC) in food industry, major concepts of QC, Significance	3	1,3
	4.2	Food safety Standards and Regulations-ISO 22000, HACCP, FSSAI, GMP, AGMARK Visit any Food industry/Food processing unit that follows food safety standards and regulations and submit a report	7	1,3
	4.3	Qualitycontrol activities-Sampling and Inspection, Certification, Testing laboratories	3	1,3
5	Teacher specific course components			

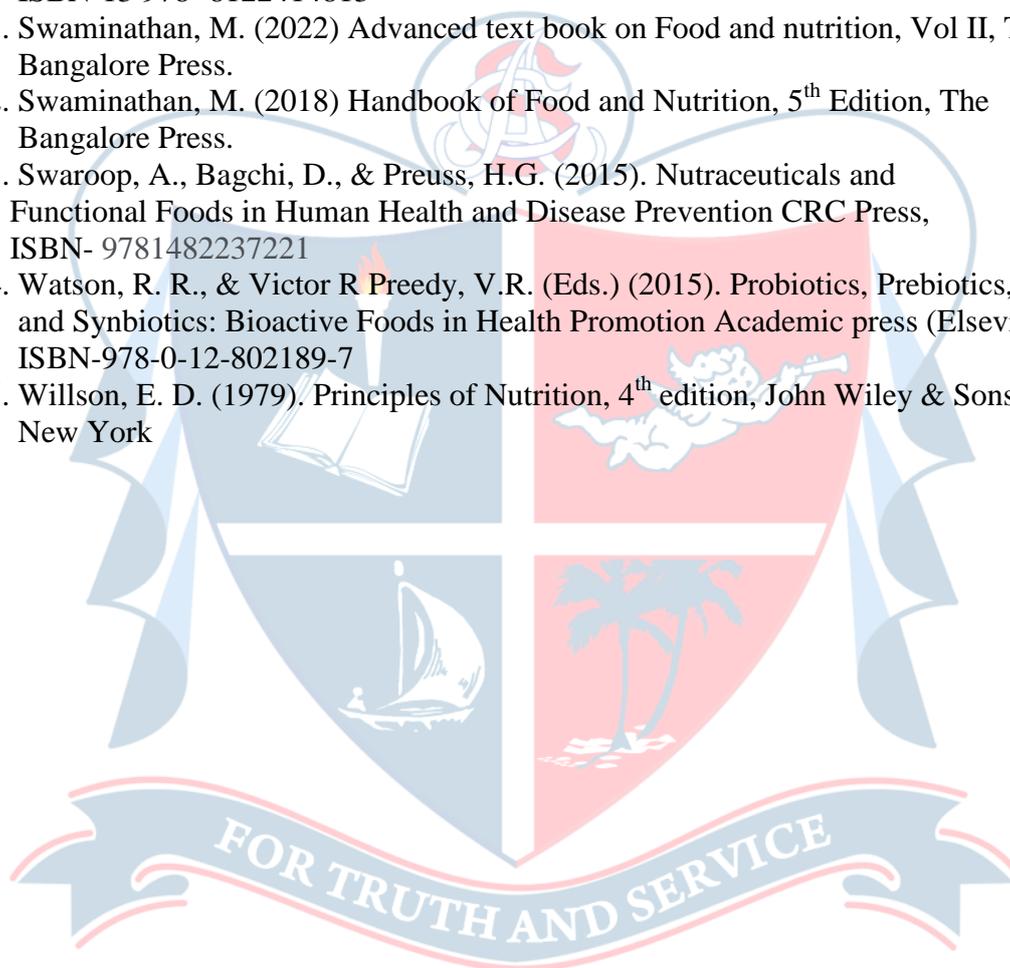
Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
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Assessment Types	MODE OF ASSESSMENT
	<p style="text-align: center;">A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	<p style="text-align: center;">B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12) : 2 x 10=20 Marks ● Short Answer (8 out of 10) : 8 x 5= 40 Marks Essay (1 out of 2): 1x 10= 10marks

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Department of Botany
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Programme	BSc.(HONOURS) BOTANY					
Course Name	HORTICULTURE AND POST-HARVEST TECHNOLOGY					
Type of Course	DSE					
Course Code	24SACBOT4DE202					
Course Level	200					
Course Summary	Students are expected to gain knowledge on various horticultural disciplines including gardening, field management and postharvest technologies. They will also develop an understanding of regulatory laws related to food safety and quality control along with exploring the entrepreneurial aspects within the field of horticulture.					
Semester	IV	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any	Familiarity with basic plant science, soil science and environmental science					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Develop a comprehensive understanding of horticulture, importance and its branches	U	PO10
2	Apply crop management techniques in horticulture including soil preparation, irrigation and pest control	A	PO2
3	Develop expertise in postharvest handling techniques to minimize losses and enhance the shelf life	A	PO2
4	Administer storage and transportation practices to maintain freshness and nutritional quality	A	PO2
5	Develop new value addition strategies based on the principles on harvesting, processing and packaging of		

	Horticultural produces	C	PO1
6	Evaluate and implement sustainable practices in horticulture considering environmental impact resource conservation and promotion of biodiversity	E	PO6
7	Develop entrepreneurial skills including market analysis, business planning and risk management in horticultural industry	C	PO 5
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to Horticulture (3 hours)				
1	1.1	Introduction, Scope and Importance, Branches of horticulture.	3	1
Soil Science and field management (12 hours)				
2	2.1	Components of soil: Organic, Inorganic & physiological-types and its importance.	2	2
	2.2	Classification of soil: Criteria for classification - soil profile- soil types - red soil, black soil, alluvial soil, laterite soil, coastal soil, sandy soil, serpentine soil, sodic soil, problematic soil, acidic and alkaline.	4	2
	2.3	Irrigation: Principles. Methods of irrigation - surface, subsoil and overhead irrigation system – types.	2	2
	2.4	Manuring: organic and Synthetic manures - Classification. Methods of manuring- broadcast, seed treatment, foliar application	3	2
	2.5	Estimation of soil pH using pH meter.	1	2
Landscape architecture & Commercial Horticulture (25 hours)				
3	3.1	Gardening: styles of gardens - English, Mughal, Japanese, Persian, French and Italian gardens - characteristics and components (Brief account Only). Garden tools and Implements – Types. Garden designing and layout. Different types of gardens:	6	1

		Outdoor, indoor garden, water garden, rockery.		
	3.2	Landscape architecture: types - Contemporary, Environmental, Industrial, institutional and playground landscaping.	3	1,6
	3.3	Plant propagation methods: Budding, Grafting, Layering and Tissue culture.	3	2
	3.4	Major branches of horticulture: Floriculture: definition and significance, Components – Cut flower, loose flower, dry flower, Floral oil. Olericulture: definition and significance; Types of vegetables: Warm season and cool season vegetables, types of vegetable farming- kitchen, garden, terrace garden, market garden, truck garden. Pomology: Types of fruits – Tropical, Subtropical and Temperate. General care of fruit crops - techniques for planting, pruning and training, pest management.	8	1
	3.5	Practice different types of grafting (approach, whip and tongue, cleft), T budding/ Patch Budding.	5	2
	Post harvest Management; Laws & Entrepreneurship (20 hours)			
4	4.1	Importance of post-harvest management. Postharvest handling methods: Washing, Grading, Waxing. Storage methods: Pre-cooling. Controlled atmospheric storage, Modified atmospheric storage – Low pressure storage and cold chain concept	3	3,4
	4.2	Packaging of fresh and processed products: general principles and methods of preservation - dehydration, thermal processing, chemical preservatives, fermentation, ionizing, radiation, Preparation of jams, jellies, squashes, pickles, salads, syrups and beverages.	4	4,5
	4.3	Government policies, regulations and specifications for fresh and processed products, Food safety and quality control-FSSAI. Export promotion agencies and their role on export of fresh and processed products.	3	6
	4.4	Importance and scope of processing industry in India. General guidelines for the establishment of small and large scale processing units. Business opportunities, Role of HortiCorp and VFPC.	2	6,7

	4.5	Training on making jams, jellies, squashes, pickles, salads, syrups and beverages	3	5
	4.6	Visit a garden and identify the components, plants, and prepare a report. Collect, familiarize and identify ornamental plant groups.	5	7
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12) : 2 x 10=20 Marks ● Short Answer (8 out of 10) : 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

References

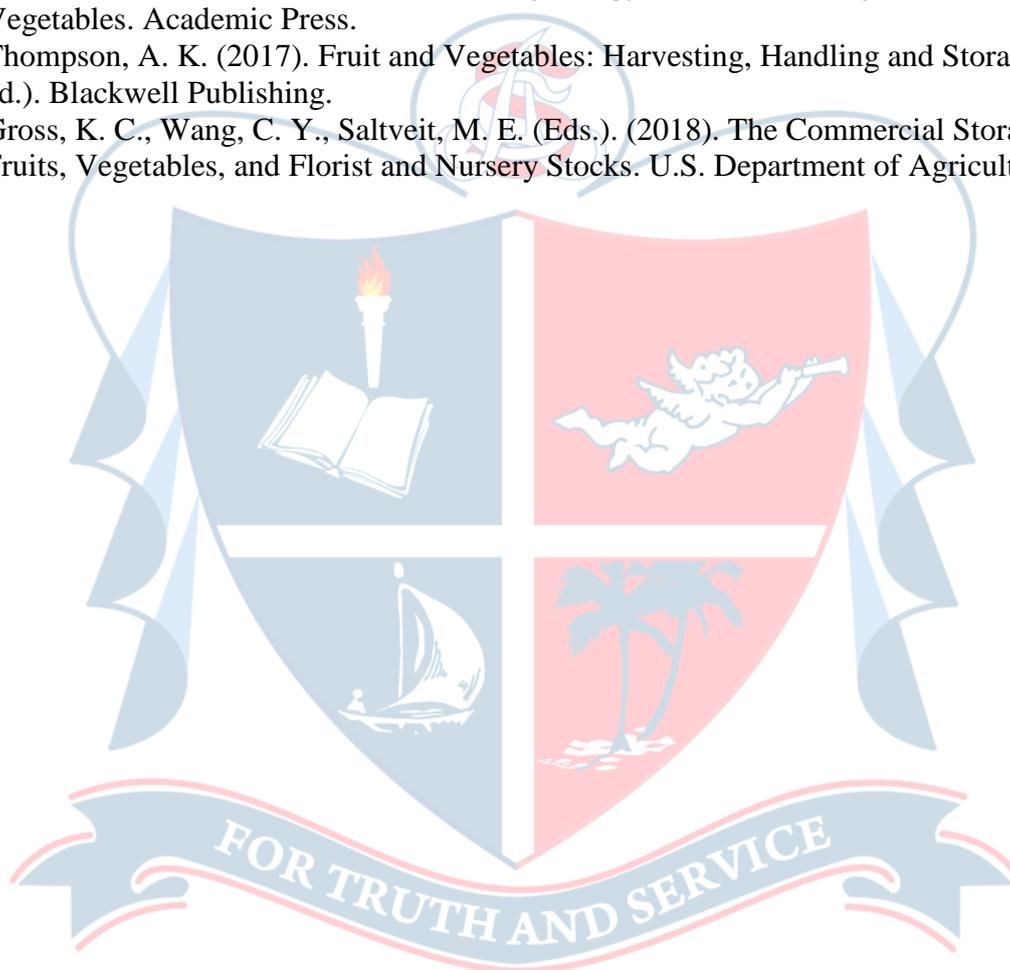
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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	INTRODUCTION TO FLOWERING PLANTS AND THEIR ECONOMIC IMPORTANCE					
Type of Course	DSC B					
Course Code	24SACBOT4DB201					
Course Level	200					
Course Summary	Upon completion of the course, a student should be able to identify and classify plants based on natural system of classification, use taxonomic aids for scientific studies and research, understand the use and importance of plants and appreciate the traditional knowledge of local culture and people, know the basic techniques of dry preservation of plants					
Semester	IV	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	75
Pre-requisites, if any	-					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Analyse morphological characters of plants helpful in the identification of plants	An	PO2
2	Apply techniques in plant taxonomy for the identification and preservation of plant species.	A	PO2, PO7
3	Interpret angiosperm families based on Bentham and Hookers Classification for the identification of common plants	A	PO7, PO10
4	Explain the botanical details and uses of selected plants of daily use.	U	PO10, PO2,

5	Appraise the utility of plants in the daily life of tribal people.	An	PO8, PO1, PO6, PO 2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Morphology of Angiosperms (10 Hours)				
1	1.1	Leaf – types, phyllotaxy. Flower as a modified shoot Structure of flower - floral parts, Flower types - Hypogyny, Perigyny, Epigyny, Symmetry of flowers, aestivation and placentation; floral diagram and floral formula.	10	CO1
	1.2	Inflorescence: racemose – simple raceme, spike, corymb, umbel, head; cymose – simple cyme		
	1.3	Fruits: Simple: Fleshy - drupe, berry, hesperidium Dry - Dehiscent and Indehiscent with examples. Aggregate fruit Multiple fruit: Sorosis		
Classification, Nomenclature. and Systematic Botany (20 Hours)				
2	2.1	Types of Classification: Bentham and Hookers System of Classification (up to Series)	5	CO2
	2.2	Binomial nomenclature, Author Citation	5	CO2
	2.3	Herbarium Techniques	5	CO2
	2.4	Study of the following families of Bentham and Hooker's system of classification with special reference to major identifying characters and economic importance: Malvaceae, Leguminosae (Fabaceae),	15	CO3

		Rubiaceae, Apocynaceae, Poaceae (Graminae).		
	Economic Botany & Ethnobotany (15 Hours)			
3	3.1	<p>Binomial and Uses of the following plants:</p> <p>Cereals – Rice</p> <p>Pulses - Green gram</p> <p>Sugar-yielding plants Sugarcane</p> <p>Fruits - Mango and Jackfruit</p> <p>Vegetables – Amaranthus and Moringa</p> <p>Tuber crops – Tapioca</p> <p>Beverages - Tea, Coffee</p> <p>Oil yielding plants- Coconut,</p> <p>Spices – Pepper, Turmeric</p> <p>Fibre yielding plants – Cotton</p> <p>Rubber yielding plant- Rubber</p> <p>Medicinal plants – Tulsi, Neem</p>	10	CO3
	3.2	<p>Introduction, scope and significance of ethnobotany.</p> <p>Study of the following plants used in daily life by tribals and village folks.</p> <p>Food- Finger Millet, Little millet</p> <p>Shelter - <i>Bambusa</i>, <i>Calamus</i>;</p> <p>Medicine – <i>Trichopuszeylanicus</i>, <i>Alpinia galanga</i>.</p>	5	CO4
	Practicals (30 Hours)			
4	4.1	<ol style="list-style-type: none"> 1. Collect and submit specimens/geotagged photos of at least three items each of the inflorescence and fruits mentioned in the syllabus. 2. Study of floral parts and construction of floral diagram and floral formula of at least one plant from each family and mentioned in the syllabus and submit a record. 3. Prepare a herbarium of 5 plants representing each family. 4. Conduct a field visit to explore the Angiosperm diversity and submit a report 5. Study the useful parts of plants mentioned under 	30	CO5

		economic botany and ethnobotany, with special reference to the binomial and uses		
5	Teacher Specific Content			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Lecture, hands-on training in plant identification, lab-to-field connection through field visits, nature study, specimen collection, documentary, and use of online tools and resources in taxonomic and ethnobotanical studies</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course · Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> -Lab involvement and practical skills -Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1 = 10$</p> <p>Short Essay (6 out of 8) : $6 \times 5 = 30$</p> <p>Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> · Practical based assessments: 30 marks · Record: 5 marks

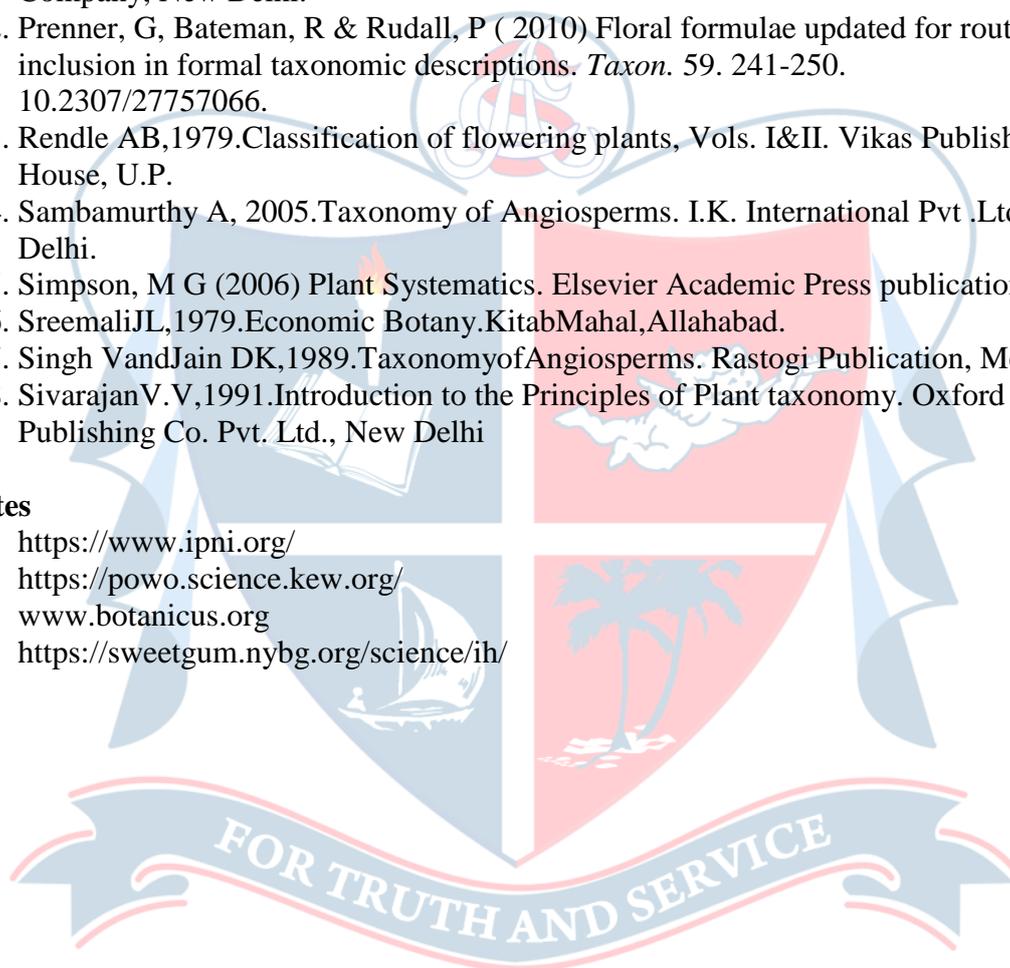
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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	ENVIRONMENTAL POLLUTION AND MANAGEMENT					
Type of Course	DSC B					
Course Code	24SACBOT4DB202					
Course Level	200					
Course Summary	The course aims to equip students with the knowledge and skills necessary to understand, assess, manage, and mitigate environmental pollution while considering sustainable and socially responsible practices.					
Semester	IV	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		3	-	1		75

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the definition, structure and constituents; sources and nature of air pollutants. Distinguish between the various types of air pollutants. Examine the effects of air pollution on - Human being - Animals - Plants - Materials, buildings and climate. Discuss the control various measures of Air pollution.	U, A, An	PO1, PO2, PO3, PO10
2	Understand the definition, Types and sources of water pollution. Examine and discuss the effects and various measures to control water pollution.	U, A, An	PO1, PO2, PO3, PO10
3	Understand the definition, Types and sources of soil pollution. Examine and discuss the effects and various measures to control soil pollution.	U, A, An	PO1, PO2, PO3, PO10

4	Understand the definition of noise pollution. Examine and discuss the effects of noise pollution, control and protective measures.	U, A, An	PO1, PO2, PO3, PO10
5	Understand the definition, Types and sources of Radioactivity. Examine and discuss the effects of Radioactive pollution, precautions and control measures.	U, A, An	PO1, PO2, PO3, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Air pollution - Sources, effects and control measures (13 hours)				
1	1.1	Air pollution - Sources, effects and control measures Definition - Structure and constituents; sources, nature and types of pollutants - primary and secondary air pollutant, particulate matter, aerosols, fly ash, biopollutants.	8	CO1
	1.2	Effects of air pollution on - Human beings - Animals - Plants - Materials, buildings and climate. Control measures of Air pollution.	5	CO1
Water and Soil / Land pollution - Sources, effects and control measures (20 hours)				
2	2.1	Definition, Types of water pollution - Point and non point source of water pollution- surface and ground water pollution.	4	CO2
	2.2	Sources of water pollution - Domestic, Industrial, Agricultural and Natural sources.	4	CO2
	2.3	Effects of water pollution on human being, animals, plants and environment. Control measures of water pollution.	4	CO2
	2.4	Sources, nature and types of soil pollutants - fertilizer residues, solid wastes, radioactive substances, hospital	6	CO3

		wastes, pesticides, field run off and sewage effluents.		
	2.5	Control measures of soil pollution.	2	CO3

	Noise pollution and Radioactive pollution - definition, effects and control measures (12 hours)			
	3.1	Definition, general effects of noise pollution.	2	CO4
3	3.2	Control and protective measures of noise pollution.	4	CO4
	3.3	Definition, Types and sources of Radioactivity.	2	CO5
	3.4	Effects of Radioactive pollution, precautions and control measures.	4	CO5
	Practical (30 hours)			
4	4.1	<ul style="list-style-type: none"> - Collection and analysis of water samples from various sources (rivers, lakes, groundwater) - Assessment of physical, chemical, and biological parameters - Understanding the impact of pollutants on aquatic ecosystems Soil analysis - Determination of pH, acidity, total organic content, potassium and calcium. - Familiarize the equipment's used in soil analysis. Determination of soil texture - triangular diagram 	30	CO1 CO2 CO3
5	Teacher specific course content			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
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Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course · Any other method as may be required for specific course / student by the course faculty.
	<p>Practical: 15 marks</p> <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1 = 10$</p> <p>Short Essay (6 out of 8): $6 \times 5 = 30$</p> <p>Essay (1 out of 2): $1 \times 10 = 10$</p> <p>Practical: 35 marks</p> <p>Practical based assessments: 30 marks Record: 5 marks</p>

References

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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	FRUIT SCIENCE					
Type of Course	DSC B					
Course Code	24SACBOT4DB203					
Course Level	200					
Course Summary	Fruit Science is an important branch of horticulture which deals with various aspects of fruits starting from raising of saplings, growing them properly, providing various intercultural operations, harvesting, ripening and marketing. The course is designed to educate the future generation on the crop management, conventional and molecular breeding of fruit crops of commercial importance through continuing education. The course also aims at equipping students in strengthening fruit science to promote food security,					
Semester	IV	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the importance and classification of Pomology	U	PO2
2	Understand pre- and post-harvest techniques	U	PO2
3	Remember the government policies regarding food safety	K	PO2, PO7, PO8, PO10
4	Apply knowledge to manage the fruit gardens	A	PO2

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Introduction to fruit science (20 Hours)				
1	1.1	Introduction to Fruit science- Importance of fruits. classification of fruit plants. Fruit cultivation in India. Role of fruits in the Indian economy.	5	1
	1.2	Tropical and Subtropical Fruit Production: Commercial varieties of regional, national and international importance, eco -physiological requirements, recent trends in propagation, scion-stock relationship, planting systems, cropping systems, canopy management, nutrient management, water management, fertigation, role of bioregulators, abiotic factors limiting fruit production, physiology of flowering, pollination, fruit set and development, honeybees in cross pollination, physiological disorders—causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; industrial and export potential.	5	1
	1.3	Cultivation of fruit trees - Tropical Crops: Mango, Banana, Citrus, Papaya, Guava, Sapota. Subtropical Crops: Pineapple, Jackfruit, Apple, Grapes.	10	1
Post harvest technology				
2	2.1	Post-Harvest Technology: Maturity indices, harvesting practices and grading for specific market requirements, influence of pre-harvest practices, enzymatic and textural changes, respiration, transpiration; Physiology and biochemistry of fruit ripening, ethylene evolution and ethylene management, factors leading to post-harvest loss, pre-cooling;	5	2

	2.2	Treatment prior to shipment, viz., chlorination, waxing. Chemicals, bio-control agents and natural plant products, fungicides, hot water, vapour heat treatment, sulphur fumigation and irradiation. Methods of storage-ventilated, refrigerated, MAS, CA storage, physical injuries and disorders; Packing methods and transport, quality evaluation.	5	2
	2.3	Principles and methods of preservation, food processing, canning, fruit juices, beverages, pickles, jam, jelly, candy; Dried and dehydrated products, nutritionally enriched products, fermented fruit beverages, packaging technology, processing waste management and food safety standards; Role of HACCP.	5	2
3	Policies and regulations (10 Hours)			
	3.1	Government policies, regulations and specifications for fresh and processed products, export promotion agencies and their role on the export of fresh and processed products.	5	3
	3.2	Food standards- Important food standards, packaging and labelling,	2	3
	3.3	General guidelines for establishment of a home scale processing unit	3	3, 4
	Practicals (30 Hours)			
4	4.1	Collection and identification of different fruit types Visit to established orchards, fruit processing industries Demonstration of preservation methods specified in the syllabus	30	
	Teacher specific course content			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Practical, Activities
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course · Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1 = 10$</p> <p>Short Essay (6 out of 8): $6 \times 5 = 30$</p> <p>Essay (1 out of 2): $1 \times 10 = 10$</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> · Practical based assessments: 30 marks · Record: 5 marks

References

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2. Bose T K, Mitra S K, Sanyal D, 2002. Fruits: Tropical and Subtropical, Vol. I & II, Nayaprakash publications, Calcutta.
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Suggested readings

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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	BIOFERTILIZERS AND BIOCONTROL AGENTS					
Type of Course	SEC					
Course Code	24SACBOT4SE201					
Course Level	200					
Course Summary	The course Biofertilizers and Biocontrol agents is designed in such a way to develop skills in graduate-level students to prepare various types of eco – friendly bioformulations for sustainable agriculture. The course deals with important categories of micro and macroscopic agents that can act as biofertilizers and biocontrol agents, their preparation and application methods.					
Semester	IV	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	-	-	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Relate the different concepts and approaches of sustainable agriculture	U	PO3
2	Implement the knowledge of various organisms in sustainable agricultural practices.	A	PO1, PO3 PO6
3	Compare and evaluate the role of various components of bioformulations.	An	PO1, PO3, PO6, PO10
4	Practice bioformulation production and their application methods.	A	PO1, PO2

5	Implement the knowledge acquired to develop compost from household waste.	A	PO1
6	Develop various categories of bioformulations.	C	PO1, PO2, PO6
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to Sustainable agricultural practices (5 hours)				
1	1.1	<p>Sustainable agricultural practices: Definition and concepts, Different approaches of sustainable agriculture/ natural farming: organic farming, Whole farm planning, Minimal cultivation, Environment- friendly agriculture</p> <p>Learning activity:</p> <ol style="list-style-type: none"> Group discussion/Debate – conventional and sustainable agriculture. Prepare and submit a report on various agricultural practices in an agricultural field based on a field visit. 	5	CO1
Biofertilizers and Biocontrol agents for sustainable agroecosystem (15 hours)				
2	2.1	<p>Brief history and concept of Biofertilizers, status, scope, and importance of Biofertilizers. Classification of Biofertilizers – (a) Nitrogen-fixing (b) Phosphorus- solubilising bio-fertilizers or PSB (c) Potash- solubilising bio-fertilizers (d) Plant growth promoting microbes (PGPR). Major groups of microbial biofertilizers – Bacteria (Rhizobium, Pseudomonas) and Fungi (AM mycorrhiza and ectomycorrhiza). Blue-green algae (BGA), Plant-based biofertilizer – Azolla.</p> <p>Learning activity:</p> <ol style="list-style-type: none"> Field exploration for macroscopic biofertilizers. 	8	CO2
	2.2	<p>Brief history and development of Biocontrol agents, Types: Macro biocontrol agents – egg parasitoids</p>	7	CO3

		<p>(<i>Trichogramma</i>) and Microbial biocontrol agents – (a) Bioinsecticides – <i>Bacillus thuringiensis</i>, (b) Bio fungicides – <i>Trichoderma</i>. Plant-based biopesticides: Neem and tobacco-based products (Brief account only). Commercially available botanical biopesticides – Pyrethrum, <i>Eucalyptus</i> essential oil.</p> <p><u>Learning activity:</u></p> <ol style="list-style-type: none"> 1. Collect recipes, uses and modes of action of various types of plant-based biopesticides. 2. Conduct a presentation/group discussion on the recipes they collected. 		
Bioformulations (25 hours)				
	3.1	<p>Bioformulations: Definition, components (Active ingredient, carrier material, additive), Types of bioformulations: Solid (granules, wettable powders, wettable granules, dust) liquid (suspension concentrate), encapsulation. Bioformulations for the uptake of nutrients like - Nitrogen, Phosphorus, Potassium, and Iron. Bioformulations as biocontrol agents/biopesticides: Bacterial, Fungal and Viral.</p> <p><u>Learning activity:</u></p> <ol style="list-style-type: none"> 1. Visit a biofertilizer/pesticide manufacturing industry. 2. Make a comparison chart of the components of commercially available biofertilizers/biopesticides. 	7	CO4
	3.2	<p>Rhizobium-based biofertilizer production steps: Selection of strain, Mass culture, Carrier preparation, Inoculant production. Formulation of <i>Trichoderma</i> as biocontrol agents. Delivery methods of various biofertilizer and biocontrol agents – seed treatment, soil amendment, soil drench, aerial spraying, root dip method.</p> <p><u>Learning activity:</u></p> <ol style="list-style-type: none"> 1. Field exploration for plants with root nodules 	10	CO4

		Practice various methods of biofertilizer and biocontrol agent application.		
	3.3	Types of household wastes, manufacturing of biofertilizers using household waste: Procedure- sorting of household waste, composting (biodegradation)- enzymatic method, backward method, composting by microbial inoculation and biological beneficial organisms. Methods to improve the quality of household compost- mineral additives and plant hormones. Learning activity: 1. Conduct the preparation of compost from household wastes using the Garden pot composting method or Pipe composting method.	8	CO5

4	Teacher specific course content
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Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 25 Marks</p> <p>Involvement and responses in class room transactions</p> <p>Home Assignments</p> <p>Oral presentation/ Viva/Quiz/Open book test</p> <p>Field study, Group discussion on a recent research or review article (<5 years) related to the course</p> <p>Any other method as may be required for specific course / student by the course faculty</p>

	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): 10 x 1=10</p> <p>Short Essay (6 out of 8): 6 x 5= 30</p> <p>Essay (1 out of 2): 1x 10= 10</p>
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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	CONSERVATION BIOLOGY AND SUSTAINABLE DEVELOPMENT					
Type of Course	VAC					
Course Code	24SACBOT4VA201					
Course Level	200					
Course Summary	The course provides a basic overview regarding the concepts in conservation biology. It also gives a basic outlook towards the need for biodiversity conservation and sustainable development. It also creates an awareness regarding the transition to green growth.					
Semester	IV	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		3	-	-	-	45

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Recall the concepts in conservation biology	K	PO1, PO4
2	Identify a variety of tools used by conservation biologists	U	PO1, PO4, PO10
3	Outline the concept and importance of sustainability	An	PO1, PO2, PO6
4	Examine the threats and adopt creative measures for biodiversity conservation	An	PO2, PO6, PO9, PO10
5	Assess the current status of biodiversity	E	PO2, PO4

6	Create an awareness in the society for the transition to the green growth	C	PO4, PO6, PO9
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Conservation Biology (15 hours)			
	1.1	Introduction to conservation Biology –Definition, career prospects in conservation biology, Conservation and management practices	3	1
	1.2	Conservation Techniques-Principles of conservation -ex-situ and in-situ conservation techniques, ecological restoration Statistical and computational tools used in conservation biology- Population Viability Analysis (PVA), Minimum Viable Population, Decision Analysis and Multiple-Criteria Approaches	7	2
	1.3	Statistical and computational tools used in conservation biology- Population Viability Analysis (PVA), Minimum Viable Population, Decision Analysis and Multiple-Criteria Approaches	7	2
2	Biodiversity (15 hours)			
	2.1	Definition, types and importance	3	4
	2.2	Biodiversity loss- Causes, extinction, IUCN account of biodiversity, red data book, rare, endangered and threatened species (RET).	5	4, 5
	2.3	Concept of endemism, Biodiversity hotspots in India.	2	4, 5
	2.4	Biodiversity documentation- Case study- Students have to submit a brief report with geo-tagged photographs of the biodiversity of the nearby locality.	5	5

3	Sustainable development (15 hours)			
	3.1	Introduction -aim and impact of sustainable development	3	6
	3.2	Sustainable development- Basic characteristics, core elements, principles and goals	5	6
	3.3	Strategies and policies for sustainable development Examples of Sustainable development in daily life – Wind energy, solar energy, sustainable forestry, bio-composting, biogas production, water efficient fixtures, green spaces and sustainable construction.	7	6
4	Teacher specific course content			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 25 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course <p>Any other method as may be required for specific course / student by the course faculty</p>
	<p>B. End Semester Evaluation (ESE) Theory: 50 marks</p> <p>Short answer (10 out of 12) : 10 x 1=10 Short Essay (6 out of 8) : 6 x 5= 30 Essay (1 out of 2) : 1x 10= 10</p>

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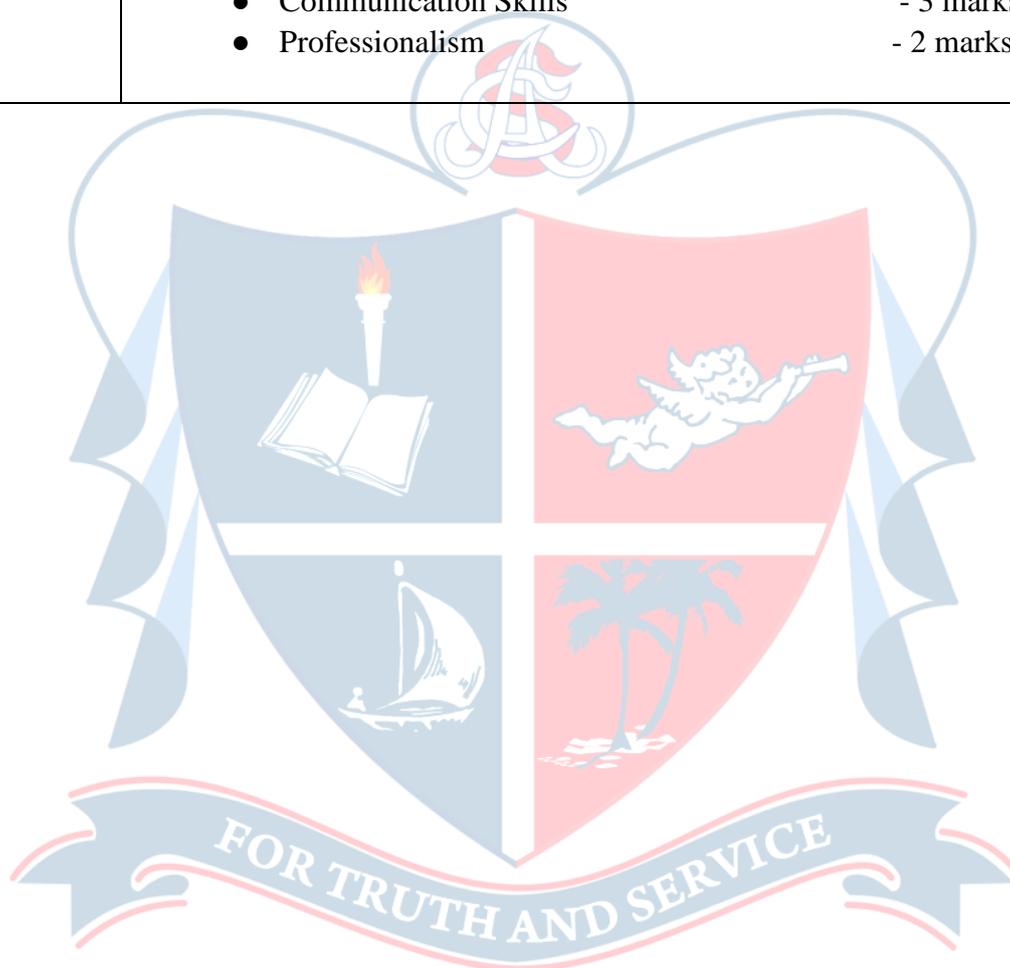


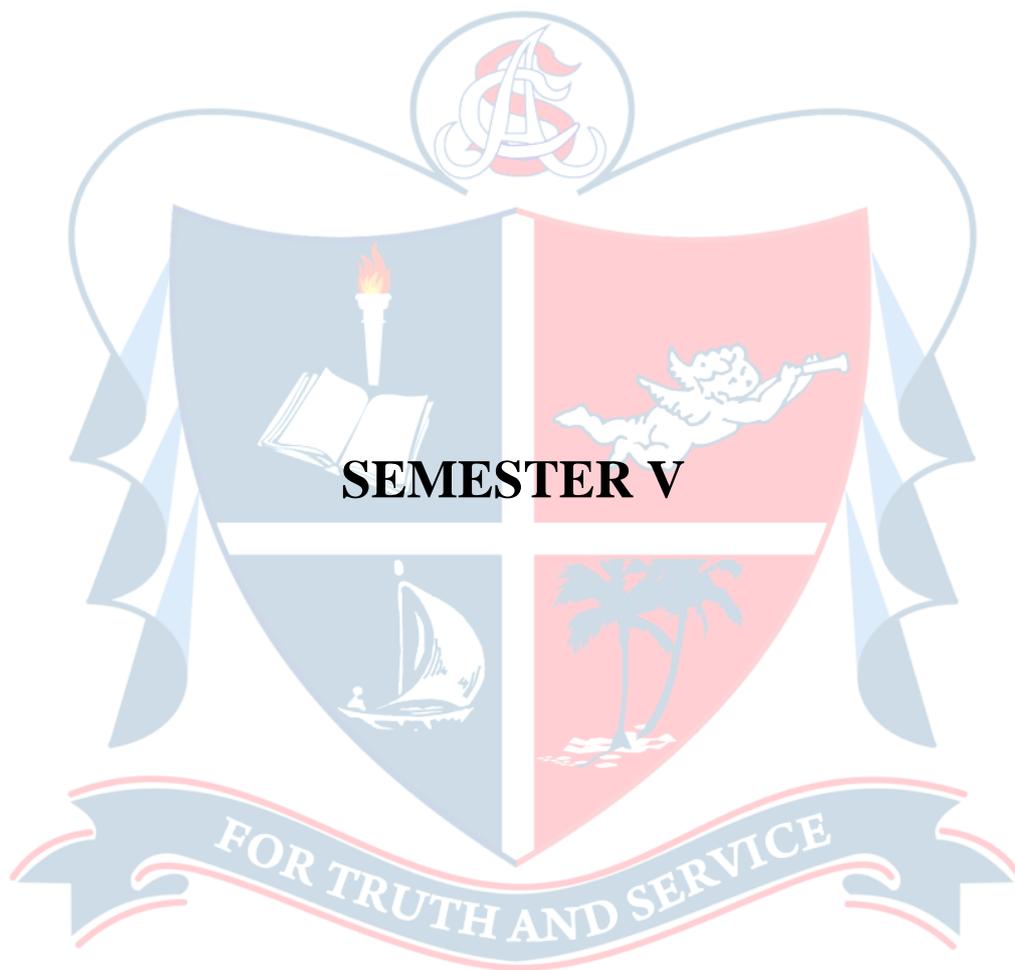
Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY
Course Name	INTERNSHIP
Course Code	24SACBOT4IN201
Course Summary	The internship is for gaining first-hand experience by an individual besides comprehending the way of working in an organization, leading to improvement in skill aptitude for specific job or job role and to build research aptitude with learning opportunities. All students shall undergo summer internship or apprenticeship in a research station, industry or organization or training centres, recognized laboratories, nurseries with artificial propagation activities, with faculty/technical staffs and researchers or other higher education institutions (HEIs) or research institutions after the completion of fourth semester.
Evaluation scheme Total 50 marks	A) Continuous Comprehensive Assessment (CCA): 15 marks (Internal marks may be obtained from the organization/institution where the student is doing internship using the following format)
	Undergraduate Student Evaluation Form for Internship: Botany Internship Details Student name : Date of evaluation : Duration of internship : Mentor name :
	Instructions: Please rate the student's performance based on their abilities, skills, and behaviour during the internship. Provide specific examples or comments where applicable to support your ratings.
	A. Continuous Comprehensive Assessment (CCA):15 marks 1. Performance and Professionalism (4 marks) Criteria: <ul style="list-style-type: none"> ● Punctuality, attendance, and adherence to workplace norms. ● Ability to work independently and collaboratively.

	<ul style="list-style-type: none"> ● Demonstration of initiative, creativity, and problem-solving skills. ● Professional behaviour and ethical conduct. <p>2.Skill Application and Development (4 marks)</p> <p>Criteria:</p> <ul style="list-style-type: none"> ● Application of academic knowledge to practical tasks and projects. ● Development of new skills relevant to the field of study. ● Adaptability and learning agility in new or challenging situations. ● Use of technical tools and methodologies pertinent to the internship role. <p>3.Communication Skills (4 marks)</p> <p>Criteria:</p> <ul style="list-style-type: none"> ● Effectiveness in written and oral communication. ● Ability to document and present work clearly and professionally. ● Interaction with colleagues, supervisors, and clients. <p>4.Supervisor's Evaluation (3 marks)</p> <p>Criteria:</p> <ul style="list-style-type: none"> ● Feedback from the internship supervisor regarding the intern's performance, growth, and contributions. ● Supervisor's overall satisfaction with the intern's work and professionalism. <p>Total (out of 15)</p>												
	<p>Comments and Recommendations: (Provide specific comments on the student's strengths, areas for improvement, and any additional feedback or recommendations for their future development.)</p> <p>Mentor Signature: (Insert mentor's signature) :</p> <p>Date (Insert date of evaluation) :</p>												
	<p>B) End Semester Evaluation (ESE): 35 marks</p> <p>(I) Report (20 marks)</p> <p>Criteria/ Components</p> <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="padding-left: 20px;">Introduction and background</td> <td style="text-align: right;">- 2 marks</td> </tr> <tr> <td style="padding-left: 20px;">Objectives and Goals</td> <td style="text-align: right;">- 3 marks</td> </tr> <tr> <td style="padding-left: 20px;">Review of Literature</td> <td style="text-align: right;">- 4 marks</td> </tr> <tr> <td style="padding-left: 20px;">Methodology and Experiments</td> <td style="text-align: right;">- 4 marks</td> </tr> <tr> <td style="padding-left: 20px;">Data Analysis and Interpretation</td> <td style="text-align: right;">- 3 marks</td> </tr> <tr> <td style="padding-left: 20px;">Conclusion and Future Prospects</td> <td style="text-align: right;">- 2 marks</td> </tr> </tbody> </table>	Introduction and background	- 2 marks	Objectives and Goals	- 3 marks	Review of Literature	- 4 marks	Methodology and Experiments	- 4 marks	Data Analysis and Interpretation	- 3 marks	Conclusion and Future Prospects	- 2 marks
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Objectives and Goals	- 3 marks												
Review of Literature	- 4 marks												
Methodology and Experiments	- 4 marks												
Data Analysis and Interpretation	- 3 marks												
Conclusion and Future Prospects	- 2 marks												

	<p>Overall Presentation and formatting - 2 marks</p> <p>(II) Viva voce (15 marks)</p> <p>(Student's skills, work ethics, professionalism and contribution to the organization may be evaluated through viva)</p> <ul style="list-style-type: none">• Understanding of learning objectives and goals of the internship - 4 marks• Knowledge and application of Scientific method - 4 marks• Data Analysis and Interpretation - 2 marks• Communication Skills - 3 marks• Professionalism - 2 marks
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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	ANGIOSPERM SYSTEMATICS AND ECONOMIC BOTANY					
Type of Course	DSC A					
Course Code	24SACBOT5DA301					
Course Level	300					
Course Summary	Angiosperm Systematics deals with the systematic arrangement of flowering plants, interrelation between plants and their evolutionary descent and Economic Botany is the study of the morphology of useful parts of economically important plants.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Comprehend the general principles of angiosperm systematics and plant nomenclature	U	PO2
2	Summarize taxonomic information from available resources	U	PO4
3	Compare the morphological characters of plants belonging to different plant families	An	PO2
4	Execute field collections and plant specimen preparations scientifically	An	PO10
5	Utilize the knowledge in plant systematics for the benefit of science and society	A	PO2

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Exploring the Plant Kingdom (15 Hours)				
1	1.1	Leaf morphology- Different types and arrangements of leaves Inflorescence types–Racemose-Simple Raceme, Spike, Catkin, Spadix, Corymb, Umbel, Head; Cymose- Simple cyme, monochasial- helicoid and scorpioid, dichasial and polychasial cymes; Specialtypes- Cyathium, Verticillaster, Thyrsus, Hypanthodium and Panicle	4	3
	1.2	Flower – as a modified shoot Floral whorls- arrangement, relative position- Symmetry, Aestivation, Placentation. Cohesion and adhesion of essential organs. Floral diagram and Floral Formula.	3	3
	1.3	Fruit Types- Simple fruits- Fleshy, Dry – Dehiscent, Indehiscent and Schizocarpic fruits; Aggregate fruits and Multiple fruits.	3	3
Plant Taxonomy (32 hours)				
	2.1	History of Plant Classification systems- Artificial System- (Linnaeus - Brief account), Natural System (B & H system- Detailed account), Phylogenetic Systems (E & P system- Brief study), APG (brief account).	3	2
	2.2	Herbarium technique -Steps in preparation of herbarium, Importance of Herbaria, Major Herbaria - National and International, Virtual Herbaria- Index herbariorum, Botanical Survey of India.	3	4
	2.3	Botanical Literature- Floras- Regional and National Floras, Revision & Monographs (Brief account). Online Taxonomic Databases: International Plant Names Index (IPNI), Plants Of the World Online (POWO), Botanicus.org (Brief account).	2	5
	2.4	Plant Nomenclature- Binomial, ICN- Introduction & Principles (Brief study), Rule of priority, Author citation, Homonym, Synonym, Basionym.	2	1

	2.5	Type concept- (Holotype, Isotype, Lectotype).	3	1
	2.6	Taxonomic keys- Bracketed and Indented keys (Brief account).	2	1
	2.7	Study the following families of Bentham and Hooker's System with special reference to their vegetative and floral characters; special attention should be given to common and economically important plants within the families Annonaceae, Malvaceae, Rutaceae, Anacardiaceae, Leguminosae (Mimosaceae, Caesalpiniaceae and Fabaceae), Cucurbitaceae, Apiaceae.	9	3
	2.8	Rubiaceae, Asteraceae, Sapotaceae, Apocynaceae, Convolvulaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Orchidaceae, Arecaceae, Poaceae.	8	3
3	Economic Botany (3 hours)			
	3.1	Study of the following plants with special reference to the botanical name, family and morphology of useful parts - Cereals (Rice, Wheat), Millets (Ragi, Fox tail millet), Pulses (Green gram, Bengal gram), Sugar Yielding (Sugar Cane), Fruits (Banana, Guava), Vegetables (Carrot, Ladies finger), Tuber crops (Tapioca, Greater Yam), Beverages (Tea, Coffee), Oil yielding plants (Coconut, Ground nut), Fibre yielding (Coir, Cotton), Gums and resins (White dammar, Gum Arabic, Asafoetida) Insecticide yielding plants (Tobacco, Neem).	3	2
4	Practicals (30 hours)			
		<ol style="list-style-type: none"> 1. Collect and submit different types of fruits mentioned in the syllabus. 2. Collect and submit any 5 types of leaves and inflorescence mentioned in the syllabus. 3. Explore habitats to identify the inflorescence and fruit types mentioned in the syllabus. 4. Conduct field work for a period of not less than 5 days to familiarize plants under the guidance of faculties and submit a field report with geotagged photos. 5. Visit a recognized herbarium, practice herbarium technique and submit 15 	30	4

		<p>herbarium sheets with a field book.</p> <p>6. Examine vegetative and floral features of different plants and assign them to respective families mentioned in the syllabus. Collect, identify and submit morphologically useful parts of any 10 plants mentioned in Economic Botany.</p>		
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5	Teacher specific course content
Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>

Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks</p> <ul style="list-style-type: none"> ·Involvement and responses in class room transactions ·Home Assignments/preparedness ·Oral presentation/Viva/Quiz/Open book test/written test <p>Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course</p> <ul style="list-style-type: none"> ·Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> ·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE) Theory: 50 marks</p> <p>Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8): 6 x 5= 30 Essay (1 out of 2): 1x 10= 10</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> ·Practical based assessments: 30 marks ·Record: 5 marks

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT CELL AND MOLECULAR BIOLOGY					
Type of Course	DSC A					
Course Code	24SACBOT5DA302					
Course Level	300					
Course Summary	<p>Cell and Molecular Biology play a crucial role in shaping understanding of life. The course emphasizes the basic principles that buttress the processes unique to living organisms at the molecular and cellular levels. Students will acquire a basic understanding of architecture of plant cells, organization of genetic material, the storage, transfer, and regulation of genetic information etc. Students learn how genes and proteins organize cells for cellular activities thereby gaining an in-depth understanding of cellular function. On completion of this course, they are equipped to tackle fundamental scientific questions. The course envisages the application of modern molecular and cellular biology in Plant Sciences and provides a solid foundation for further studies in the areas of molecular life sciences, bioengineering, and biotechnology.</p>					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any	Should have basic knowledge of Botany and Botanical skills					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Outline the historical developments in cell and molecular biology	U	PO3
2	Illustrate the structure and function of plant cell wall and cell organelles	A	PO2
3	Describe the function of the nucleus and chromosome condensation process and their role in heredity	U	PO1, PO2, PO10
4	Assess the gene regulatory network and inheritance in organisms	E	PO1, PO2
5	Examine how Cell division and programmed cell death occur within a plant cell	An	PO3, PO10
6	Investigate the role of enzymes in regulating cell activities	E	PO2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Introduction, cellular architecture and cell organelles (20 hours)				
1	1.1	History and Scope of Cell and Molecular Biology; Major developments in Cell and Molecular Biology.	1	1
	1.2	Architecture (Brief Account) and Functions of Plant Cell Wall. Cell Membrane and Chemical Composition of Cell Membrane.	3	2
	1.3	Structure and Major Functions of the following cell organelles: Endoplasmic Reticulum, Lysosomes, Dictyosomes, Vacuole, Ribosomes (Brief Account) and Cytoskeleton. Structure and Major Functions of Semi-autonomous Cell Organelles - Chloroplast, Mitochondria, Major Components and Definitions of GERL and Endomembrane System.	6	2
	1.4	Ultra Structure of Nucleus, Nuclear Envelope, Nuclear Pore Complex (NPC). Structure and Function of Nuclear lamina and Nucleolus.	3	3

	1.5	Morphology of a typical chromosome, Organization of genetic material in chromosomes. Structural organization: Histones, Non-histone proteins, Nucleosomes, Chromatosomes. Higher level of chromosome organization; Solenoid model. Special Chromosomes: Structure and Function of Polytene and Lamp brush chromosomes.	6	3
	1.6	Types and Organization of Chromatin: Heterochromatin, Euchromatin, Karyotype, Idiogram	1	3
Genetic material, cell cycle and mutations (15 hours)				
2	2.1	Significance of mitosis and meiosis, Eukaryotic Cell cycle (G1, S, G2, M) Evolutionarily conserved genes and proteins.	3	5
	2.2	Cell Death, Programmed Cell Death (Apoptosis), Necrosis (Overview). Activity: Students may submit appropriate illustrations with short descriptions to explain how events of meiosis together with gametic fusion during sexual reproduction, brings about genetic variability in progenies of plants.	2	5
	2.3	Basic understanding of Genetic material, Types of DNA: A, B and Z DNA, Plastome - Chloroplast DNA. Types and functions of RNA: hnRNA, mRNA, tRNA, rRNA, snRNA and microRNA Activity: Prepare a comparative account on the types of RNA and submit for evaluation	4	5
	2.4	DNA replication (prokaryotic): Role of enzymes - DNA Polymerases, Primases, Helicases, Ligases and DNA Topoisomerases.	3	6
	2.5	Point Mutations: Definitions of Transition Mutations, Transversion Mutations, Silent mutations, Missense mutations, Nonsense Mutations. Molecular basis of point mutations. Definition and Significance of Frameshift mutations. Significance of DNA repair mechanisms in cells. Activity: Discuss how mutation in a single nucleotide leads to altered phenotype citing suitable examples.	3	6

3	Gene expression (10 hours)			
	3.1	Gene expression: Central dogma of molecular biology and its revisions. Basic mechanism of Transcription in Prokaryotes. Perspective of transcription in Eukaryotes: Split genes, Introns, Exons, Spliceosomes (Definitions and significance). Post transcriptional modification of mRNA. Translation in Prokaryotes.	5	6
	3.2	Genetic code, Wobble hypothesis, Regulation of gene expression in prokaryotes by Operons: Lac and Trp operon, Regulation in eukaryotes (brief study).	4	5
	3.3	Endosymbiont hypothesis (Overview), Significance of chloroplast and nuclear DNA in the biosynthesis of RUBISCO.	1	6
	Practical (30 hours)			
	4.1	Study of mitosis by squash preparation of <i>Allium</i> sp. root tip	30	2, 3, 5
	4.2	Calculate mitotic index of root tips prepared by squash preparation		
	4.3	Identification of various stages of meiosis I using appropriate illustrations		
	4.4	Isolation of plant DNA from appropriate plant specimen		
	4.5	Demonstration (any one) of <ul style="list-style-type: none"> ● Cell viability using tri-phenyl tetrazolium chloride (TTC). ● Cell counting using haemocytometer ● Observation of cyclosis and Chloroplast in leaf of <i>Hydrilla</i> or Staminal hairs of <i>Rhoeo discolor</i> 		
	4.6	Separation of cells from cell suspension/ cell culture using centrifugation (yeast cells)		
5	Teacher specific contents			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks</p> <ul style="list-style-type: none"> ·Involvement and responses in class room transactions ·Home Assignments/preparedness ·Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related to the course ·Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> ·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE) Theory: 50 marks</p> <p>Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8): 6 x 5= 30 Essay (1 out of 2): 1x 10= 10</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> ·Practical based assessments: 30 marks ·Record: 5 marks

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Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT BREEDING AND PLANT GENETIC RESOURCES					
Type of Course	DSE					
Course Code	24SACBOT5DE301					
Course Level	300					
Course Summary	<p>The course on Plant Breeding and Plant Genetic Resources provides a comprehensive understanding of the principles and practices involved in enhancing the genetic makeup of plants for improved traits and characteristics. Students delve into the conservation, and sustainable utilization of plant genetic resources, emphasizing the importance of biodiversity in agricultural systems. The curriculum covers various breeding methods, including classical and molecular techniques, enabling students to grasp both traditional and cutting-edge approaches to develop crop varieties with desirable traits such as yield, disease resistance, and environmental adaptation. Overall, this course equips students with the knowledge and skills needed to contribute to the advancement of sustainable agriculture and food security through effective plant breeding practices and responsible use of genetic resources</p>					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-		60
Pre-requisites, if any	Basics of plant hybridization or basic plus two knowledge.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Summarize the origin and scope of plant breeding		

	along with the major research centers involved in plant breeding	U	PO4, PO6,
2	Choose a proper plant breeding method for a crop improvement programme	A	PO, PO2, PO7, PO10
3	Explain the nuances of heterosis and inbreeding depression	U	PO1, PO2, PO4, PO7
4	Explore the importance and applications of plant genetic resources for food security and agriculture	A	PO1, PO2, PO3, PO4, POPO8, PO9, PO10
5	Develop strategies for conserving the regional plant genetic resources	C	PO1, PO2, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to plant breeding (10 hours)				
1	1.1	Significance of plant breeding.	2	1
	1.2	The centres of origin: Nikolai Vavilov's Centres of Origin of Cultivated Plants - Different centres and their significance.	4	1
	1.3	National and International Centres of Plant breeding- ICAR, NBRI (National Botanical Research Institute), IIRI Philippines, IPGRI (International plant genetic resource institute, Rome). Plant breeding Stations in Kerala and their achievements – CPCRI, CTCRI, RRII.	4	1
Plant Breeding methods for crop improvement (10 hours)				
2	2.1	Plant introduction: procedure of plant introduction - quarantine regulations, acclimatization, agencies of plant introduction in India, major achievements.	2	2
	2.2	Plant Selection: mass, pure-line, clonal	2	2

	2.3	Hybridization: types, procedure, important achievements.	2	2
	2.4	Mutation breeding and polyploidy breeding: methods and applications	2	2
	2.5	Advanced tools and techniques in plant breeding (Brief account).	2	2
(Optional reading: Breeding of virus-resistant transgenic sugarcane by the integration of the Pac1 gene.)				
Heterosis and Inbreeding depression (22 hours)				
	3.1	Heterosis in plant breeding - characteristic features, applications and achievements in crop improvement, dominance, overdominance and pseudo-overdominance hypothesis of heterosis.	3	3
	3.2	Effects of inbreeding. Inbreeding depression-features, degree of inbreeding depression.	2	3
	3.3	Methods of segregating generations - pedigree method, bulk method, back cross method.	3	3
Activity				
3	a	Compare the effectiveness of any one Emasculation method in any bisexual plant and take photos of the same.	3	2
	b	Demonstration of hybridization in plants	2	2
	c	Identify self- pollinated and cross-pollinated plants present in your locality based on floral morphology and make an album with details (at least ten plants are required)	3	2
	d	Find any 10 plant breeding centres in India using google map. Prepare a report on these research centres.	2	1
	e	Visit any plant breeding station in Kerala and understand various breeding practices followed there.	4	1
Plant genetic resources for food and agriculture (18 hours)				
	4.1	Exploration and collection of genetic resources - importance of wild relatives of crop plants and their genetic diversity in crop improvement.	2	4
		Ethnobotany in relation to conservation of genetic resources. Identification of farming		

	4.2	systems of: food crop – Rice (need to learn any 5 traditional rice varieties in Kerala); Vegetables - Cow pea, Bitter gourd; Spices- Ginger, Black pepper; Medicinal plants - <i>Aloe</i> ; Plantation crops – Coffee and Coconut; Fruits - Banana.	5	4
	4.3	Binomial, Family and uses of the following underutilized edible plants - Vegetables - <i>Averrhoa carambola</i> (Chathurappuli), <i>Dioscorea esculenta</i> (Nanakizhangu), <i>Canavalia gladiata</i> (Valpayar), <i>Psophocarpus tetragonolobus</i> (Chathurapayar), <i>Sauropusandrogynus</i> (Velicheera), <i>Ipomoea turbinata</i> (Nithya Vazhuthana); Fruits - <i>Artocarpus hirsutus</i> (Anjili), <i>Aporosacardiosperma</i> (Vetti), <i>Spondias pinnata</i> (Ambazham), <i>Syzygiumcumini</i> (Njaval), <i>Flacourtiamontana</i> (Kattuloovika), Millets - <i>Echinochloa crus-galli</i> (Barnyard grass)	3	4
	4.4	Major threats to the genetic resources: anthropogenic activities – deforestation, habitat destruction and invasive species.	2	5
	4.5	Conservation of genetic resources - biodiversity conservation, in-situ conservation – national parks, sanctuaries, and biosphere reserves; ex-situ conservation – Botanical gardens, gene banks, germplasm banks and cryopreservation, NBPGR	3	5
Activity				
	a	Collect and submit any two traditional cultivars of the vegetables, fruits, spices, medicinal plants and plantation crops mentioned in the syllabus.	3	1, 2, 4, 5
	b	Make a list of traditionally cultivating crops in the local area, and make a registry	2	4, 5
Teacher specific course content				

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
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Assessment Types	<p style="text-align: center;">MODE OF ASSESSMENT</p> <p style="text-align: center;">A. Continuous Comprehensive Assessment (CCA)</p> <p style="text-align: center;">Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course <p>Any other method as may be required for specific course / student by the course faculty</p>
	<p style="text-align: center;">B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

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Programme	BSc.(HONOURS) BOTANY					
Course Name	PHYTOGEOGRAPHY, FORESTRY AND ECOTOURISM					
Type of Course	DSE					
Course Code	24SACBOT5DE302					
Course Level	300					
Course Summary	The course 'Phytogeography, Forestry and ecotourism' deals with the study of distribution of plant community, its management and conservation.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain various theories and principles related to plant distribution	U	PO1, PO6
2	Identify and categorize the interactions in the ecosystem and factors affecting the plant growth	An	PO1, PO2
3	Describe the principles and practices in forest management	U	PO1
4	Evaluate and appreciate the role of youth, Clubs, organizations in conservations.	Ap	PO3, PO4, PO7
5	Appreciate the role of ecotourism projects in nature conservations	Ap	PO3, PO7, PO9, PO10
6	Explain various theories and principles related to plant distribution	U	PO1, PO6

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Plant and Environment (17 hours)				
1	1.1	Ecological complexes and factors affecting plants growth and distribution. Biotic factors: interactions – positive and negative	3	2
	1.2	Topographic factors: altitude and aspects. Edaphic factors – soil profile and physical and chemical properties of soil, soil formation	4	2
	1.3	Climatic factors: temperature and pressure, water - precipitation, humidity, soil water holding capacity, light - global radiation	3	2
	1.4	Morphological, anatomical, and physiological adaptation of plants to the environment with references to biomes.	7	2
Phytogeography (16 hours)				
2	2.1	Definition, principles governing plant distribution, factors affecting plant distribution	2	1
	2.2	Plant distribution- distribution of plants- continuous, discontinuous, and endemic. Theories of plant distribution – migration hypothesis, long distance dispersal hypothesis, theory of continental drift, age area hypothesis, land bridge theory.	5	1
	2.3	World Biomes - aquatic and terrestrial, Climatic, vegetational and botanical zones of India.	4	1
	2.4	Remote sensing - Definition and data acquisition techniques. Application of remote sensing in vegetation classification, understanding environmental issues and ecosystem management. Geographic information system (GIS).	5	1
3	Forestry (17 hours)			
	3.1	Introduction to forestry: Classification of forests (Champion and Seth, 1968). Major types of forests in India. Silviculture; principles and practices- clear felling system, coppice system. Common plants in silviculture. Sustainable forest management approaches with reference to Kerala	6	3

		- timber plantation, agroforestry, social forestry, JFM		
	3.2	Forest Ecosystems and biodiversity- Forest ecology and ecosystem services. Biodiversity- definition, values of biodiversity, levels of biodiversity. Biodiversity loss, Concept of endemism. Types of endemism.	5	3
	3.3	Species extinction – Rate of species extinction, reasons to stop extinction- methods to save species. Threats to forest biodiversity, IUCN- threat categories. IUCN account of biodiversity, red data book and hot spots.	6	4
Ecotourism(10 hours)				
4	4.1	Ecotourism definition, Elements and characteristics of ecotourism. Types of ecotourism – Heritage ecotourism, coastal ecotourism, cultural ecotourism, festival ecotourism, ayurvedic ecotourism. positive and negative impacts of ecotourism.	5	5
	4.2	Major ecotourism centers in Kerala – Gavi, Thattekadu, Thenmala. Learning activity: Visit an ecotourism centre and identify the ecotourism components of the ecotourism and submit a report.	2	5
	4.3	Wildlife tourism and its opportunities with reference to Kerala- Periyar tiger reserve, Tholpetty wildlife sanctuary	3	5
5	Teacher specific course content			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks</p>

	<ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● Any other method as may be required for specific course / student <p>by the course faculty</p>
	<p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

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Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT BIOTECHNOLOGY					
Type of Course	DSE					
Course Code	24SACBOT4DE303					
Course Level	300					
Course Summary	The course is designed as a comprehensive exploration to the field of Plant Biotechnology. The course aims to familiarize students with the key developments in the sphere of Plant Biotechnology and to discuss the potential applications of biotechnology in crop improvement and for novel uses for plants.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any	General overview and key concepts of Biotechnology					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Choose methods for <i>in vitro</i> regeneration of plants from explants including shoot and root organogenesis	E	PO1, PO2, PO3, PO10
2	Construct vectors for specific purposes like gene expression, replication and selection markers.	E	PO1, PO2, PO3
3	Develop proficiency in fundamental gene cloning techniques.	A	PO1, PO2, PO3
4	Compare different gene transfer methods based on efficiency and specificity.	An	PO1, PO2, PO3
5	Explain the applications of plant genetic engineering in		PO1, PO2,

	the field of agriculture, medicine, environment, and industry.	A	PO3, PO7, PO10	PO6, PO8,
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)				

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Plant Tissue Culture (15 Hours)				
1	1.1	Introduction to Plant Biotechnology, concept of totipotency, callus, basic infrastructure of tissue culture lab, sterilization methods, composition, and preparation of culture media; role of hormones in morphogenesis, direct and indirect organogenesis; somatic embryogenesis (brief account only)	6	1
	1.2	Tissue culture applications -micropropagation, androgenesis, virus elimination, haploids, hybrids Secondary metabolite production – hairy root culture, bioreactors: design of simple bioreactor, application in secondary metabolite production-, cryopreservation for germplasm conservation. Protoplast isolation, culture and fusion, somatic hybridisation, and applications - cybrids	9	1
Recombinant DNA Technology (29 Hours)				
2	2.1	Restriction Endonucleases (Types I-IV, biological role and application); T4 DNA Ligase; cloning Vectors: properties of ideal cloning vector, features of cloning vectors -pCAMBIA, Ti plasmid, BAC, Lambda phage, Cosmid, YAC Expression vectors, Shuttle vector- Brief account only	7	2
	2.2	Recombinant DNA technology: Rdna definition, steps involved (outline), bacterial transformation and selection of recombinant clones, PCR- mediated cloning, Plasmid construct- general design; construction of genomic and cDNA libraries, screening of recombinant	14	3

		DNA- complementation (Blue white screening), colony hybridization Biotechnology instrumentation and Lab visit Preferable: Working of PCR machine, Agarose gel electrophoresis, UV transilluminator demonstration (if facilities are available)		
	2.3	Methods of gene transfer: direct gene transfer - electroporation, microinjection, microprojectile /particle bombardment, In- direct gene transfer- Agrobacterium mediated gene transfer Selection of transgenic plants– selectable marker (antibiotic and herbicide) and reporter genes (GUS, GFP).	8	4
3	Application of Biotechnology (7 Hours)			
	3.1	Herbicide resistant plants (RoundUp Ready soybean); transgenic crops with improved quality traits (Golden rice); improved horticultural varieties (Moondust carnations)	4	5
	3.2	Role of transgenics in bioremediation (Superbug); Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products–Edible vaccine.	3	5
	3.3	Brief account and research potential in: Plant systematics, Ecology, Plant anatomy, Plant physiology, Genetics, Ethnobotany, Crop improvement & Plant genetic engineering		
4	Advances in Plant Biotechnology (9 Hours)			
	4.1	Gene editing tools (CRISPR- Cas9) and its role in transgenic plant development and gene function studies (Brief account only) Synthetic biology and plant metabolic engineering for improved crop traits, Developing climate resilient crops (Brief account only) Ethical considerations in plant biotechnology Biosafety considerations and IPR associated with GM crops	9	5
5	Teacher specific course contents			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study ● Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10= 20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10 marks

References

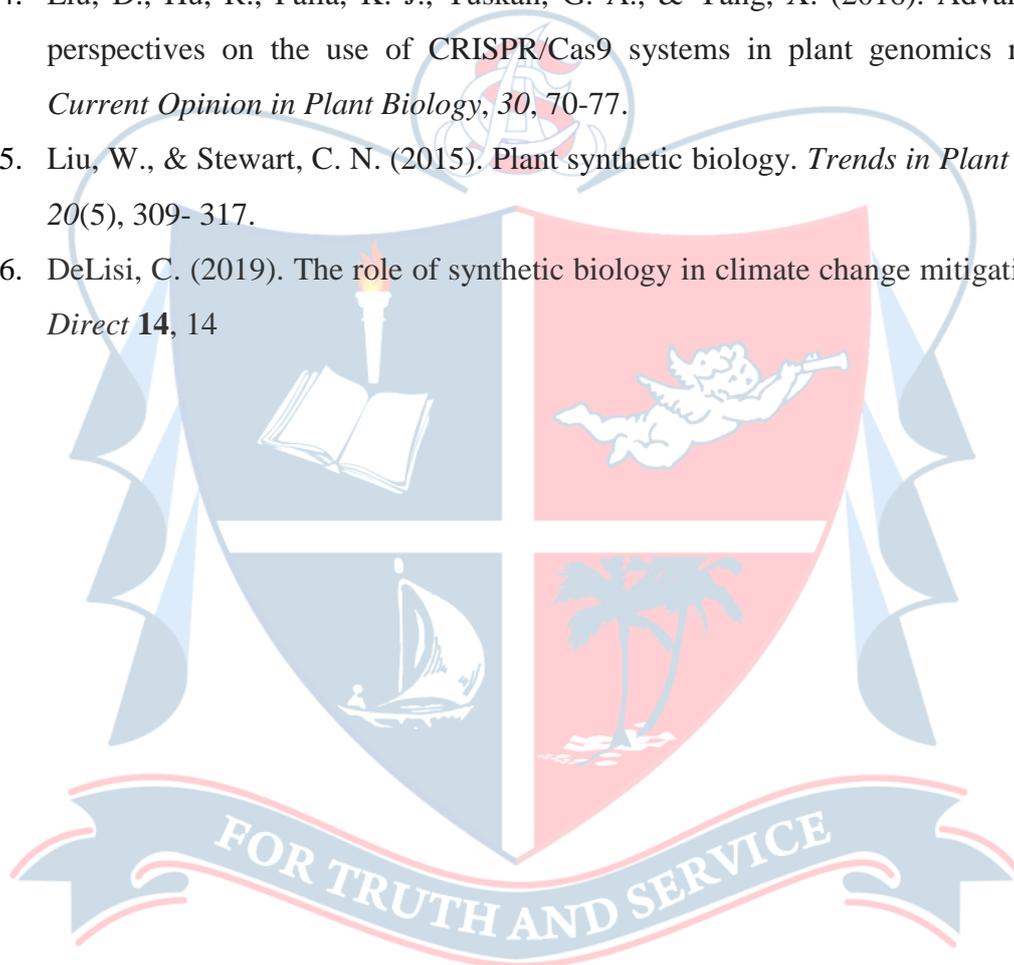
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4. Razdan M K. (2015): Introduction to Plant Tissue Culture. Oxford and IBH, MKM Publishers 2nd. Edition

Suggested readings:

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2. Timir Baran Jha and Biswajit Ghosh (2016): Plant Tissue Culture. Platinum Publishers. Revised 2nd Edition. Kolkata
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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	GREEN TECHNOLOGY AND SUSTAINABLE DEVELOPMENT					
Type of Course	DSE					
Course Code	24SACBOT5DE304					
Course Level	300					
Course Summary	This course emphasizes on green systems and the environment, energy technology efficiency and sustainability. These chemical processes make hazardous products which are made green, safe and economically acceptable by using biotechnology.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Interpret the relevance and the concept of green technology for sustainable development.	U	PO6, PO10
2	Examine the various cleaner development mechanisms.	An	PO2, PO10
3	Outline the concepts related to conventional and non-conventional energy.	K	PO2, PO10
4	Discuss and implement the environmental regulations	U	PO1, PO9

	and standards.		
5	Identify and implement the concepts on various energy efficient systems and green buildings.	U	PO6, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to Green Chemistry and Sustainability (20 hours)				
1	1.1	Twelve principles of green chemistry, green technology-definition, importance, and applications.	3	1
	1.2	Green technology initiatives in India	1	1
	1.3	Extraction procedures: Green methods of synthesis- microwave assisted synthesis, super critical fluids- extraction, process and applications.	6	1
	1.4	Introduction, Concepts- Social, economic and environmental sustainability; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs).	5	3
	1.5	Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from Oceans and Geothermal energy	5	3
Cleaner development mechanism and technologies (10 hours)				
2	2.1	Cleaner development mechanism- reuse, reduce and recycle, raw material substitution; wealth from waste; Zero waste concept, carbon credits, carbon trading, carbon sequestration.	5	2

	2.2	Bioremediation: Recent Advances with special reference to Phyto nanotechnology	5	2
3	Environmental management standards and green future (15 hours)			
	3.1	Eco-labelling, ISO 14001:2019 framework and benefits, Scope and goal of Life Cycle Analysis (LCA), Bio-mimicking, Environment Impact Assessment (EIA) (Brief account).	5	4
	3.2	Green future: Agenda of green development; reduction of ecological footprint; Water Conservation and Audit, major challenges and their resolution for implementation of green technologies; green practices to conserve natural resources	5	5
	3.3	Green buildings: Definition- Features and benefits, outlined examples; LEED certified building; Eco-mark certification, Eco-mark in India. Green planning: role of governmental bodies, land use planning, concept of green cities, green belts.	5	5
	Experiential learning (15 hour)			
4	4.1	Prepare a report on eco-friendly initiatives taking place in your locality.	3	1, 5
	4.2	Familiarizing with renewable energy gadgets.	3	1, 5
	4.3	Green Tech Trip- Visit to any well-maintained green technology institutes or establishments.	6	4, 5
	4.4	Make a report on eco-mark certification products.	3	5
5	Teacher specific course contents			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
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Assessment Types	MODE OF ASSESSMENT
	<p style="text-align: center;">A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● Any other method as may be required for specific course/ student by the course faculty
	<p style="text-align: center;">B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

References

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2. Purohit, S. S., (2008) *Green Technology - An approach for sustainable environment*, Agrobios Publication.
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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	ANALYTICAL TECHNIQUES IN PLANT SCIENCES					
Type of Course	DSE					
Course Code	24SACBOT5DE305					
Course Level	300					
Course Summary	This course will provide a comprehensive overview of the various preparative methods and analytical techniques in plant science. Students will learn the principles of different analytical techniques and its practical applications in plant research.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-			60
Pre-requisites, if any	Basic knowledge in science					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Outline the methods and procedures in microscopy	U	PO1, PO2, PO3, PO9, PO10
2	Articulate the principles underlying different instruments employed in plant science research	U	PO1, PO2, PO3
3	Explain working and application of various separation and analytical techniques	U	PO1, PO2, PO3, PO9, PO10
4			PO1, PO2, PO3, PO9,

	Apply the techniques in enumeration, analysis and purification of plant samples	A	PO10
5	Acquire expertise in various preparative methods and analytical techniques in plant science	A, S	PO1, PO2, PO3, PO9, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Exploring the Plant Kingdom (15 Hours)				
1	1.1	Collection, preservation (dry & Wet) and preparation of plant materials: squash, smear, whole mount, maceration, and Sectioning. Retaining the natural colour of the plant samples (brief study).	4	1
	1.2	Killing and fixing: properties of good fixative: types of fixative and fixation; killing and fixing agents and their composition (Carnoy's fluid and FAA)	2	1
	1.3	Sectioning- free hand and microtomy, applications of microtome - rotary microtome, sledge microtome, and cryostat	3	1, 2
	1.4	Stains and staining techniques – different types of stains and their composition- safranin, acetocarmine; vital stains - neutral red, evans blue, types of staining - Single staining and Double staining.	4	1
	1.5	Mounting and preparation of slides - mounting media: glycerine, DPX, and canada balsam; preparation of slides: temporary and permanent	2	1
	1.6	Activity: 1. Temporary mounting of a hand-sectioned single- stained specimen Maceration of a given specimen (Cucurbita stem)	4	1, 5
Wonders in Plant Kingdom and Traditional Approaches in Plant Science (15 Hours)				
2	2.1	Principle, working, and application: light microscopy, phase contrast microscopy, scanning electron microscopy. Image analysis software: ImageJ (brief account)	5	1, 2, 3

	2.2	Photometric Analysis – principle, working, and application of colorimeter and spectrophotometer. Definition and application of UV-visible spectroscopy and FTIR in plant science and related fields.	6	2, 3, 4
	2.3	Principle, working, and application of pH meter	2	2, 3
	2.4	Enumeration Techniques: Haemocytometer	2	4
	2.5	Activity 1. Prepare a standard graph and estimate the concentration of a solution using a colorimeter Adjust the pH of a solution using pH meter/ pH pen	4	2, 3, 5
Methods for sample preparation (7 Hours)				
3	3.1	Centrifugation - Principle, working, and application of high- speed centrifuge and ultracentrifuge (preparative and analytical model)	4	2, 4
	3.2	Principle and application of lyophilizer and freeze-drying	3	2
Techniques for analysis and separation				
4	4.1	Chromatography Techniques: - principle, working, and application of paper chromatography, TLC, column chromatography, HPLC.	5	2, 3
	4.2	Electrophoresis: Electrophoretic mobility, factors affecting electrophoretic mobility. working and application of SDS- PAGE and agarose gel electrophoresis	5	2, 3
	4.3	Activity: 1. Visit a recognized instrumentation lab or research lab and submit a report.	5	2, 3, 5
5	Teacher specific course content			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture- based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

References

1. Berlyn, G.P. & Miksche, J.P. (1976). Botanical Microtechnique and Cytochemistry. Wiley-Blackwell.
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Programme	BSc.(HONOURS) BOTANY					
Course Name	CLIMATE CHANGE AND DISASTER MANAGEMENT-BOTANICAL PERSPECTIVE					
Type of Course	DSE					
Course Code	24SACBOT5DE306					
Course Level	300					
Course Summary	This course is designed to equip students <ul style="list-style-type: none"> ● To develop awareness on climate change and types of disasters in modern world ● To develop climate change mitigation and disaster resilience strategies 					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-		60
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain fundamental causes and evidence of climate change & Disasters	U	PO1, PO2
2	Evaluate the multifaceted impacts of climate change	E	PO1, PO2
3	Analyze mitigation and adaptation strategies on climate change	An	PO10
4	Apply disaster management strategies	A	PO6

5	Design and propose practical, interdisciplinary solutions for climate change mitigation and disaster resilience strategies at local, regional, and global levels	C	PO1, PO3
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Basic science of Climate change (10 hours)				
1	1.1	Introduction to climate change- climate, weather, greenhouse gasses, ozone formation and depletion, carbon footprint, global warming	5	1
	1.2	Causes & evidence of climate change- natural vs. anthropogenic factors Global patterns and trends of climate change	5	1
Impact of climate change (12 hours)				
2	2.1	Global warming: Temperature rise, sea level rise, weather pattern change	4	2
	2.2	Impacts on biome: shifts in biodiversity	4	2
	2.3	Human health and social impacts: Heat related illness, food security, water scarcity	4	2
Climate change: Mitigation and Adaptation (15 hours)				
3	3.1	Mitigation strategies: reducing greenhouse gas emissions, transition to renewable energy, international efforts, and policies	5	3
	3.2	Adaptation measures: adaptation and acclimatization mechanisms in plants	5	3

	3.3	Activity - prepare a proposal on interdisciplinary solutions for climate change mitigation at local/ regional/ global levels	5	3
4	Introduction to disaster types and disaster management Strategies (23 hours)			
	4.1	Natural Disasters - Meteorological disasters: hurricanes, cyclones, Geological Disasters: earthquakes, landslides; Hydrological Disasters: floods, avalanches	5	1
	4.2	Man-Made Disasters Technological disasters: industrial accidents, Environmental disasters: pollution, deforestation, habitat destruction	5	1
	4.3	Disaster preparedness and planning: Risk assessment, developing and implementing early warning systems, strategies for effective immediate response	3	4
	4.4	Mitigation and Recovery: General Mitigation strategies - Disaster mitigation by restoring and preserving natural ecosystem (Reforestation, Mangroves, Wetlands & wetland conservation laws, Installing of coastal Tetrapods). Post Disaster Recovery (Rehabilitation, reconstruction, and restoration), Community resilience (Building community capacity)	10	4
5	Teacher specific course components			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty <hr/> B. End Semester Evaluation (ESE)- 70 marks <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12) : 2 x 10=20 Marks ● Short Answer (8 out of 10) : 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10 Marks

References

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Programme	BSc.(HONOURS) BOTANY					
Course Name	MUSHROOM PRODUCTION AND VALUE ADDITION					
Type of Course	SEC					
Course Code	24SACBOT5SE301					
Course Level	300					
Course Summary	The present course encompasses various aspects of mushrooms focusing on its importance as a valuable food supplement. The course also deals with various aspects of mushroom cultivation including the process, requirements and post-harvest steps. The value addition and marketing strategies connected to this field is also included.					
Semester	V	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any	Nil					
		3	-	-	-	45

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	State the importance of Mushrooms and distinguish between edible and poisonous mushrooms	U	PO1, PO10
2	Appreciate the nutritive value and health benefits of mushrooms and implement edible mushroom cultivation techniques	A	PO1, PO3, PO7, PO9, PO10
3	Outline the possibilities of value addition in mushrooms	An	PO1, PO2, PO7, PO9, PO10

4	Develop entrepreneurship skills through product design	S	PO1, PO2, PO3, PO5, PO7, PO9, PO10
5	Generate marketing strategies for value-added products of mushrooms	C	PO1, PO2, PO3, PO4, PO5, PO7, PO9, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Mushrooms and Nutritional Value (10 hours)			
	1.1	General characters and morphology of mushrooms. Distinguishing characters of button, oyster and milky mushrooms.	3	1
	1.2	Identification of mushrooms - edible and poisonous. Scope and significance of mushroom cultivation	3	1
	1.3	Nutritional profile of mushrooms- Carbohydrates, proteins, amino acids, vitamins, minerals, fats and fibre.	2	2
	1.4	Health benefits of Mushrooms-anti-tumour, antiviral and antibacterial effect, in therapeutic diet(brief study)	2	2
2	Mushroom Cultivation and Pest Management (23 hours)			
	2.1	Mushroom cultivation: Requirements, structure and construction of mushroom house, sanitation and sterilization	3	2, 4

	2.2	Spawn preparation- requirements, spawn substrate selection, isolation of pure culture and nutrient media for pure culture, maintenance and storage of spawn. Learning activity: Hands-on training on mushroom bed preparation/spawn preparation	5	2, 4
	2.3	Cultivation of Milky Mushroom (<i>Calocybe indica</i>), and Oyster Mushroom (<i>Pleurotus</i> spp.) using paddy straw. Learning activity: Training in Oyster mushroom cultivation	5	2,4
	2.4	Pest and disease management in mushroom cultivation (brief account), Spent mushroom substrate utilization-fodder, compost. Learning activity: Visit to a mushroom cultivation unit	10	1, 2
	Value Addition in Mushrooms (12 hours)			
	3.1	Post-harvest processing of mushrooms- refrigeration / instant packing, freeze drying, dehydration, canning	3	3, 4
3	3.2	Value-added products from mushrooms – soup powder, biscuits, chutney powder, pickles. Learning activity: Preparation of value-added products from mushrooms	5	3, 4, 5
	3.3	Marketing strategies for mushroom products	2	4, 5
	3.4	Major problems in mushroom cultivation and solutions. self-employment schemes, Government aids	2	4, 5
4	Teacher-specific course components			

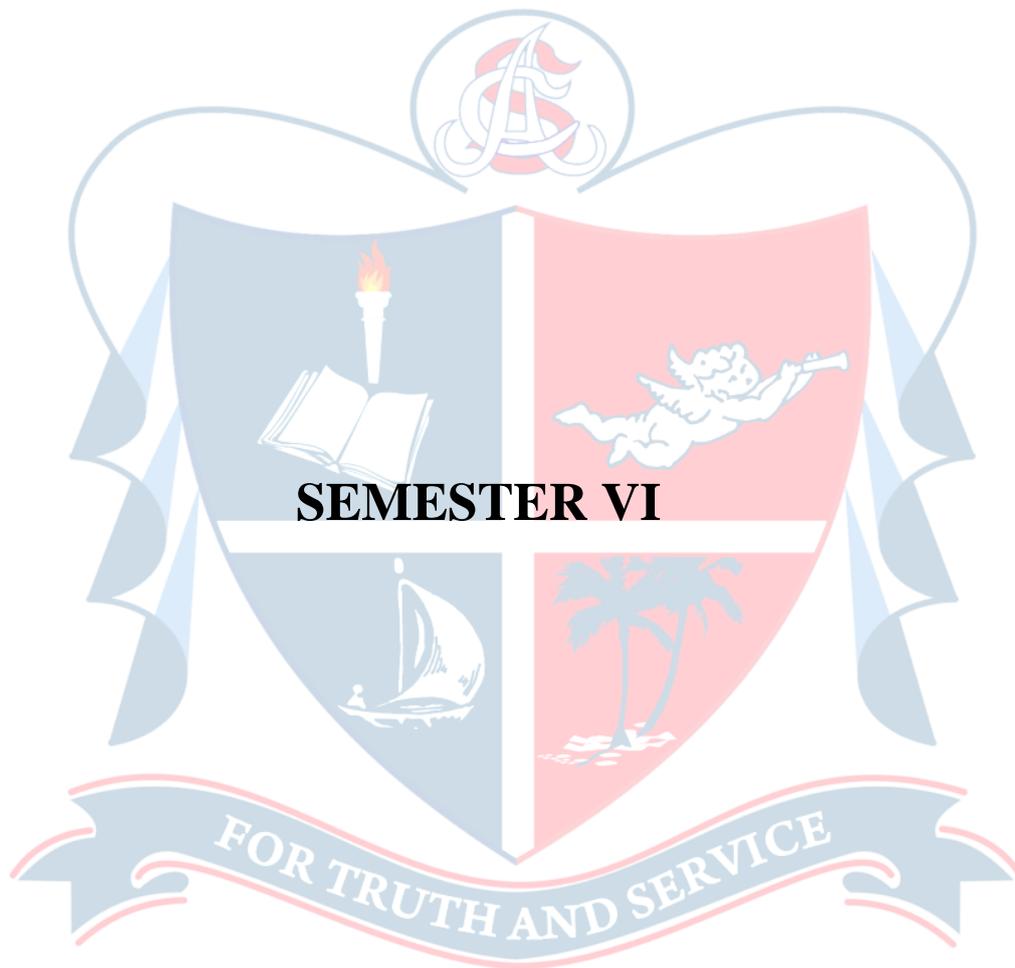
Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field trips and mushroom production visit, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lectures, group discussions, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 25 Marks <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty <hr/> B. End Semester Evaluation (ESE) <ul style="list-style-type: none"> ● Theory: 50 marks ● Short answer (10 out of 12) : 10 x 1=10 ● Short Essay (6 out of 8) : 6 x 5= 30 ● Essay (1 out of 2) : 1x 10= 10

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT PHYSIOLOGY AND BIOCHEMISTRY					
Type of Course	DSC A					
Course Code	24SACBOT6DA301					
Course Level	300					
Course Summary	The course aims at introducing the physiology of plant systems and indulges the student in finding out various processes that function within the plant body. The course also deals with various biomolecules.					
Semester	VI	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	75
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Enlist various biomolecules in the living system.	K	PO1
2	Summarize the physiology of different plant life processes.	U	PO1
3	Categorize the factors affecting physiological processes	An	PO1
4	Investigate the presence of biomolecules in a given system	E	PO2
5	Investigate the role of biotic and abiotic components in plant stress	E	PO2

6	Design experiments in plant physiology	C	PO1
7	Appraise intricacies of protein structure and diversity	Ap	PO1 PO2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Plant water relations (7 Hours)			
	1.1	Plant water relations: Diffusion, imbibition, osmosis; Absorption of water - active and passive, apoplastic and symplastic pathways.	2	2
	1.2	Ascent of sap: Cohesion-tension theory, embolism; Transpiration types, mechanism and significance; anti-transpirants. Guttation.	2	2,3
	1.3	Major and minor elements in plant nutrition, mineral uptake - passive (ion exchange) and active (carrier concept).	3	2
2	Photosynthesis and respiration (30 Hours)			
	2.1	Photosynthesis: Pigments, Photosystems; Light Reactions - cyclic and non-cyclic photophosphorylation. Dark reactions - C ₃ , C ₂ , C ₄ pathway, CAM. Factors affecting photosynthesis.	8	2,3
	2.2	Translocation of solutes: Phloem loading and unloading, polymer trapping (brief account); Mechanism - mass flow hypothesis.	2	2
	2.3	Respiration: Anaerobic and Aerobic; Glycolysis, Krebs's cycle, Mitochondrial Electron Transport system, ATP synthesis - chemi osmotic hypothesis, Factors affecting respiration.	8	2,4

	2.4	<p>Carbohydrates: Classification: mono (glucose and fructose), di (sucrose) and polysaccharides (starch); general structure (Haworth Projection) and functions.</p> <p>Lipids: General features, roles and types of lipids (Simple and Compound, structural and storage lipids).</p> <p>Proteins: General account of proteins - amino acid, peptide bond. Structural levels of proteins - primary, secondary, tertiary, and quaternary; General functions of proteins</p> <p>Enzymes: classification and nomenclature, mechanism of action (Lock and Key Hypothesis, Induced fit theory). Enzyme inhibition and Factors affecting enzyme action.</p>	12	1, 7
Plant hormones and stress physiology (8 Hours)				
3	3.1	Plant hormones: Physiological effect and practical applications - Auxins, Gibberellins, Cytokinins, ABA, and Ethylene.	2	2
	3.2	Stress Physiology: Abiotic (water and salt), Biotic (pathogens) stress, Role of phenolics and compatible solutes.	4	2,5,6
	3.3	Physiology of flowering: Phytochromes, Photoperiodism, Vernalization	2	2
Practical (30 Hours)				
4	4.1	<p>Plant Physiology (20 Hours)</p> <p>Core Experiments (any 3):</p> <ul style="list-style-type: none"> ● Separation of plant pigments by TLC/Paper/ Column chromatography. ● Estimation of plant pigments by colorimetry. ● Estimation of Proline in plant tissue under abiotic stress. ● Estimation of Phenol in plant tissues under biotic stress. ● 	20	4,5,6,7

		<p>Calculation of stomatal index in mesophytes and xerophytes</p> <ul style="list-style-type: none"> ● Estimation of rate of photosynthesis <p>Demonstration experiments: (ANY 4)</p> <ul style="list-style-type: none"> ● Demonstration of plasmolysis. ● Demonstration of tissue tension. ● Demonstration of osmosis using osmoscope. ● Demonstration of Oxygen evolution during Photosynthesis. ● Measurement of transpiration rate using Ganong's potometer/Farmer's potometer ● Measurement of leaf conductance using leaf porometer. 		
	4.2	<p>Biochemistry (10 Hours)</p> <ul style="list-style-type: none"> ● General test for carbohydrates – Molisch's test, Benedict's tests / Fehling's test. ● Colour test for starch - iodine test. ● Colour tests for proteins in solution – Million's test ● Quantitative estimation of protein using a colorimeter. 	10	5,7
	4.3	<p>Activity (Any one)</p> <ul style="list-style-type: none"> ● Design and perform an experiment related to plant physiology. Prepare and submit a report with geotagged photos. ● Prepare and submit a report with your views and conclusions on the latest research in physiology / biochemistry based on journal publications on any topic mentioned in the syllabus (A copy of the original publication has to be submitted with the report. ● Design models representing physiological or biochemical processes taking place in plants and submit them for evaluation. ● Prepare a review article in a selected research area in Physiology and biochemistry and submit for evaluation. ● Retrieve 5 research articles on any selected topic in Physiology/ biochemistry and submit them for evaluation. 		

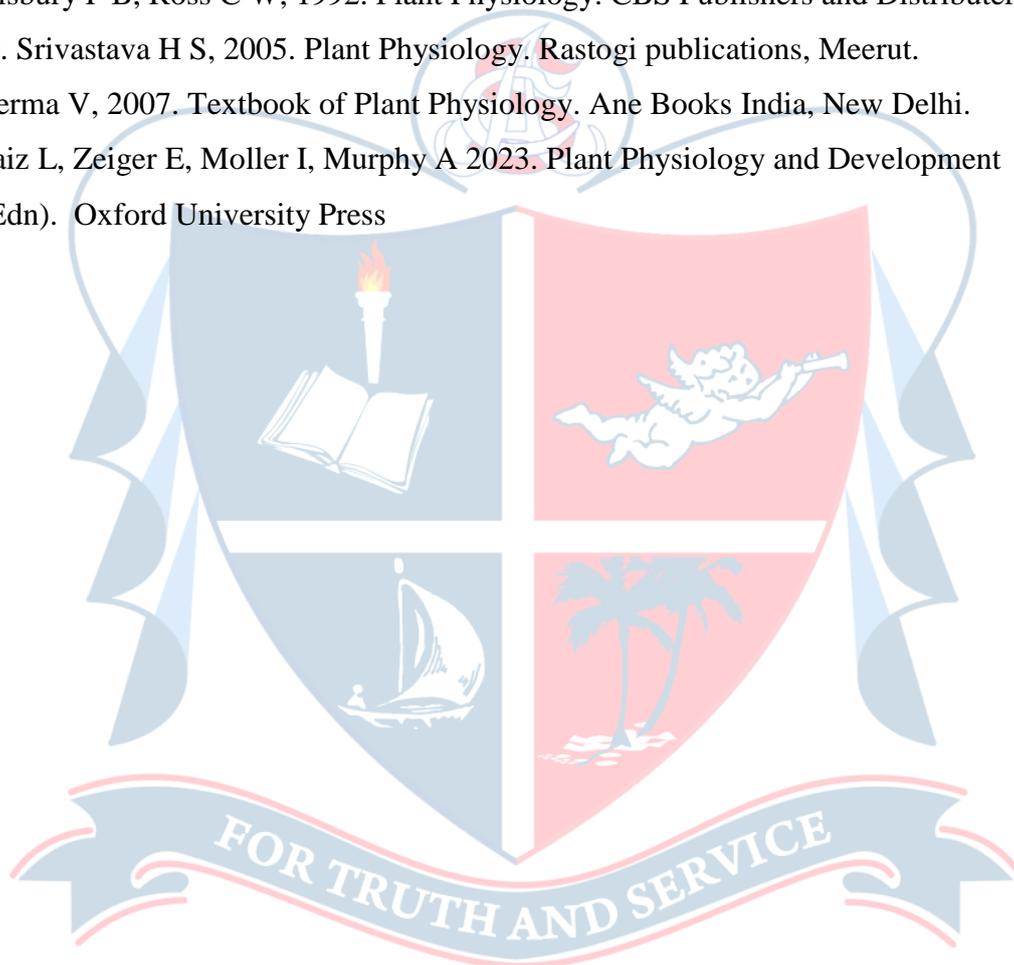
5	Teacher-specific course components
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Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test <p>Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course</p> <ul style="list-style-type: none"> · Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty <hr/> <p>B. End Semester Evaluation (ESE)</p> <ul style="list-style-type: none"> ● Theory: 50 marks ● Short answer (10 out of 12): $10 \times 1 = 10$ ● Short Essay (6 out of 8) : $6 \times 5 = 30$ ● Essay (1 out of 2) : $1 \times 10 = 10$ ● Practical: 35 marks ● · Practical based assessments: 30 marks ● · Record: 5 marks

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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	GENETICS AND EVOLUTIONARY BIOLOGY					
Type of Course	DSC A					
Course Code	24SACBOT6DA302					
Course Level	300					
Course Summary	This course provides a comprehensive exploration of the fundamental principles underlying genetics and evolutionary biology. Students will delve into the molecular basis of inheritance, the mechanisms of evolution, and the interconnectedness of these fields. Through theoretical discussions, practical applications, and case studies, participants will gain a deep understanding of how genetic processes drive evolutionary change.					
Semester	VI	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any	History of genetics and contributions of Gregor Johann Mendel. Concept of gene and chromosome.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the basic principles of classical genetics and genetic interactions	U	PO1, PO4, PO6, PO7, PO10
2	Discuss the non-Mendelian patterns seen in nature	U	PO1, PO2
3	Estimate the linkage based genetic mapping in eukaryotes	E	PO1, PO2,

4	Explain the types of sex determination mechanisms in higher organisms	U	PO1, PO2, PO7, PO10
5	Summarize the basics of population genetics	U	PO1, PO2, PO7, PO10
6	Transfer the concept of evolution in social inclusivity	A	PO1, PO2, PO6, PO7, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to Genetics, Gene Interactions and Non-mendelian Inheritance (30 hours)				
1	1.1	Terms & Concepts – chromosome, gene, allele-dominant and recessive, locus, genotype & phenotype, chromosome theory of inheritance, cross-mono hybrid & di hybrid, testcross, backcross Principles of Mendelian Inheritance- Dominance, Segregation, and Independent Assortment. Model genetic organisms- <i>Neurospora crassa</i> , <i>Saccharomyces cerevisiae</i> , <i>Arabidopsis thaliana</i> , <i>Zeamays</i> (mention only their importance in genetic study)	8	1
	1.2	Modifications of Mendelian ratios Incomplete dominance: Example - flower colour in <i>Mirabilis jalapa</i> . Co-dominance: Example - MN blood type in humans. Lethal genes: Example - pigmentation in Snapdragon. Epistasis: - Dominant epistasis: Example - fruit colour in summer squashes; Recessive epistasis – coat colour in mice Complementary gene interaction: Example - flower colour in <i>Lathyrus odoratus</i> . Multiple alleles: definition, example –Blood grouping in human ABO, Self-sterility in <i>Nicotiana tabaccum</i> .	10	1

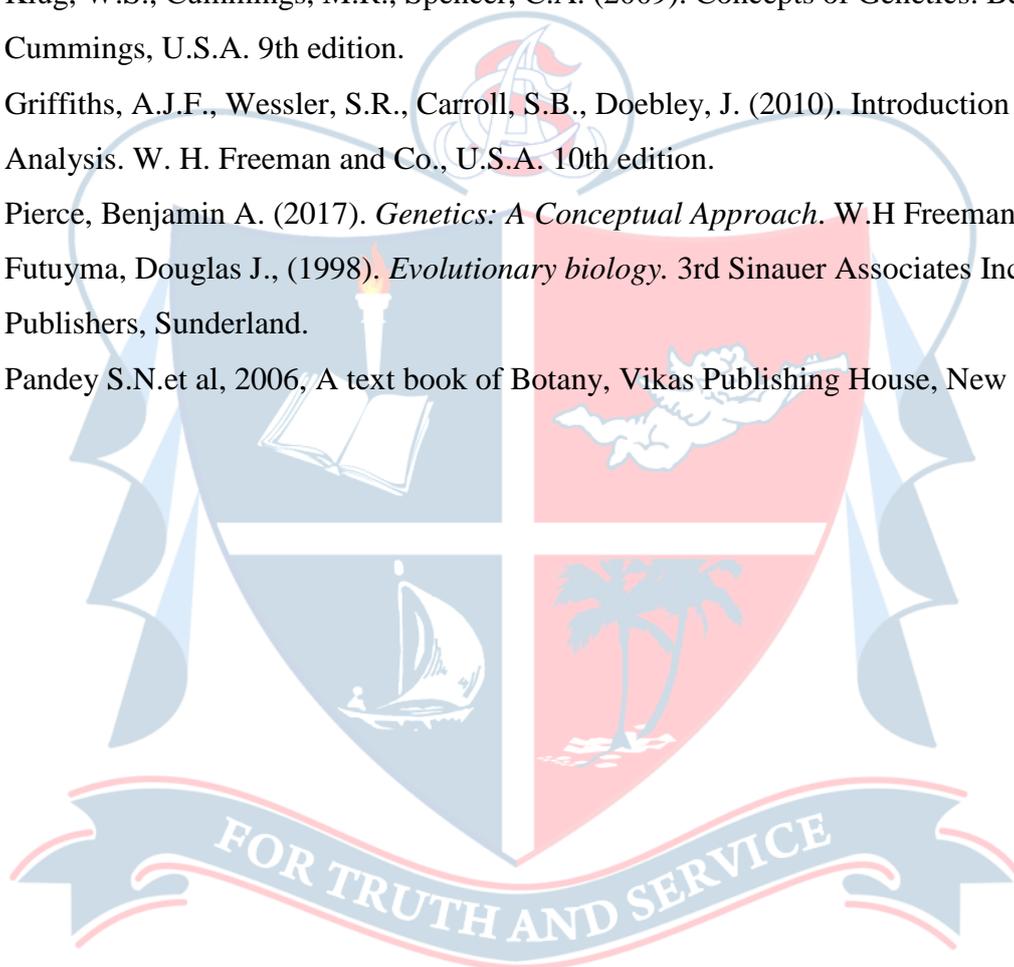
	1.3	<p>Linkage – chromosome theory of linkage; Crossing Over –mechanism of crossing over; types of crossing over – single, double and multiple; recombinant & non-recombinant gametes Linkage mapping: -two-point testcross & calculation of distance between genes; recombination frequency & map units; interference & co-incidence Extra chromosomal inheritance- cytoplasmic inheritance- Example: - leaf variegation in <i>Mirabilis jalapa</i> Quantitative inheritance: - polygenic; continuous traits. Example: ear size in maize; Quantitative trait Loci</p> <p>Learning activity: Workout Problems related to monohybrid cross, dihybrid cross, modified Mendelian ratios. Calculation of distance between genes by using two-point test crosses and linkage map construction.</p>	12	1,2, 3
Sex Determination (10 hours)				
2	2.1	<p>a) Chromosomal mechanism of sex-determination: XX-XY, XX-XO, ZZ-ZW, Haplo-Diplo system,genic balance system. b) Environmental Sex Determination: Sex determination in slipper limpet and reptiles c) X-linked inheritance - Haemophilia in man; Y-linked inheritance – SRY gene d) Sex-limited Inheritance – Example-feathering pattern in Fowl; Sex-influenced Inheritance - Example – Baldness in humans e) Mechanisms of sex determination in plants- <i>Melandrium</i> (emphasis on Epigenetic inheritance)</p>	10	4
Population genetics (10 hours)				
3	3.1	<p>Concept of Population, Allelic frequency, genotypic frequency; Hardy- Weinberg Equilibrium and the factors affecting the equilibrium. Learning activity: Problems based on Hardy- Weinberg equation</p>	10	5

	Evolution (10 hours)			
4	4.1	<p>a) Origin of life- biochemical origin of life (Miller's Experiment). Theories of evolution -Darwin's theory and modern synthetic theory. Evidences for evolution- (brief study)</p> <p>b) Character evolution; Microevolution and macroevolution; Convergent, divergent, and parallel-evolution- (definition with examples)</p> <p>c) Biological Species concept; speciation - genetic divergences and isolating mechanisms- geographical isolation & reproductive isolation (prezygotic and postzygotic- isolation mechanisms)- (brief study)</p> <p>d) Patterns of speciation- allopatric, sympatric, quantum and parapatric speciation- (brief study)</p>	10	6
5	Teacher-specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty <p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

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Department of Botany
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Programme	BSc.(HONOURS) BOTANY					
Course Name	BIOINFORMATICS IN PLANT SCIENCES					
Type of Course	DSE					
Course Code	24SACBOT6DE301					
Course Level	300					
Course Summary	<p>Bioinformatics in plant sciences provides a foundational understanding of bioinformatics, focusing on the fundamental principles, tools, and applications that form the backbone of this interdisciplinary field. Students will explore topics such as sequence analysis, molecular databases, and basic computational techniques essential for biological data analysis. Through a balanced mix of theoretical concepts and hands-on exercises, students will gain practical skills applicable to diverse areas within bioinformatics. Students can understand key concepts in genomics and proteomics, get familiarized with major biological databases and repositories, and learn how to extract relevant information for research. This course is ideal for students with a background in biology or related fields seeking to integrate computational approaches into their research or broaden their knowledge in this rapidly evolving field.</p>					
Semester	VI	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	75
Pre-requisites, if any	Basics of molecular biology and basic computer skills					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Recall fundamental bioinformatics concepts, databases and tools	K	PO 3
2	Utilize bioinformatics tools to analyse molecular sequences	An	PO1
3	Display and manipulate three-dimensional structures of biological macromolecules using molecular visualization tools	A	PO1, PO2
4	Explain how molecular data are used to infer evolutionary relationship	U	PO1
5	Interpret evolutionary relationships through phylogenetic trees	A	PO1, PO2
6	Design potential biomolecules as drug candidates	C	PO1, PO2, PO3
7	Integrate various bioinformatics techniques to solve biological research challenges	C	PO1, PO2, PO3, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	Introduction to Bioinformatics (10 hours)			
	1.1	Bioinformatics – significance and scope A brief account of omics- genomics, proteomics, transcriptomics, metabolomics	2	1
	1.2	Biological databases – types – Primary, secondary, Composite Nucleotide database – GenBank, ENA, DDBJ, NDB Protein database – PDB, UniProt, PIR Bibliographic databases -PubMed	5	1, 2

		Organismal – <i>Arabidopsis thaliana</i> - TAIR		
	1.3	Sequence retrieval and submission – Entrez, BankIt	3	2
2	Molecular Phylogenetics (15 hours)			
	2.1	Sequence alignment – types, pairwise, multiple sequence, local, global, Gaps, scoring, scoring matrix – Dot matrix method Tools – BLAST -types, CLUSTAL and Lalign	5	1,2, 4, 7
	2.2	Molecular clock Sequence homology-Homolog, ortholog, paralog	2	1, 3
	2.3	Phylogenetic tree -rooted -unrooted, monophyletic, paraphyletic and polyphyletic groups, phylogram, cladogram, dendrogram. Phylogenetic tree construction methods-brief account for Distance-based and Character-based methods. Advantages of phylogenetic trees	8	1,2, 4,5, 7
3	Genomics, Proteomics and Drug Designing (20 hours)			
	3.1	A brief account of Structural genomics, Functional genomics and Comparative genomics	1	1
	3.2	Sequencing techniques – Sanger's method, HGP Next-gen sequencing – brief study (Mention the platform – Roche454) Protein sequencing- Edman's degradation method	3	1, 7
	3.4	Gene prediction in prokaryotes and eukaryotes- <i>Ab initio</i> , homology-based, consensus-based methods, ORF. Protein structure prediction-secondary and tertiary- <i>ab initio</i> and homology methods. Molecular visualization- RasMol, PyMOL	7	1, 2, 3,6, 7
	3.5	Drug Designing Introduction to computational methods in Drug designing, Basics of molecular biology relevant to Drug design	9	1

		Computer-Aided Drug Designing (CADD)- Ligand-based, Structure-based Molecular Docking- Basics of AutoDock		
	Practicals (30 hrs)			
4		<ol style="list-style-type: none"> 1. Hands-on training for familiarizing various databases 2. Download nucleotide sequence from GenBank / ENA / DDBJ 3. Hands-on training for familiarizing various databases 3. Download 10 research papers from PubMed on a specific topic 4. Hands-on training on how to submit sequence. 5. Hands-on training - ORF finder 6. Hands-on training in primer designing – NCBI Primer-BLAST, Primer3 7. Perform BLAST for a specific sequence, select 6 sequences, and familiarize sequence alignment using Lalign and CLUSTALW (give DNA or protein sequence). Phylogenetic analysis by MEGA (Protein or DNA sequence data). Download specific sequences from PDB and visualize using RasMol.		
5	Teacher-specific course components			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks <ul style="list-style-type: none"> ·Involvement and responses in class room transactions ·Home Assignments/preparedness ·Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course <ul style="list-style-type: none"> ·Any other method as may be required for specific course / student by the

	course faculty Practical: 15 marks ·Lab involvement and practical skills Record/Any other method as may be required for specific course / student by the course faculty
	B. End Semester Evaluation (ESE) Theory: 50 marks Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8) : 6 x 5= 30 Essay (1 out of 2) : 1x 10= 10 Practical: 35 marks ·Practical based assessments: 30 marks • ·Record: 5 marks

References

1. Jin Xiong, 2006. *Essential Bioinformatics*, Cambridge University press
2. David W Mount, 2004. *Bioinformatics: sequence and genome analysis*. CBS Publishers.
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Department of Botany
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Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT CHEMICAL ECOLOGY					
Type of Course	DSE					
Course Code	24SACBOT6DE302					
Course Level	300					
Course Summary	Plant chemical ecology is a branch of ecology that focuses on the study of chemical interactions between plants and other organisms in their environment. It explores the chemical compounds produced by plants, how these compounds mediate interactions with other living organisms, and the ecological consequences of these interactions. The primary aim is to understand how chemical signals influence plant interactions with herbivores, pollinators, pathogens, neighbouring plants, and other organisms.					
Semester	VI	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	75
Pre-requisites, if any	Basic knowledge in plant defence and plant secondary metabolites					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Distinguish the diverse array of plant secondary metabolite and its orchestration in defense	E	PO1, PO2, PO3, PO9
2	Explain the significance of herbivore-induced plant volatiles to attract predators or parasitoids of the herbivores	An	PO1, PO2, PO3, PO9

3	Estimate the phenomenon of allelopathy in the germination or growth of competing plant species, influencing the composition of plant communities	E	PO1, PO2, PO3, PO7, PO9
4	Illustrate the role of volatile organic compounds (VOCs) in plant communication	An	PO1, PO2, PO3, PO7, PO9
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Chemical Defences (10 hours)			
	1.1	Biosynthesis and storage of secondary metabolites in plants	3	1
	1.2	Plant chemicals against pathogens; Terpenoids, Phenolics, Nitrogen compounds – Alkaloids and Cyanogenic glycosides	3	1
	1.3	Proteins and Enzymes that specifically inhibit pathogen – Defensins, Digestive enzyme inhibitors, Protease inhibitors, Hydrolytic enzymes.	4	1
2	Herbivore-Induced Plant Defences and allelopathy (20 hours)			
	2.1	Introduction on Herbivore-Associated Molecular Patterns (HAMPs)	2	2
	2.2	Biosynthesis of HIPVs (Herbivore-induced plant volatiles)	4	2
	2.3	Role of HIPVs in plant defense against herbivores	4	2
	2.4	Introduction to Allelopathy	1	3

	2.5	Ecological importance and consequences of Allelopathy.	4	3
	2.6	Direct allelopathy, Apparent competition, Apparent predation	3	3
	2.7	Biogeographical Variation in Allelopathy	2	3
	VOCs and Plant Communication (10 hours)			
3	3.1	Roles of volatile organic compounds (VOCs)	2	4
	3.2	Plant-plant signalling - above-ground signalling	2	4
	3.3	The Chemistry of Plant-Plant Signalling	2	4
	3.4	Plant-plant signalling - below-ground Signalling	2	4
	3.5	Self and nonself recognition in plants	2	4
	Practical (Any two practical can be provided to the students) (30 hours)			
4	4.1	Allelopathic Potential of some local plants on the seeds of weedy plants.	10	3
	4.2	Isolation of VOCs using hydrodistillation, Hot Extraction, Cold Pressing, Supercritical extraction	5	4
	4.3	Familiarize the isolation and synergistic/ antagonistic activities of VOCs using VOC chambers	5	4
	4.4	Identification of VOCs using GC-MS, HPLC and EI/MS (If facilities available)	10	4

	4.2	Isolation of VOCs using hydrodistillation, Hot Extraction, Cold Pressing, Supercritical extraction	5	4
5	Teacher-specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (\leq 5 years) related the course · Any other method as may be required for specific course / student by the course faculty Practical: 15 marks · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty</p> <p>B. End Semester Evaluation (ESE) Theory: 50 marks Short answer (10 out of 12): $10 \times 1 = 10$ Short Essay (6 out of 8) : $6 \times 5 = 30$ Essay (1 out of 2) : $1 \times 10 = 10$ Practical: 35 marks Practical based assessments: 30 marks .Record: 5 marks</p>

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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	RESEARCH METHODOLOGY AND BIOMETRICS					
Type of Course	DSE					
Course Code	24SACBOT6DE303					
Course Level	300					
Course Summary	The course discusses various aspects of research – like how to find a research problem, the major sources of literature for research, the major steps in research, methods of report writing, use of ICT and statistics in research.					
Semester	VI	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Discuss the basic concepts of research.	U	PO 1 PO 2 PO 3
2	Identify and compile the various sources of literature for research.	U	PO 3
3	Outline a research problem in Biology and design a project based on it.	An	PO 1 PO 2 PO 3
4	Write a research report in an accepted format.	A	PO 4

5	Familiarize various available operating systems.	A	PO 3
6	Operate various tools in MS office/Libre Office to generate and present research reports.	A	PO 3
7	Evaluate the data using various statistical tools and interpret the results.	E	PO 1 PO 2 PO 3 PO4
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Major Steps in research (15 hours)			
	1.1	Objectives of research. Types of research - pure and applied. Identification of research problem, formulation of hypothesis – Null hypothesis and alternate hypothesis.	2	1
	1.2	Major steps, purpose, literature sources, names of reputed National and International journals in life science (Minimum 2 international & 3 national); reprint acquisition – INFLIBNET, PubMed, NCBI.	5	2
	1.3	Definition of the problem; Identification of the objective(s); literature review (brief account only), introducing working hypothesis, design of the study – basic principles and significance; sampling for data – methods, Identification and collection of data, types of data – Primary and Secondary; Collection of primary data – observation method, interview method, questionnaire method, through schedules; analysis and interpretation of data, Report writing (Brief account).	5	3

	1.4	Preparation of dissertation - IMRAD system - Preliminary pages – Title pages – Certificate, Declaration, Acknowledgement, Table of contents, Abstract; Main text - Introduction and review of literature, Materials and methods, Results, Discussion, Conclusion; End matter – Bibliography and Appendix.	3	4
Use of ICT in Research (10 hours)				
2	2.1	Basic components of a computer – concept of Hardware and Software, Major Operating Systems: Proprietary: Windows, Macintosh and Open source: Linux. Application suit – M.S Office (Brief introduction).	1	5
	2.2	MS WORD - Word Processing - creating a new document, saving a document, exporting to pdf, opening an existing document, basic text editing; Editing tools – cut, copy, paste, find, and replace, undo and redo; Formatting tools – font formatting, paragraph formatting, bullets and numbering, styles, page formatting.	2	6
	2.3	MS EXCEL - creating worksheet, data entry, sorting data. Statistical tools (SUM, AVERAGE, MEDIAN and MODE.SNGL). Preparation of graphs and diagrams (Bar diagram, Pie chart, Line chart, Histogram).	2	6
	2.4	MS-POWERPOINT: Steps of preparation of presentation based on a topic from biology, which includes Tables, Charts, and Images. Ideal characteristics of a presentation slide set for scientific purposes using a model template.	2	6
	2.5	LibreOffice – Writer, Calc, Impress; Open Office (brief study).	1	6
	2.6	Search engines: Google.com; meta-search engine – Metacrawler; academic search - Google scholar. Educational sites related to biological science – Scitable, DNAi.	2	2
3	Biometrics (20 hours)			

	3.1	Statistical terms, and symbols (Brief study only). Sampling: concept of sample, sampling methods - random and non-random sampling.	3	7
	3.2	Diagrammatic and graphic representation - line diagram, bar diagram, pie diagram, histogram, frequency curve.	2	7
	3.3	Measures of central tendency: mean, median, mode, (discrete and continuous series). Measures of dispersion: standard deviation. Probability and distribution patterns: normal distribution, binomial distribution. Tests of significance (Z – test, t–test and Chi-square test).	15	7
	Practicals (30 hrs)			
4		<p>1.Preparation of a list of references (not less than 10) on a given topic of biological science Preparation of Review on a given topic using online and print resources</p> <p>2.Collect information on a topic related to biological science using the internet and make a report based on the collected information (Using M.S WORD / Libre Office Writer)</p> <p>3. Collect a compound leaf with at least 25 leaflets of varying sizes from a plant, measure the length of each leaflet, and conduct the following works using M.S Excel/ Libre Office Calc and record: (a) Prepare data table/frequency table in M.S Excel / Libre Office Calc (b) Prepare bar diagram (c) Prepare Line chart (d) Prepare a Pie chart (e) Prepare Histogram</p> <p>4. Collect data on a particular topic using online or print questionnaires and perform the following activities in M.S Excel / LibreOffice Calc and record. (a) Calculate the average of variables (b) Calculate the median of variables (c)Calculate the mode (mode.sngl) of variables.</p> <p>5. Prepare a worksheet using a set of data collected and find out the SUM.</p> <p>6.Preparation of PowerPoint presentation using M.S PowerPoint / LibreOffice – Impress, based on a given topic.</p> <p>7.Problems related to a. Measures of central tendency</p>		

		b. Measures of dispersion c. Probability d. Test of significance (Z – test, t – test, Chi-square test)		
5	Teacher-specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks ·Involvement and responses in class room transactions ·Home Assignments/preparedness ·Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course ·Any other method as may be required for specific course / student by the course faculty Practical: 15 marks ·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty</p> <p>B. End Semester Evaluation (ESE) Theory: 50 marks Short answer (10 out of 12): $10 \times 1 = 10$ Short Essay (6 out of 8) : $6 \times 5 = 30$ Essay (1 out of 2) : $1 \times 10 = 10$ Practical: 35 marks ·Practical based assessments: 30 marks · Record: 5 marks</p>

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT ECOLOGY, CONSERVATION AND SUSTAINABLE DEVELOPMENT					
Type of Course	DSE					
Course Code	24SACBOT6DE304					
Course Level	300					
Course Summary	This course introduces ecology as a scientific discipline. By the end of the course, students should be familiar with ecological principles related to how plant populations & communities interact with their environments at local, regional, & global scales.					
Semester	VI	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the basic concepts of plant ecology	U	PO 1, PO 4
2	Describe the adaptations of different plants	U	PO 1, PO 4
3	Outline the structure and functions of community	An	PO 1, PO 2
4	Illustrate conservation strategies	A	PO 1, PO 2, PO 10

5	Critically assess the sustainable uses of resources	E	PO 1, PO 2, PO 4, PO 6, PO 10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Plant Ecology (12 hours)			
	1.1	Definition and scope of plant ecology, branches of ecology, ecological hierarchy-individual, population, community, ecosystem.	4	1
	1.2	Types of ecosystems- Terrestrial (Grassland, desert and forest), Aquatic (freshwater and marine).	4	1
	1.3	Adaptations of plants- hydrophytes, xerophytes, epiphytes, halophytes with special reference to Mangroves (Morphological, anatomical and physiological).	4	1
2	Autecology & Synecology (15 hours)			
	2.1	Study of plant populations, population characteristics-size, density, dispersion, natality, mortality, survivorship curve, immigration and emigration, population growth, Environmental resistance, biotic potential, carrying capacity.	6	2
	2.2	Community structure and organization- Key concepts: species interactions, species richness, species diversity, habitat, niche, ecological indicators, ecotone and edge effect, Foundation species, keystone species, Umbrella species.	5	2
	2.3	Ecological Succession: types, processes and impacts of Hydrosere & Xerosere.	4	2
3	Conservation Ecology and Sustainable Development (18 hours)			
	3.1	Definitions: Genetic, Species and Ecosystem/Community diversity (Alpha, beta and gamma diversity), biosphere, hotspots, megadiversity. Threats to biodiversity: habitat loss and fragmentation-landslides, landslip, cloud burst, dam issues, Quarry issues, Ecologically Fragile Lands	5	3

		(EFL), man-wildlife conflicts, climate change.		
	3.2	Organizations, movements and contributors of environmental studies and conservation: organizations - WWF, Chipko; contributors - Salim Ali, Sunder Lal Bahuguna, Madhav Gadgil, Tulsi Gowda, Lakshmikutty Amma.	2	3
	3.3	Conservation strategies- Definition and goals. <i>In-situ</i> and <i>ex-situ</i> conservation. IUCN, red data book, RET plant species. Technological Approach to Assessment and Conservation-Environmental Impact Assessment (EIA) brief account only. Application of Remote Sensing and GIS (brief account only) Conservation strategies and efforts in India, wetland conservation-Ramsar sites in Kerala.	5	3
	3.4	Sustainable development-definition, principles. The three pillars of sustainability. Global Responses to Sustainable Development (Paris Convention-goals of Sustainable development). Indicators of sustainable development, a brief introduction to green technology.	4	4
	3.5	Sustainable development-Kerala model, Rainwater harvesting and responsible tourism.	2	4
	Practical (30 hours)			
4	4.1	Conduct a two days field trip to any of the wild life sanctuaries, NPs, Ramsar sites and prepare a report categorizing major plant groups with geotagged photographs	10	1
	4.2	Ecological adaptations: Morphology and anatomy of hydrophytes, xerophytes, epiphytes, and mangroves	4	1
	4.3	Familiarize with different sampling methods (Quadrat/ Transect) Assessment of diversity, abundance, and frequency of plant species by quadrat method	10	2
	4.4	Estimation of CO ₂ , Cl, and alkalinity of water samples (Titrimetry)	6	2
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test · Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course · Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty <p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1 = 10$</p> <p>Short Essay (6 out of 8): $6 \times 5 = 30$</p> <p>Essay (1 out of 2): $1 \times 10 = 10$</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> · Practical based assessments: 30 marks · Record: 5 marks

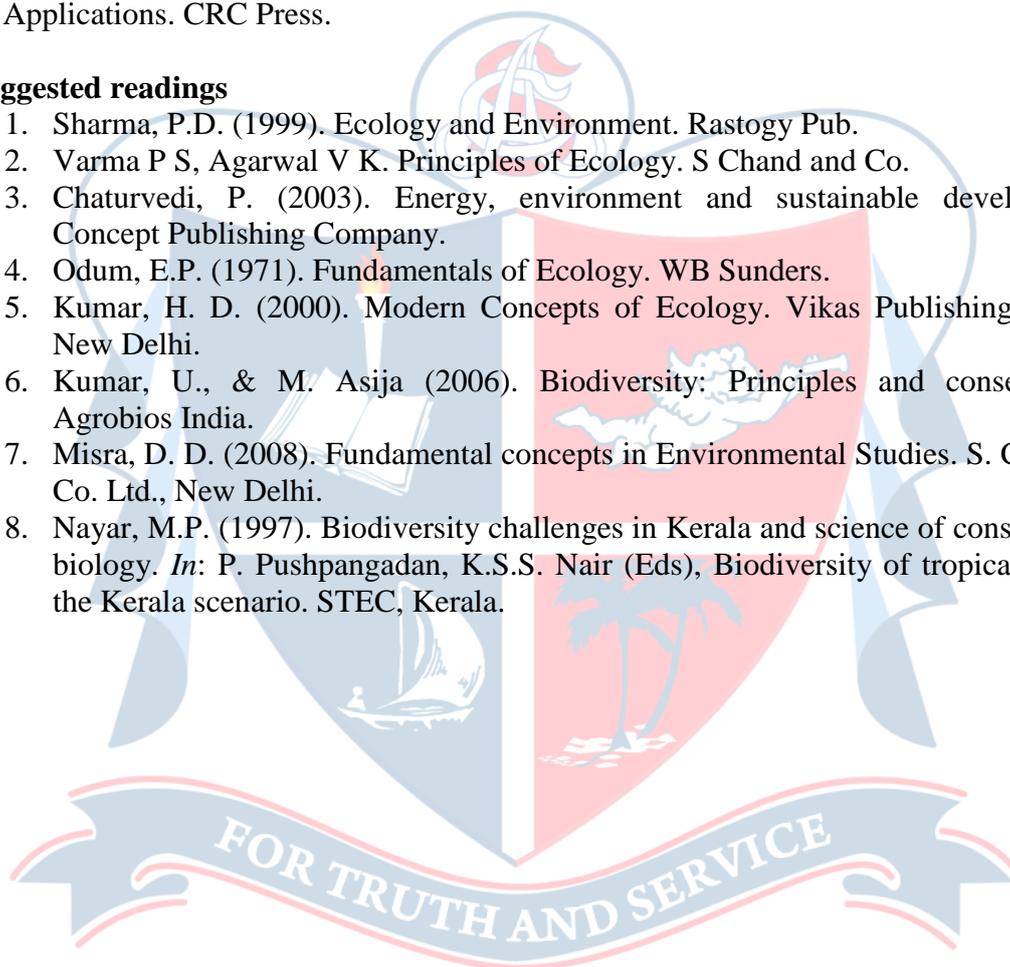
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Suggested readings

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	<h2 style="margin: 0;">Department of Botany</h2> <h3 style="margin: 0;">St. Albert's College (Autonomous)</h3> <h3 style="margin: 0;">Ernakulam</h3>
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Programme	BSc.(HONOURS) BOTANY					
Course Name	ENTREPRENEURIAL BOTANY					
Type of Course	SEC					
Course Code	24SACBOT6SE301					
Course Level	300					
Course Summary	The course aims to prepare the students for an entrepreneurial journey by giving an overview of entrepreneurship. The course discusses the process of developing and independent idea into ventures. Different areas of opportunity					
Semester	VI	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	-	-	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate knowledge of diverse botanical entrepreneurship and develop business acumen for botanical ventures	U, S	PO 2, PO 5, PO 7
2	Analyze and evaluate real world success stories of entrepreneurs from government initiatives and support schemes	A, S, E	PO 2, PO 5, PO 7
3	Propose entrepreneurial ideas based on plant and plant-based product conducting preliminary research	C, A, S, Ap	PO 1, PO 2, PO 5, PO 8
4	Evaluate the success stories in entrepreneurship	C, A, S, E, Ap	PO 2, PO 5, PO 6, PO 7, PO 8

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Fundamentals of Botanical Entrepreneurship (15 hours)				
1	1.1	Introduction to Entrepreneurship (5 hours) Types and Characterization of Botanical Entrepreneurship Explore various types: agribusiness, bio ventures, aesthetics Characterize ventures based on botanical products Analyze socio-economic factors driving entrepreneurial endeavors in botany	8	1, 4
	1.2	Entrepreneurship as Innovation, Risk Assessment, and Solutions; Examine the role of innovation in botanical entrepreneurship; Assess risks specific to botanical ventures and propose strategic solutions	7	2, 4
Bio Ventures, Business Planning, and Government Initiatives (15 hours)				
2	2.1	Overview of Key Botanical Industries in Kerala Explore Spirulina, mushroom, drumstick, and coconut industries. Case studies on successful ventures - Jackfruit 360 and Vegro Biotech startups and support mechanisms (KDISC, Bio 360, BioNest) Aesthetics in Kerala Botanical Entrepreneurship Explore the market for ornamental plants and flowers in Kerala Identify opportunities and challenges in the aesthetics industry	8	1, 4
	2.2	Fruit and Vegetable-Based Products Production of juices, squashes, and other fruit-based products considering Kerala's agricultural landscape Bamboo and Cane-Based Products, Nutraceuticals, and Oils Herbal medicines and cosmetics Government Initiatives and Support Scheme - Kerala Startup Mission and Start Up India - MUDHRA Yojan and Stand Up India - SC/ST Hub Initiative	7	2, 4
Integrating Government Initiatives and entrepreneurial ventures (15 Hrs)				
3	3.1	Navigating Government Support Practical guidance on how entrepreneurs can navigate and access the above-mentioned government schemes	5	

		Develop a comprehensive business plan integrating one or more government schemes and do presentations.		
	3.2	Success Stories and Case Studies Analysing real world success stories of entrepreneurs who have benefited from the mentioned government initiatives: BIRAC schemes, YIP, Atal innovation missions Extracting key lessons and best practices. Each student presents an analysis of a chosen success story related to government support schemes.	2	
	3.3	Entrepreneurial Impact Assessment: Evaluating the impact of government schemes on entrepreneurial ventures Discussing challenges faced and proposing solutions for improvement. Make an audio-visual document of an interview with an entrepreneur.	5	
4		Teacher specific course components		

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Interactive lectures, Group discussions, Problem-based learning, Flipped classroom, Discussion-based Learning, Case-based Learning, Experiential Learning, Inquiry-Based Learning, Game-Based Learning, Socratic Method, Peer Teaching, Simulations, Online Learning, Blended Learning, and other innovative approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory/ Hands on Work- 25 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty <p>B. End Semester Evaluation (ESE) Theory: 50 marks</p> <p>Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8): 6 x 5= 30 Essay (1 out of 2): 1x 10= 10</p>

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Suggested readings

1. Kerala startup mission handbook 2021



Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	ENVIRONMENTAL SCIENCE AND HUMAN RIGHTS					
Type of Course	VAC					
Course Code	24SACBOT6VA301					
Course Level	300					
Course Summary	<p>The course provides an in-depth exploration of key topics in environmental sciences and an understanding of various forms of pollution, their sources, impacts on human health and the environment, and mitigation strategies. It will cover principles and practices of conservation biology, including the importance of biodiversity, ecosystem services, and the impacts of habitat destruction, invasive species, and climate change. Students will learn about conservation strategies and will examine environmental policies and laws. The course will explore the intersection of environmental sciences and human rights, including the right to a healthy environment, environmental justice, and the disproportionate impacts of environmental degradation. By fostering critical thinking and interdisciplinary approaches, students will be empowered to advocate for environmental justice and contribute to a more sustainable and equitable world.</p>					
Semester	VI	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	-	-	45
Pre-requisites, if any	No pre-requisites for this course.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Distinguish the multidisciplinary nature of environmental science.	E	PO 3
2	Evaluate the principles of ecology, ecosystem structure and function, and the importance of biodiversity.	An	PO 1, PO 2
3	Evaluate sustainable practices for the utilization of natural resources	An	PO 6, PO 7, PO 8, PO 10
4	Prioritize the control measures for air, water, and soil pollution by examining the environmental laws in India	An	PO 6, PO 7
5	Collaborate strategies and solutions aimed at biodiversity conservation from a global perspective.	C	PO 3, PO 7
6	Develop the relevance of human rights in real-world scenarios to make responsible citizens.	A	PO 6, PO 7, PO 8, PO 10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Introduction to Environmental Science & Environmental Pollution (15 hours)				
1	1.1	Introduction to Environmental Science: a) Definition, scope & significance, multidisciplinary nature of environmental studies b) Principles of ecology, ecosystem structure and function, biodiversity and its importance	3	1, 2
	1.2	Natural Resources: a) Concept of resource b) Classification of natural resources (renewable and non-renewable) c) Sustainable practices for resource utilization	4	3

	1.3	Overview of Environmental Pollution: Definition and types of pollution. Overview of air, water, soil, noise, and light pollution.	1	4
		Air pollution: Air pollutants, types, sources, effect of air pollution on plants and humans, control measures	2	4
	1.4	Water pollution: Common pollutants, sources, impact, control measures; water quality standards - DO and BOD; eutrophication.	2	4
	1.5	Soil Pollution: Causes, sources, solid waste, biodegradable, non-biodegradable, management of solid waste, composting, e-waste, waste management and recycling.	3	4
	Climate Change and Environmental Legislation and Laws (15 hours)			
	2.1	Environmental issues: a) Global warming, greenhouse effect, causes and consequences of climate change, ozone layer depletion. b) Carbon sequestration. c) Carbon foot prints-Indian carbon footprint	3	5
2	2.2	Global Conservation: a) Definition, importance, overview of threats to biodiversity b) International Conservation Organizations: Role of NGOs in Conservation (eg. WWF, Conservation International), United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN)-categories c) Overview of Key International Treaties (e.g., Kyoto Protocol, Paris Agreement)	7	5
	2.3	a) Environment (Protection) Act 1986 and Environment (Protection) Amendment Rules, (2023) b) Wildlife (Protection) Act, 1972, amended in 2022, c) Forest (Conservation) Act, 1980, Forest (Conservation) Amendment Bill 2023 Biological Diversity (Amendment) Act, 2023 [brief account only]. d) Corporate Environmental Responsibility [brief account only]	5	5
3	Human Rights (15 hours)			

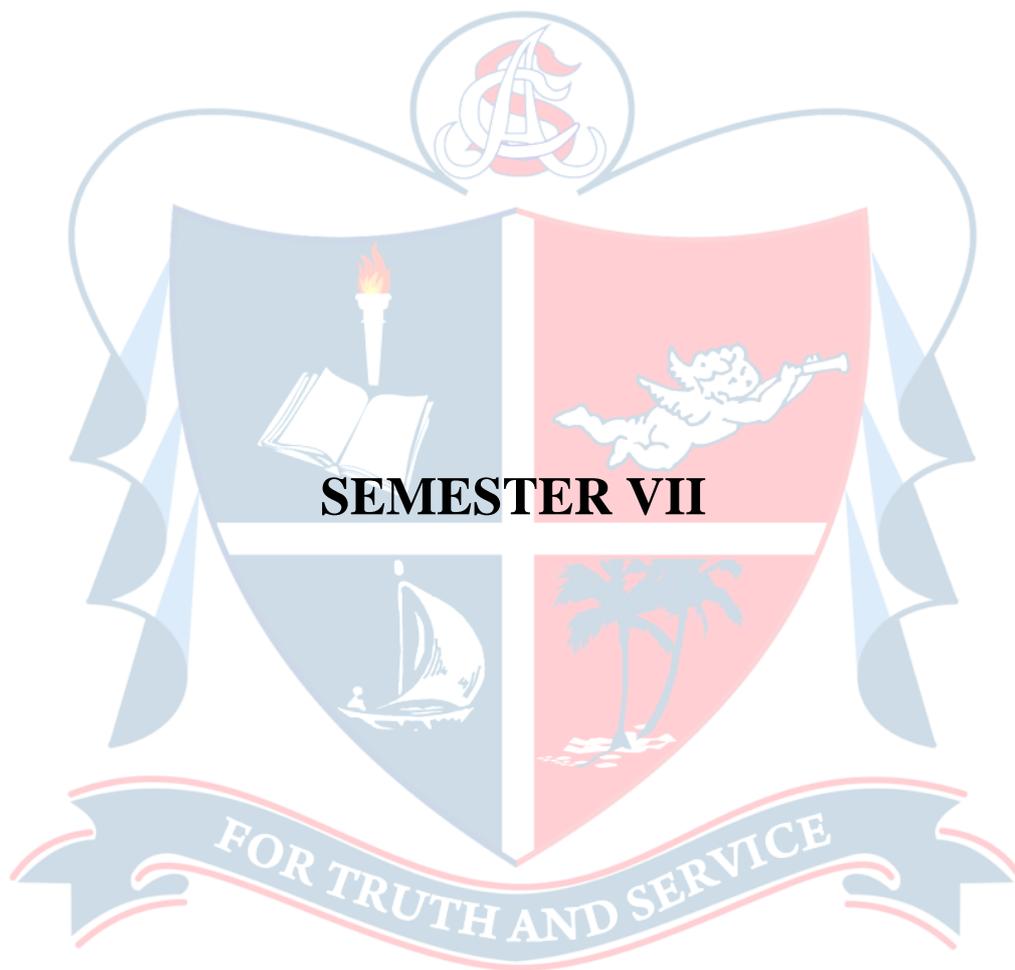
	3.1	An Introduction to Human Rights, history of Human Rights, Generations of Human Rights, Universality of Human Rights, Basic International Human Rights Documents - UDHR, ICCPR, ICESCR. -Value dimensions of Human Rights.	5	6
	3.2	Human Rights and United Nations: Human Rights coordination within the UN system, Role of UN secretariat, Economic and Social Council, Commission of Human Rights, Security Council and Human Rights, Committee on the Elimination of Racial Discrimination, Committee on the Elimination of Discrimination Against Women, Committee on Economic, Social and Cultural Rights, The Human Rights Committee, Critical Appraisal of UN Human Rights Regime.	5	6
	3.3	Human Rights National Perspective: Human Rights in Indian Constitution, Fundamental Rights, Directive Principles of State Policy and Human Rights- Human Rights of Women- Children -Minorities-Prisoners, Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human rights awareness in education.	5	6
4	Teacher-Specific Course Components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ul style="list-style-type: none"> ● Lectures ● Invited talks: Invite guest speakers from environmental organizations, human rights NGOs, and academia to share practical insights and experiences. ● Seminars ● Debate: Facilitate discussions and debates on ethical dilemmas related to environmental science and human rights. ● Technology Integration: Utilize technology for virtual field trips, data analysis, and collaboration on global environmental and human rights issues. ● Case Study: Learner has to present a case study of environmental issues. <ul style="list-style-type: none"> ● The learner has to identify the issue ● Distinguish the cause(s) ● Investigate the effects ● Evaluate the responses ● Educate/Propose solutions to mitigate the issue
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	<ul style="list-style-type: none"> Project-Based Learning, Experiential Learning, Peer Teaching, group discussions, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 25 Marks</p> <ul style="list-style-type: none"> Involvement and responses in class room transactions Home Assignments Oral presentation/ Viva/Quiz/Open book test Field study, Group discussion on a recent research or review article (<5 years) related to the course Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8): 6 x 5= 30 Essay (1 out of 2): 1x 10= 10</p>

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	RESEARCH METHODOLOGY AND BIOSTATISTICS					
Type of Course	DCC					
Course Code	24SACBOT7CC401					
Course Level	400					
Course Summary	This course equips the students to conduct research in the field of their interest. Course discuss various aspects of research like - identification of research problems, formulation of hypothesis, collection of literature, analysis and interpretation of data, hypothesis testing, preparation of research reports, project proposal, and use of statistics in research. The course also discusses various ethical concerns related to research.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Discuss the basics of research	U	PO 1, PO 2, PO 3
2	Conduct comprehensive literature reviews by utilizing physical and digital databases.	A	PO 1, PO 3, PO 9
3	Identify, explain, compare, and compose the fundamental components of a research proposal/report or presentation.	U	PO 4, PO 6
4	Capable of referencing literature using MLA, APA, Chicago, and Harvard citation styles and publishing an	A	PO 3, PO 4, PO 6, PO 10

	article in a journal.		
5	Practice the preparation of proposals for research funding	A	PO 4, PO 6
6	Choose different ethical concerns within research for an ideal experimental design	A	PO 1, PO 2, PO 3, PO 8
7	Perform different quantitative data collection methods and processing methods in research using various statistical significance tests and statistical analysis methods.	A	PO 1, PO 2, PO 3
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to research methodology and review of literature (10 hours)			
	1.1	Need for research, objectives of research, types of research; Stages of research – generation of a research problem, review of literature, formulation of hypothesis, preparation of research design, execution of work, recording of observations, Analysis of data, interpretation and conclusions, preparation of report.	5	1
	1.2	Features of a Scientific Library, Journals (Current and Back-volumes), Books. Computerized catalogue; Journals: indexing journals, abstracting journals, research journals, review journals, e-journals. Learning Activity: Visit a scientific library or documentation centre and submit a report.	3	2
	1.3	Online and Open access Initiative – Google Scholar, NCBI, PubMed, Medline, INFLIBNET, N-list and Shodhganga, Acquisition of Reprints and filing.	2	2
2	Academic communication (20 hours)			
	2.1	Writing Dissertation/Thesis: General Format (IMRAD-System) and General principles in writing: Front matter - title page, certificate, acknowledgements, and contents page. Body of the Dissertation/Thesis: introduction, review of literature, material(s) and method(s), heading(s), result(s): table(s) and illustration(s), marginal indicator(s), caption(s), camera-ready copy; discussion, summary and conclusion; references, abstract(s) and appendix.	5	3

	2.2	Reference styles – APA, MLA, Harvard, Chicago. Bibliography Management system: Mendeley, Zotero (Brief Account), Endnote. Learning Activity: Preparation of at least 20 references on a given topic in APA reference style using any reference management system (Mendeley/Zotero/Endnote).	5	4
	2.3	(i) Formats for preparation of Research paper and short communications – title, author name and affiliations, Abstract, Keywords, Introduction, methods, results, discussion, conclusion, acknowledgement, references. (ii) Preparation of review articles. (iii) Proofreading-standard abbreviations for proof correction. (iv) Presentation of Research findings in Seminars and Workshops. Learning Activity: Submit a review paper to the instructor based on a topic of choice.	6	3
	2.4	Selection of Appropriate Journal for publishing, Method for submitting research papers to journals (Elsevier/Springer). Peer review process, Responding to comments by reviewers. Authorship: Corresponding Author, Co-authorship. Indices for Assessment of Journals and Authors: Impact factor of journals; author citation and citation indices: h – index, i – index.	4	4
	Preparation of Research proposals for funding and Ethics in Research (10hours)			
3	3.1	Title, introduction, literature review and abstract; aim and scope; present status; location of experiments; materials and methods; justification; expected outcome; date of commencement; estimated date of completion; estimated cost; references; funding agencies. Learning activity: Prepare a project proposal to submit a funding agency.	6	5
	3.2	Introduction, important concepts and terms, Intellectual property rights, Patent, Trademark, Geographical indication, Copyright and related rights, royalty, Plagiarism and tools to detect plagiarism (Urkund).	4	6
	Statistics in research (20 hours)			
4	4.1	Principles - Replication, Randomization and Local Control. Common designs in biological experiments: Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD), and Factorial Design (FD).	5	6

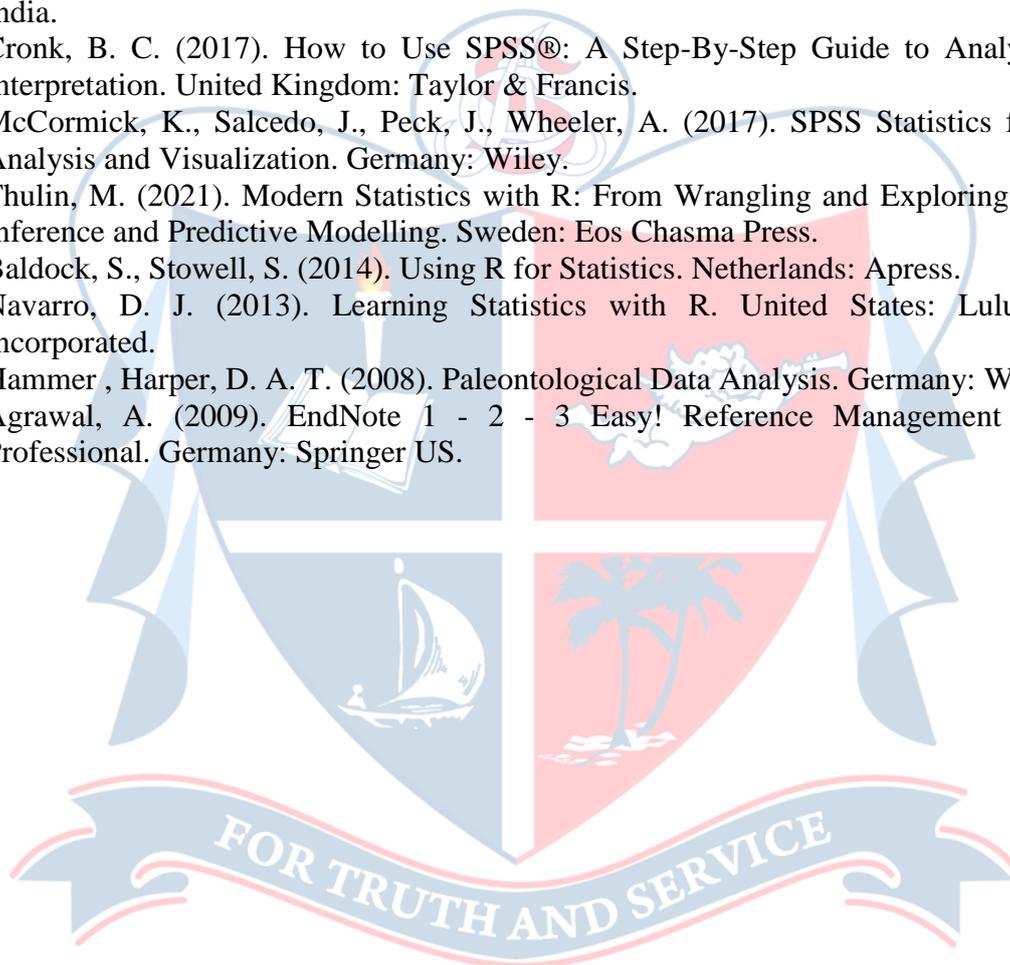
	4.2	Data collection, Primary and Secondary data. Tools for data collection and presentation. Measures of central tendency and dispersion. Probability - Definition, mutually exclusive and independent events. Binomial and Normal distribution. Linear Regression and Correlation (<i>Simple and Multiple</i>).	5	7
	4.3	Statistical Inference-Estimation-Testing of Hypothesis: - t-Test, Chi-square Test (Goodness of fit, Independence or Association, Detection of Linkages), F-test, ANOVA. Statistical data analysis using any of the following Software – SPSS / R / Past. Learning activity: 1. Test the significance of a given data using the t-Test, Chi square -test. 2. Analysis of a set of data for Correlation / Regression (Scatter diagram). 3. Determine the probability of different types of events. 4. Perform statistical data analysis using a given data in SPSS/ R /Past software.	10	7
5	Teacher-specific content			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	B. End Semester Evaluation (ESE)- 70 Marks <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BBSc.(HONOURS) BOTANY					
Course Name	ADVANCES AND APPLICATIONS IN PLANT SCIENCE – THALLOPHYTES					
Type of Course	DCC					
Course Code	24SACBOT7CC402					
Course Level	400					
Course Summary	This course will enable the students to identify, and compare the characteristics of the major groups of thallophytes and to classify them within a phylogenetic framework. Students will be able to use the evidence of comparative biology to correlate the evolutionary trends to the diversity of plant life on earth. Knowledge about the interactions and associations of lower plants will provide better insights on the adaptive strategies of plants. Awareness in the thrust areas of research will generate interest in students to pursue the same.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	75
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explore the course of evolution of algae and land plants	U	PO 1, PO 2
2	Analyze the diversity of thallus forms in algae and its adaptive strategies to diverse environments.	An	PO 1, PO 2, PO 3
3	Review the affinities of fungi with other groups and differentiate morphological forms within the group.	U	PO 1, PO 2, PO 3
4	Analyse different fungal associations and its ecological impact	An	PO 1, PO 2, PO 3

			3
5	Evaluate the various applications of thallophytes in different fields	E	PO 1, PO 2, PO 3
6	Generate interest in recent research trends in Thallophyta.	I	PO 3, PO 6, PO 9
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	Introduction to Algae and Evolution of Land Plants (15 hours)			
	1.1	The range of thallus diversity in the algae. Polyphyletic origin of algae and its evolution, with emphasis on endosymbiosis	3	1, 2
	1.2	Algae and the fossil record; Gene sequencing (18SrRNA, HTS) in algal systematics.	2	1, 2
	1.3	Algal pigments involved in photosynthesis Evolution and structural variations of Chloroplast in algae Algal responses to light- phototaxis, photophobia, and gliding.	4	1, 2
	1.4	Adaptation strategies of algae to different environmental conditions-Resting spores, Allelopathy in algae, UV Sunscreens	2	1, 2
	1.5	Algal symbiosis-extracellular (lichens, association of cyanobacteria with <i>Azolla</i> , Coralloid roots) and intracellular associations. Nitrogen fixation by blue-green algae.	4	1, 2
2	Introduction to Fungi and Fungal Associations (15 hours)			
	2.1	General features of fungi. Affinities with plants and animals; Modern trends in fungal classification; Molecular phylogeny of fungi with emphasis on 18srRNA sequencing.	1	3
	2.2	Architecture of the fungal cell wall.	2	3
	2.3	Morphological diversity of fungi- an overview (Slime molds, Mycelial and non-mycelial fungi)	1	3
	2.4	Types of Fungal spores and its dispersal mechanisms (Ballistic dispersal, Dispersal by gravity, wind, water, insects and animals)	4	3

	2.5	Lichens– Ecological role, Nature of associations of algal and fungal partners with emphasis on its nutritional relation, Establishment of a lichen thallus-the process. Mycorrhiza-Ectomycorrhiza, Endomycorrhiza and their significance. Phosphate solubilisation	4	4
	2.6	Fungus-insect mutualism- Fungal farming by ants Parasites - Common fungal parasites of plants, humans, insects and nematodes (Brief account only). Saprophytes - Fungal decomposition of organic matter, coprophilous fungi, cellulolytic fungi, lignolytic fungi (Brief account only).	3	4
Applied Aspects of Algae and Fungi (15 hours)				
3	3.1	Brief Account on the following applications of algae. Algae as the source of food and fodder. Algal polysaccharides-its commercial utilization. Algae as the source of diatomaceous earth, pigments, fatty acids and pharmaceuticals. Production of biofuel, biogas and bioplastics from algae. Algae as pollution indicator, algae-based wastewater treatment for biodiesel production, phycoremediation and biodegradation of plastics. Algae in soil fertility: Soil algae and cyanobacteria	4	5, 6
	3.2	Algal blooms: Beneficial, harmful and toxic bloom. Common cultivated algal species in India. Algal research stations in India Algal culture: scope and a brief account on isolation and culturing techniques (Axenic, Clonal, Unialgal, Enrichment, Maintenance, Batch, Continuous and Immobilized Culture) Molecular genetic techniques for algal bioengineering (Brief Account only), phylogenomics in algal research (Brief Account only) - current trends.	4	5, 6
	3.3	Brief Account on the following applications of fungi. Fungi in the food industry-Flavour & texture, Fermentation, Baking. Application of fungi in agriculture-Mycoherbicides, Mycoinsecticides, Myconematicides. Fungi as a biofertilizer Fungi as the source of Mycotoxins-Aflatoxins, Amatoxin, Ergot, Fusarin	4	5, 6
	3.4	Commercial production of Organic acids, Enzymes, Plant hormones Mycoproteins, and alcohol from fungi. Antibiotics from fungi- penicillin, cephalosporin, Griseofulvin, Volatile organic compounds production by fungi. Fungi as plant and animal pathogen. Fungi as a model organism in	3	5, 6

		genetic experiments- <i>Neurospora</i> , <i>Saccharomyces</i> . Recent research trends in fungi-Zombie ant fungi, Adaptive cognitive behavior and learning in slime molds.		
	Practical (30 hours)			
4	4.1	Study of the thallus morphology of the following algal genera; Cyanophyceae: <i>Lyngbya</i> , <i>Oscillatoria</i> , <i>Scytonema</i> Chlorophyceae: <i>Chlorella</i> , <i>Zygnema</i> , <i>Mougeotia</i> , <i>Pithophora</i> , <i>Nitella</i> , <i>Caulerpa</i> , <i>Ulva</i> , <i>Halimeda</i> Bacillariophyceae: <i>Navicula</i> , <i>Odontella</i> Phaeophyceae: <i>Ectocarpus</i> , <i>Turbinaria</i> , <i>Padina</i> , <i>Dictyota</i> Rhodophyceae: <i>Batrachospermum</i> , <i>Gracilaria</i> , <i>Gelidium</i> , <i>Kappaphycus</i> Activity: Conduct a field visit to familiarize algal habitats, especially seaweeds; and study algal diversity of a location and submit a report	15	2, 5, 6
	4.2	Morphological study of the following types by preparing suitable micro preparations of the following fungi <i>Albugo</i> , <i>Rhizopus</i> , <i>Mucor</i> , <i>Aspergillus</i> , <i>Pilobolous</i> , <i>Xylaria</i> , <i>Peziza</i> , <i>Pleurotus</i> , <i>Auricularia</i> , <i>Lycoperdon</i> , <i>Fusarium</i> . Lichen- <i>Usnea</i> Isolation of fungi from rotten vegetables and culturing the same on PDA; Staining and observing VAM Fungal spore staining using lactophenol cotton blue. Conduct field visit to study on fungal diversity of a location. Lichen identification- morphological and chemical methods	15	3, 5, 6
5	Teacher specific course content			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
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Assessment Types	<p style="text-align: center;">MODE OF ASSESSMENT</p> <p style="text-align: center;">A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments/preparedness ● Oral presentation/Viva/Quiz/Open book test/written test ● Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course ● Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> ● Lab involvement and practical skills ● Record/Any other method as may be required for specific course / student by the course faculty
	<p style="text-align: center;">B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1=10$</p> <p>Short Essay (6 out of 8): $6 \times 5= 30$</p> <p>Essay (1 out of 2): $1 \times 10= 10$</p> <p>Practical: 35 marks</p> <p>Practical based assessments: 30 marks</p> <p>Record: 5 marks</p>

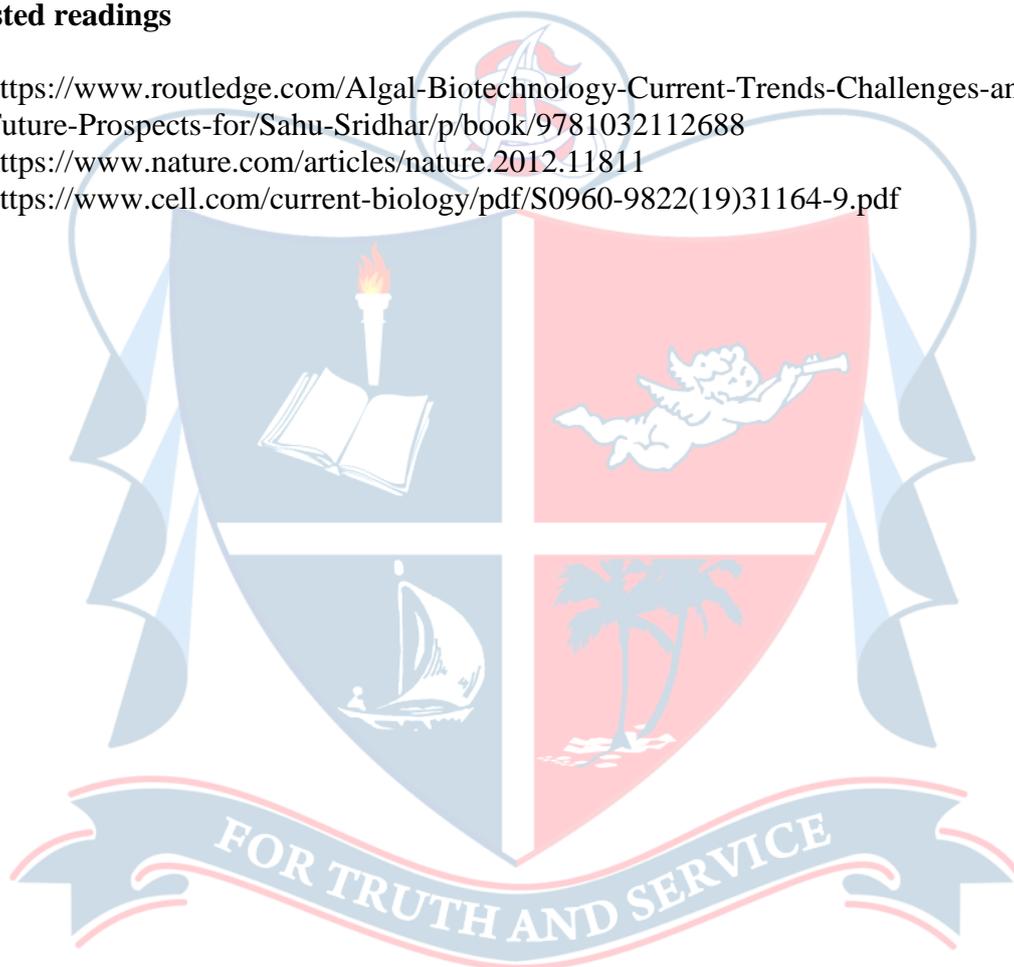
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Suggested readings

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19. <https://www.nature.com/articles/nature.2012.11811>
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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	ADVANCES AND APPLICATIONS IN PLANT SCIENCE - ARCHEGONIATES					
Type of Course	DCC					
Course Code	24SACBOT7CC403					
Course Level	400					
Course Summary	<p>The course is designed to make students aware of advances and applications in archegoniates. After completion of the course, the students will be able to</p> <ul style="list-style-type: none"> ● Recognize the habitat variation, morphological diversity and reproductive behavior of archegoniates. ● Describe the economic significance of archegoniates. ● Summarize the diversity and distributions of prehistoric archegoniate flora. ● Classify archegoniates based on morphological and evolutionary characters. ● Compare the evolutionary trends and ecological significance of archegoniates. ● Investigate the diversity of archegoniates. ● Construct artificial ecosystems for conservation of archegoniates. 					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Recognize the habitat variation, morphological diversity, and reproductive behaviour of bryophytes, pteridophytes, and gymnosperms	U	PO 1
2	Describe the economic significance of bryophytes, pteridophytes, and gymnosperms	U	PO 1
3	Summarize the diversity and distributions of prehistoric archegoniate flora	U	PO 2
4	Classify archegoniates based on morphological and evolutionary characters	A	PO 2, PO 3
5	Compare the evolutionary trends and ecological significance of archegoniates	An	PO 3
6	Investigate the diversity of archegoniates	E	PO 2, PO 4
7	Construct artificial ecosystems for the conservation of archegoniates	C	PO 2, PO 6
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	Bryology (21 hours)			
	1.1	Introduction- Salient features, classification by Goffinet <i>et al.</i> 2008	1	4, 5
	1.2	Comparative account of gametophyte, sporophyte, their inter relationship and spore dispersal mechanisms of the following phylum Marchantiophyta (<i>Riccia</i> , <i>Marchantia</i> , <i>Porella</i>), Bryophyta (<i>Pogonatum</i>) and Anthocerotophyta (<i>Anthoceros</i>).	5	1, 6
	1.3	Origin and evolution of sporophyte and gametophyte in bryophytes.	2	5
	1.4	Ecologic roles, economic importance, and conservation of bryophytes.	1	2, 7
Practicum	1.	Detailed study of the structure of gametophytes and sporophytes of the following genera of bryophytes by suitable micropreparation: <i>Targionia</i> , <i>Cyathodium</i> , <i>Marchantia</i> , <i>Lunularia</i> , <i>Dumortiera</i> , <i>Reboulia</i> ,	12	1, 6

		<i>Pallavicinia, Fossombronia, Porella, Anthoceros, Notothylas, Pogonatum.</i> 2. Conduct a field study and submit a report with geo-tagged photos related to diversity of bryophytes in your locality.		
2	Pteridology (22 hours)			
	2.1	Introduction, general characters, Trends, and concepts in classification of pteridophytes with emphasis on PPG 1. (brief study)	4	4, 6
	2.2	Stelar and soral evolution in pteridophytes. Structural organization of sporophyte and gametophyte (development of sex organs not necessary) of the following type with special reference to stelar structure, heterospory and seed habit. Lycophytes (Lycopodiopsida) <ul style="list-style-type: none"> ● <i>Palhinhaeacernua</i>(syn - <i>Lycopodiellacernua</i>) ● Selaginella Ferns (Polypodiopsida) <ul style="list-style-type: none"> ● Equisetum ● Psilotum ● Marsilea 	6	1, 5
	2.3	<ul style="list-style-type: none"> ● Economic importance of pteridophytes. ● Endemic pteridophytes, and conservation. 	2	1, 2, 7
Practicum	<ol style="list-style-type: none"> 1. Study of morphology and anatomy of vegetative and reproductive organs using clear whole mounts/sections of the following genera: <i>Palhinhaeacernua</i>, <i>Selaginella</i>, <i>Equisetum</i>, <i>Angiopteris</i>, <i>Marsilea</i>, <i>Azolla</i>, <i>Lygodium</i>, <i>Acrostichum</i>, <i>Adiantum</i>, 2. Study of two fossil pteridophytes with the help of specimens or permanent slides. 3. Conduct a survey and submit a report with geo-tagged photos of pteridophyte flora in your locality / Submit a survey report with geo-tagged photos of ornamental pteridophytes. 	10	1, 2, 6	
3	Gymnosperms (15 hours)			
	3.1	Introduction, general characters, evolutionary significance. Origin of seed plants: -Evolution of pollen and seed - the key reproductive evolutionary mechanisms for Life on Land. Relationships among gymnosperms - molecular phylogeny	2	4, 5

	3.2	<p>Study the Morphological and Applied Aspects of gymnosperms</p> <p>Cycadales - Ginkgoalesclade (general account on morphology)</p> <p>Coniferales clade -Pinaceae, Cupressaceae, Taxaceae, Podocarpaceae, Araucariaceae (general account on morphology)</p> <p>Gnetales: <i>Gnetum</i>(general account on morphology).</p> <p>Brief study of habit, morphology and reproductive characters of <i>Welwitschia mirabilis</i></p> <p>Pollination strategies in gymnosperms</p> <p>Vascular system of gymnosperms (give emphasis to wood architecture)</p> <p>The ecological and economic importance of gymnosperms.</p> <p>Conservation of gymnosperms</p>	7	1, 2, 5, 6, 7
Practicum		<p>1. Study of the morphology and anatomy of vegetative and reproductive parts of <i>Zamia</i>, <i>Cupressus</i>, <i>Podocarpus</i>, <i>Agathis</i>, <i>Araucaria</i> and <i>Gnetum</i> (reproductive structure only).</p> <p>Conduct a field survey of gymnosperms in your locality and submit a report with geo-tagged photos. / Conduct a case study to summarize the reasons for the fast extinction of gymnosperms and submit a report based on your findings.</p>	6	1, 5, 6
	Paleobotany: (4 hours)			
4	4.1	<ul style="list-style-type: none"> Introduction, fossil types & technique of study. Indian contribution to paleobotany <p>Fossil plants Study of the following types;</p> <ul style="list-style-type: none"> Fossil bryophytes: <i>Naiadita lanceolata</i> Fossil pteridophyte: <i>Rhynia</i> Fossil gymnosperms: <i>Williamsonia</i> 	4	3
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
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Assessment Types	MODE OF ASSESSMENT
	<p style="text-align: center;">A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	<p style="text-align: center;">B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

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2. <http://www.northernontarioflora.ca/links.cfm?val=bryophytes>
3. <http://bryophytes.plant.siu.edu/>
4. <http://worldofmosses.com/>
5. <http://www.unomaha.edu/~abls/>
6. <http://www.anbg.gov.au/bryophyte/index.html>
7. <http://www.bryoecol.mtu.edu/>
8. <http://www.mobot.org/MOBOT/tropicos/most/Glossary/glosefr.html>
9. http://www.fairhavenbryology.com/Master_Page.html
10. <http://www.mygarden.ws/fernlinks.htm>
11. <http://www.anbg.gov.au/fern/index.html>
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13. http://botany.csd.tamu.edu/FLORA/gallery/gallery_query.htm
14. <http://homepages.caverock.net.nz/~bj/fern/>
15. <http://www.home.aone.net.au/~byzantium/ferns/>
16. <http://www.northernontarioflora.ca/links.cfm?val=pteridophytes>
17. http://www.fiu.edu/~chusb001/giant_equisetum.html
18. <http://www.mygarden.ws/fernlinks.htm>
19. http://www.nrm.se/en/menu/researchandcollections/departments/cryptogamicbotany/collections/pteridophytes.652_en.html
20. <http://www.amerfernsoc.org/>
21. <http://www.gymnosperms.org/>
22. <http://www.plantapalm.com/vce/toc.htm>

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Programme	BSc.(HONOURS) BOTANY					
Course Name	AGRONOMY, HORTICULTURE AND AGROFORESTRY					
Type of Course	DCE A					
Course Code	24SACBOT7DE401					
Course Level	400					
Course Summary	Agronomy, Horticulture, and Agroforestry is an interdisciplinary course that examines the management and optimization of crop production, the science of garden cultivation, and the integration of trees and agriculture in sustainable land management. It explores the principles, techniques, and applications of these fields in the context of modern agricultural practices. Learners will acquire practical knowledge in horticulture and different entrepreneurial skills, which have potential career opportunities in industries and start-ups.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any	A basic understanding of biological sciences would be beneficial.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify the different methods of crop propagation, crop management and cropping patterns in agronomy	R	PO 1, PO 2, PO 4
2	Describe the role of manures and fertilizers in crop management	U	PO 5, PO 6, PO 8
3	Explain different plant propagation methods in Horticulture and the importance of organic farming	A	PO 7, PO 9, PO 10
4	Evaluate the role of Hi-Tech farming in modern agriculture and institutions giving financial assistance for agriculture	An	PO 3, PO 6

5	Appraise the applications of agroforestry	E	PO 3
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Principles of Agronomy (18 hours)			
	1.1	Introduction: Meaning, definition and scope of agronomy. Crop Growth- factors affecting growth.	1	1
	1.2	Crop propagation: Seed – characteristics of good quality seeds. Factors affecting seed quality, Seed viability testing-Seed germination test and Tetrazolium test. Seed Dormancy-Primary and Secondary. Vegetative propagation- Bulbs, Tubers, Corms, Rhizomes, Rootstock, runners, Offsets and suckers.	4	1, 3
	1.3	Methods of sowing/planting: Planting geometry and its effect on growth and yield.	1	1
	1.4	Soil and Soil Profile: Physical, chemical and biological properties of soil. Soil fertility and Soil productivity.	2	1, 3
	1.5	Tillage: definition- objectives, types of tillage, tillage implements. Learning activity: Identification of different tillage implements.	2	1, 3
	1.6	Crop nutrition: Micro and Macro nutrients (role & deficiency symptoms), Nutrient sources- organic manures, fertilizers, biofertilizers; Integrated Nutrient Management.	2	1, 2
	1.7	Cropping Patterns: Multiple cropping, Intercropping, sequential cropping and crop rotation. Mixed farming.	2	1, 3
	1.8	Irrigation and water management: Irrigation: definition and objectives. Types and methods- surface irrigation, subsurface and micro irrigations including sprinkler and drip irrigation. Learning activity: Visit a field showing different types of irrigation methods.	4	1, 3
	Horticulture (12 hours)			

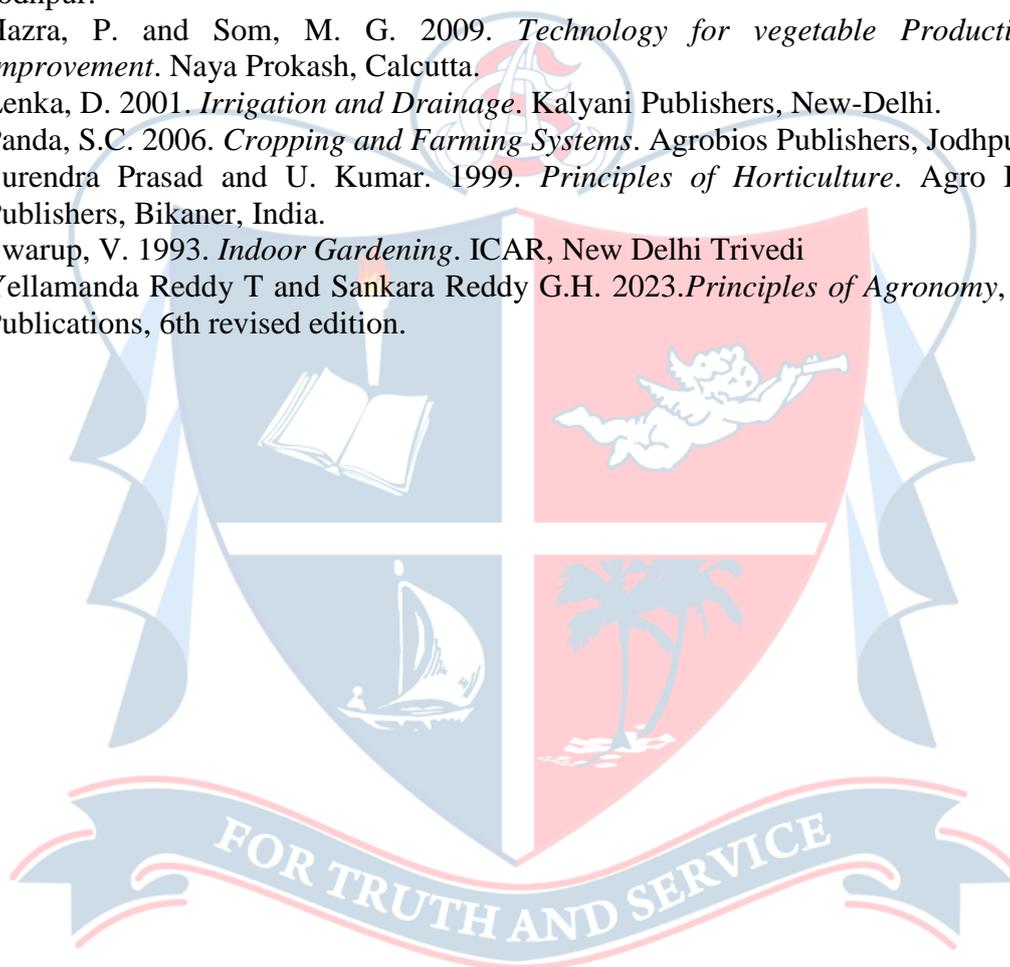
2	2.1	Introduction to Horticulture: Definition and objectives of Horticulture; branches of Horticulture- Pomology, Olericulture, Landscape Gardening, Nursery management.	2	1, 3
	2.2	Plant propagation methods: Propagation by seeds; Vegetative propagation- Natural, Artificial- Budding ('T' and patch budding), Grafting (approach and wedge Grafting) and layering (Air Layering). Learning activity: Demonstration of budding/grafting techniques	5	1, 3
	2.3	Manures and Fertilizers: Manures: Farm Yard Manure (FYM), neem cake, green manure, organic manures, vermicompost. Fertilizers: NPK; Biofertilizers (Bacterial, Fungal and Algal). Organic Farming: Definition and Scope. Learning activity: Identification of plants as green manure – <i>Glyricidiasp.</i> , <i>Vigna unguiculata</i> , <i>Leucaena sp.</i>	5	1, 2, 3
3	Plant Protection (15 hours)			
	3.1	Diseases: General account of Plant diseases (viruses, bacteria, mycoplasma, fungi, nematodes and parasitic plants). Case study-Bunchy top of Banana. Pests on horticultural crops- General account on Aphids, beetles, stem borer, caterpillars and rats.	4	1, 3
	3.2	Weed Management: Introduction, harmful and beneficial effects of weeds, crop weed association, crop weed competition and allelopathy. Methods of weed control: physical, chemical and biological methods. Integrated Weed Management (IWM). Learning activity: 1. Prepare a report on the diversity of weeds in your locality with suitable geotagged photos. 2. Preparation of a list of commonly available herbicides in the market.	6	1, 3
	3.3	Methods of Pest Control: Pest management, Integrated Pest Management (IPM). Learning activity: Bordeaux mixture preparation	5	1, 3, 5
4	Gardening, and Principles of Agroforestry (15 hours)			
	4.1	Establishing a Garden: Selection of site, Preparation of land for vegetable garden-Mulching; Sowing; Transplanting.	2	3

	4.2	Landscape Gardening: Principles of landscaping & garden design. Indoor gardens; Terrarium/Bottle Garden, Hydroponics Garden Components: Hedges & Edges, Lawn, Flowerbeds, Arches & Pergolas, Fencing, Water bodies. Learning activity: Prepare and submit a Bottle Garden / Terrarium.	4	3, 4
	4.3	High –Tech farming: Brief overview on Greenhouse technology, Polyhouse, and Precision farming. Procuring financial assistance from different funding agencies-National Horticulture Mission (NHM), State Horticulture Mission (SHM), MSME.	4	4, 5
	4.4	Agroforestry: Definition and scope. Agroforestry in the farming system in the different parts of the farm, Climate farming system (Climate Smart Agriculture- CSA) Practical application of Agroforestry-As live fences, hedgerow barriers, windbreaks and shelterbelts Silviculture, Agri-silviculture, Agri-horticulture, Alley cropping, Taungya cultivation and social forestry (Brief study only).	5	4, 5
5	Teacher Specific course components			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Interactive Lectures, PowerPoint presentations, Group discussions, Hands-on training, Field trip flipped classroom, Project-Based Learning, Experiential Learning, Peer Teaching, invited lectures, group discussions, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	B. End Semester Evaluation (ESE)- 70 marks <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

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12. Yellamanda Reddy T and Sankara Reddy G.H. 2023.*Principles of Agronomy*, Kalyani Publications, 6th revised edition.





Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT GENOMICS					
Type of Course	DCE A					
Course Code	24SACBOT7DE402					
Course Level	400					
Course Summary	The Plant Genomics course offers a comprehensive examination of the molecular intricacies governing plant life, emphasizing genomic principles. Students delve into the structural nuances of plant genomes, exploring chromosomal organization, gene structure, and the role of repetitive DNA elements. Functional genomics techniques, such as transcriptomics and proteomics, are explored alongside an in-depth look at cutting-edge tools like next-generation sequencing. Comparative genomics sheds light on the evolutionary aspects of plant genomics, while mapping and sequencing techniques provide insights into genome structure. The course equips students with the emerging trends in plant genomics research, ensuring students are prepared for careers at the intersection of genomics and plant biology.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any	Basics of molecular biology and genetics					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the basics of genome organization	U	PO 2, PO 6
2	Illustrate the processes in genome mapping	An	PO 2, PO 6, PO 8
3	Distinguish various sequencing technologies and its	An	PO 1, PO 2,

	applications in plant science		PO 3, PO 5, PO 6, PO 7, PO 8, PO 9, PO 10
4	Consider various functional genomics aspects in plant science research	E	PO 1, PO 2, PO 3, PO 9, PO 10
5	Choose comparative genomic tools in evolutionary studies	E	PO 1, PO 2, PO 3, PO 4, PO 6, PO 7, PO 8, PO 10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Structural genomics (15 hours)			
	1.1	Introduction to genomics	1	1
	1.2	Brief overview of prokaryotic and eukaryotic genome organization	2	1
	1.3	Extra-chromosomal DNA: Mitochondrial and chloroplast genomes	2	1
	1.4	Genetic mapping and physical mapping.	2	1, 2
	1.5	Construction of linkage maps using molecular markers – RFLP, RAPD, AFLP, SSLP, SNP	5	1, 2
	1.6	Physical mapping – restriction mapping, STS mapping, EST	3	1, 2
2	Genome sequencing (20 hours)			
	2.1	Sanger's DNA sequencing method; Genome sequencing strategies-Whole genome, clone-by-clone and hybrid approaches.	5	3
	2.2	Next generation sequencing technologies- <ul style="list-style-type: none"> ● Pyrosequencing, ● Reversible terminator sequencing, ● ion torrent method, ● PacBio long range sequencing, 	10	3

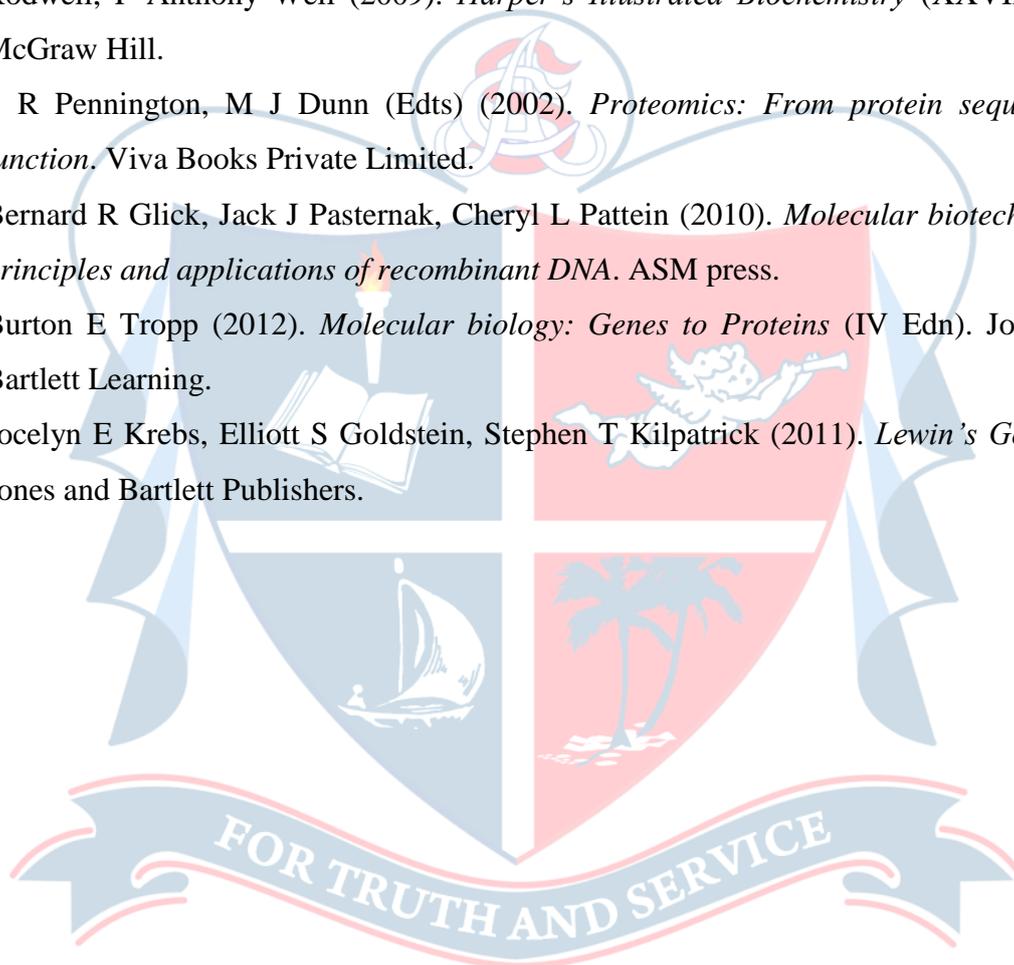
		<ul style="list-style-type: none"> nanopore sequencing. Applications of NGS in modern world (Any five applications)		
	2.3	Sequence assembly – methods used. (Reference and <i>de novo</i>)	1	3
	2.4	Genome Annotation, Gene Ontology (GO)	2	3
	2.5	Important findings of the completed genome projects: Arabidopsis genome project, Tomato genome project and Banana Genome project.	2	3
	Functional Genomics (15 hours)			
	3.1	Transcriptome/RNA seq, Exome sequencing	2	4
	3.2	Expression profiling using Real time quantitative PCR (RT-qPCR).	2	4
	3.3	Methyl sequencing	1	4
	3.4	Gene expression analysis using dot blotting and microarrays.	2	4
	3.5	Chromatin immunoprecipitation sequencing (ChIP Seq) and its applications.	2	4
	3.6	Gene editing using CRISPR-Cas9 technology, its applications	1	4
3	Experiential Session: Provide the students a captivating day-long laboratory excursion, offering an exclusive visit to a state-of-the-art sequencing facility.		5	4
	Comparative genomics (10 hours)			
	4.1	Gene identification by comparative genomics	1	5
	4.2	Comparative genomics as a tool in evolutionary studies (molecular phylogeny): Orthologous, Analogous, Paralogous and Xenologous genes	2	5
	4.3	Metagenomics. (A brief account with its applications)	2	5
	Experiential Session: Phylogenetic analysis using genomic tools (MEGA or Phylip)		5	5
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Interactive lectures, Group discussions, Problem-based learning, Flipped classroom, Discussion-based Learning, Case-based Learning, Experiential Learning, Inquiry-Based Learning, Game-Based Learning, Socratic Method, Peer Teaching, Simulations, Online Learning, Blended Learning, and other innovative approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty <hr/> <p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

References

1. Brown, T. A. (2023). Genomes 5. CRC Press; 5th edition
2. Farrell Jr, R. E. (2009). *RNA Methodologies: laboratory guide for isolation and characterization*. Academic Press.
3. S B Primrose, R M Twyman (2006). Principles of gene manipulation and genomics (VII Edn). Blackwell publishing.
4. James D Watson, Amy A Caudy, Richard M Myers, Jan A Witkowski (2007). *Recombinant*
5. Cullis, C. A. (2004). *Plant genomics and proteomics*. John Wiley & Sons.
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7. David P Clark (2010). *Molecular biology*. Elsevier.
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11. C W Sensen (2002). *Genomics and Bioinformatics*. Wiley – VCH.
12. Thieman, W J, Palladino M A. (2009). *Introduction to biotechnology* (II Edn). Pearson
13. Robert K Murray, David A Bender, Kathleen M Botham, Peter J Kennelly, Victor W Rodwell, P Anthony Weil (2009). *Harper's Illustrated Biochemistry* (XXVIII Edn). McGraw Hill.
14. S R Pennington, M J Dunn (Edts) (2002). *Proteomics: From protein sequence to function*. Viva Books Private Limited.
15. Bernard R Glick, Jack J Pasternak, Cheryl L Pattein (2010). *Molecular biotechnology, principles and applications of recombinant DNA*. ASM press.
16. Burton E Tropp (2012). *Molecular biology: Genes to Proteins* (IV Edn). Jones and Bartlett Learning.
17. Jocelyn E Krebs, Elliott S Goldstein, Stephen T Kilpatrick (2011). *Lewin's Genes X*. Jones and Bartlett Publishers.





Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	SEED TECHNOLOGY					
Type of Course	DCE A					
Course Code	24SACBOT7DE403					
Course Level	400					
Course Summary	This course is a comprehensive study of principles and application of seed science and technology. The course provides an understanding of the vital role in seed plays in agriculture, plant biology and sustainable development.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the basics of seed biology and seed quality	U	PO 2, PO 4
2	Evaluate the quality of seeds using seed testing method	E	PO 2, PO 9
3	Outline the steps in seed processing and seed certification	R	PO 2, PO 9
4	Apply the role of biotechnology in seed development	A	PO 2, PO 3, PO 9
5	Analyze seed marketing and trade	An	PO 1, PO 2, PO 3, PO 9

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	Introduction to seed technology (15 Hours)			
	1.1	Definition of seed science and technology, scope; Heritage of seed technology and contribution of seed technologists towards the holistic development of modern science (interactive sessions)-	1	1
	1.2	Morphology and seed development: Seed Biology- Study of floral biology of monocots and dicots external and internal structures of monocot and dicot seeds; seed coat structure, different types of embryos, endosperm and cotyledons Seed development Physiology-Physiology of seed development and maturation; chemical composition, synthesis and accumulation of seed reserves, induction of desiccation tolerance, hormonal regulation of seed development Dormancy- definition, types, mechanisms, advantage, disadvantage, endogenous and exogenous factors regulating dormancy, role of phytochrome and PGR, genetic control of dormancy Seed deterioration- causes and factors affecting seed deterioration, Physiological, cytological and biochemical changes during seed storage and its implication in seed quality, methods to reduce seed deterioration Activity: Preparation of seed albums and identification	9	1
	1.3	Seed ripening and maturation process, Factors affecting seed setting. Seed germination -Seed germination; factors affecting germination; role of embryonic axis; growth hormones and enzyme activities, effect of age, size and position of seed on germination. Physiological processes during seed germination; seed respiration, breakdown of stored reserves in seeds, mobilization and interconversion pathways.	5	1
2	Seed quality and vigour (17 Hours)			
	2.1	Seed viability and longevity, pre and post-harvest factors affecting seed viability; seed aging; physiology of seed deterioration; lipid peroxidation and other viability theories; means to prolong seed viability; mechanism of desiccation sensitivity and	7	2

		<p>recalcitrance with respect to seed. Varietal Seed vigour and its concept, vigour test methods, factors affecting seed vigour, physiological basis of seed vigour in relation to crop performance and yield. Seed invigoration and its physiological and molecular control</p> <p>Methods to prolong seed viability, Procedures involved in seed testing, (Sampling, physical purity, germination, seed moisture, viability, health, vigour and determination of genuineness), Devices and tools used in seed testing. ISTA, AOSA and its role in seed testing.</p> <p>Activity:</p> <ul style="list-style-type: none"> • Seed viability testing method (Tetrazolium), • Seed germination test (Between paper/Top of paper method) • Visit to seed production Unit 		
	2.2	<p>Seed storage: general principles, Seed drying and storage; drying methods-importance and factors affecting it, changes during storage, concepts and significance of moisture equilibrium, methods of maintaining safe seed moisture content. Methods to minimize the loss of seed vigour and viability; factors influencing storage losses. Methods of seed storage – modified atmospheric storage – ultra dry storage – vacuum storage – cryopreservation – germplasm storage – gene banks – NBPGR, IPGRI and National seed storage laboratory, Measures for pest and disease control during storage, Seed Bank Seed treatments-methods of seed treatment, seed treating formulations and equipments, Biological seed treatments, seed disinfestations, identification of treated seeds; Packaging: principles, practices and materials; bagging and labeling</p>	10	3
	Seed production and enhancement (20 Hours)			
3	3.1	<p>Seed production through crop improvement and breeding, hybrid seeds (Maize, Sunflower), Causes of varietal deterioration and maintenance of genetic purity during seed production</p> <p>Seed quality control – Definition of seed and its quality-concept and objectives; regulatory mechanisms – Seed Act (1966) – Seed Rules (1968), statutory bodies– Central Seed Committee – Central Seed Certification Board, DUS test. Detection of genetically modified seeds. Identification through Grow Out Test and Electrophoresis.</p> <p>Seed certification –objectives; general and specific crop standards, field and seed standards; seed</p>	10	3

		certification agency – role of certification agencies, phases of seed certification; Brief account on role and working of CSTL. Seed processing technologies(seed cleaning and equipment in seed processing)		
	3.2	Seed quality enhancement Seed priming: types of priming technology, biochemical and molecular changes associated, pre-germination, film coating and pelleting, seed tapes, seed mats, seed colouring, bioprimering Seed marketing: structure and organization, sales generation activities, promotional media.; Factors affecting seed marketing. Seed trade regulations, IPR in seed technology	10	3, 5
Biotechnology in seed improvement (8 Hours)				
4	4.1	Impact of genetic engineering, Genetic purity analysis of seeds, Use of Molecular markers, GMOs in seed production, Detection of genetically modified crops; Transgene contamination in non-GM crops; GM crops and organic seed production.; Application of tissue culture in genetic conservation-Embryo culture, Embryo rescue, pollen and anther culture	8	4
5	Teacher specific course components			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty

	<p style="text-align: center;">B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none">● Very Short Answer (10 out of 12): 2 x 10=20 Marks● Short Answer (8 out of 10): 8 x 5= 40 Marks● Essay (1 out of 2): 1x 10= 10marks
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References

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Suggested readings

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3. Chakrabarthy SK. 2010. Seed Production and Quality Control. Kalyani Publishers. New Delhi.
4. Chalam GV Singh A and Douglas JE. 1967. Seed Testing Manual. ICAR and United States Agency for International Development, New Delhi



Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	ECOLOGY AND ECOTOURISM					
Type of Course	DSE B					
Course Code	24SACBOT7DA301					
Course Level	300					
Course Summary	The course 'Ecology and Ecotourism' deals with the study of how organisms interact with their environment and ecotourism deals with sustainable management of natural ecosystems.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		4	-	-	-	60

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the properties of different levels of organization ecosystem	U	PO 1, PO 4
2	Outline the structure and functions of an ecosystem	An	PO 1, PO 2, PO 4
3	Illustrate conservation strategies	A	PO 2, PO 4
4	Critically assess the environmental and economical impacts of ecotourism	E	PO 2, PO 6, PO 9

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	Plant Ecology (15 hours)			
	1.1	Introduction to ecology, levels of organizations (species, population, community, ecosystem, biome).	4	1
	1.2	Population ecology, Characteristics of population - Population size, density, natality, mortality, age structure, growth form. Population growth models – S and J	5	1
	1.3	Community ecology - Population interactions – Positive and negative; Mutualism, Commensalism, Competition, Predation. Learning activity: Visit an ecosystem and submit any type of interaction with report.	6	1
2	Ecosystem (15 hours)			
	2.1	Ecosystem structure - biotic and abiotic. Trophic levels - producers, consumers decomposers.	4	2
	2.2	Function of ecosystems - Food chain and food web and flow of energy-homoeostasis and cybernetics. Productivity of ecosystem; Primary, Secondary, gross and net productivity.	6	2
	2.3	Ecological pyramids; Pyramid of number, Pyramid of biomass, pyramid of energy. Biogeochemical cycles - Gaseous cycle (Nitrogen) and Sedimentary (Phosphate).	5	2
3	Conservation Ecology (15 hours)			
	3.1	Definition, strategies and practices, Role of protected areas in conservation, Local, national, international efforts to conserve biodiversity. IUCN categories.	6	3
	3.2	Threats to biodiversity - Habitat loss, over exploitation, poaching, invasive species, climate change.	4	3
	3.3	Awards and appreciations in conservation biology - Nobel Peace award, Goldman Environmental Prize, International Conservation Award, <i>Indira Gandhi Paryavaran Puraskar</i> , Kerala state biodiversity board award, Haritha Mitra award.	5	3
4	Ecotourism (15 hours)			

	4.1	Understanding ecotourism: Definition, scope and prospects, principles and types of Ecotourism.	4	4
	4.2	Sustainable tourism practices - Community-based tourism and its benefits. Challenges and solutions in ecotourism. Ecotourism and ethics. Ecotourism centres in Kerala-Thenmala/ Thattekkad-A case study.	6	4
	4.3	Learning activity: Visit an ecotourism centre, identify the components, and prepare a report and submit it for valuation.	5	4
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty <p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

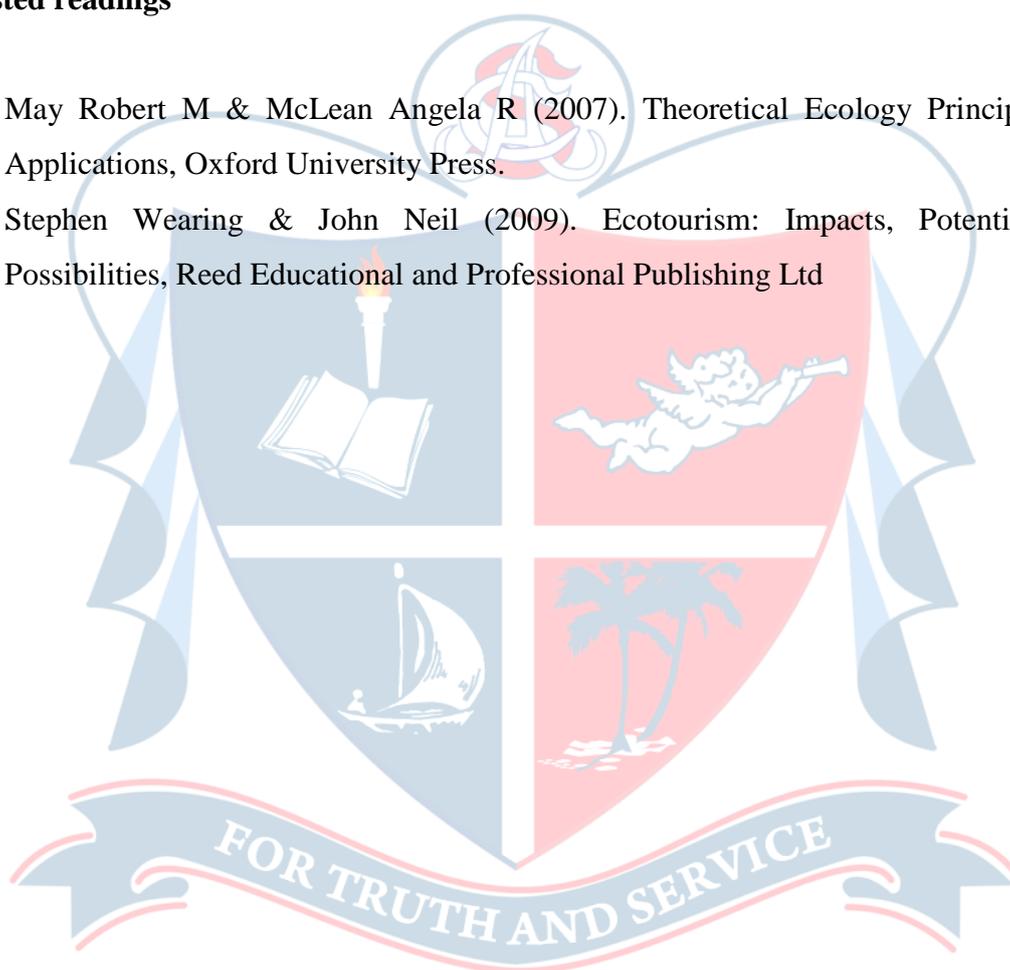
References

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2. Stuart Chapin F, Pamela Matson A & Peter Vitousek M, (2011). Principles of Terrestrial Ecosystem Ecology, Springer.
3. Roy Ballantyne & Jan Packer (2013). International Handbook on Ecotourism, Edward Elgar Publishing Limited
4. Fennel David A (2004). ecotourism an introduction, outledge, 11 New Fetter Lane, London.

Suggested readings

1. May Robert M & McLean Angela R (2007). Theoretical Ecology Principles and Applications, Oxford University Press.
2. Stephen Wearing & John Neil (2009). Ecotourism: Impacts, Potentials and Possibilities, Reed Educational and Professional Publishing Ltd





Department of Botany

St. Albert's College (Autonomous)

Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	BIOLOGICAL APPROACHES AND EVOLUTIONARY TRENDS IN PLANTS					
Type of Course	DSE B					
Course Code	24SACBOT7DA302					
Course Level	300					
Course Summary	<p>Upon completion of the course, a student should:</p> <ul style="list-style-type: none"> ● have a better understanding of how evolutionary science generates knowledge by way of hypothesis testing, systematic observations, and the comparative method ● have phylogenetic thinking; how new species arise; the major species concepts ● be able to better distinguish scientific from unscientific arguments ● apply evolutionary principles in her or his own research 					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Evaluate and Summarize the fundamental evolutionary processes in the natural world and their influence on the origin of life and its diversity	E	PO 1, PO 2, PO 10
2	Develop phylogenetic thinking; how new species arise and the major species concepts	A	PO 2, PO 3, PO 8
3	Formulate sound evolutionary hypotheses for a variety of biological phenomena	A	PO 1, PO 10

4	Examine the benefits of evolution	An	PO 10
5	Apply evolutionary biology as a powerful set of tools for approaching current changes in biodiversity and addressing future challenges	S	PO 1, PO 2, PO 7, PO 8
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	Organic Evolution (10 Hours)			
	1.1	Origin of life- Oparin and Haldane's theory, Urey Miller's Experiment.	5	1
	1.2	Overview of evolution, Role of evolution in plant diversity	2	1
	1.3	Origin of Photosynthesis, evolution of oxygen, ozone buildup, endosymbiotic theory of eukaryotic origin	3	1
2	Evidence and Mechanism of Evolution (18 Hours)			
	2.1	Biological evolution and evidence for biological evolution from living organisms (comparative anatomy, embryology and molecular phylogeny) and fossil record (paleontological) Activity: Collect the evidence of evolution as pictures using e-resources and submit a report (Anyone mentioned in the syllabus)	5	2
	2.2	Types of fossils and fossilization, dating techniques	3	2
	2.3	Variation (Mutation and Recombination) and Natural Selection with examples; Gene flow and genetic drift; Hardy- Weinberg's principle; Speciation, Adaptive Radiation Activity: 1. Compute allele frequencies using Hardy-Weinberg's principle Identify the role of mutation/ variation in crop improvement (Submit Report)	10	4
3	Darwin's Theory and Neo-Darwinism (12 Hrs)			

	3.1	Darwin's contribution to evolution, Types of natural selection (Directional, Stabilizing, Disruptive), Natural Selection as a guiding force of evolution: coloration, camouflage, and mimicry Activities Prepare a report on Darwin's contribution to evolution and submit it as e-copy.	5	3
	3.2	Modern Synthetic Theory of Evolution, Modern advances in evolutionary biology, Micro and macroevolution (Brief study)	3	3
	3.3	Extinction: Mass extinction (Causes, Names of five major extinctions), Role of extinction in evolution	4	3
	Plants People Interaction: An Evolutionary Approach			
4	4.1	Detailed examination of evolution in plants, timeline of plant evolution, adaptations to environmental factors, co-evolution with other organisms Activity: Using a geological timescale identify the important eras of plant evolution	7	5
	4.2	Human impact on plant evolution: Domestication and Agriculture	5	5
	4.3	Manmade causes of evolution: Brief mention of pesticide, and herbicide resistance in plants Activities: Critically evaluate the paper- 'Plants and people: Our shared history and future' (Group Discussion) https://nph.onlinelibrary.wiley.com/doi/full/10.1002/ppp3.12	3	5
5	Teacher Specific Content			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Videos, PowerPoint Presentations, Group Discussion.
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments

	<ul style="list-style-type: none"> ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)- 70 Marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

References

1. Arora, P.M. (2015). Evolutionary Biology. Himalaya Publishing House.
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6. Rasthogi, V.B. (2023). Organic Evolution (Evolutionary Biology). MedTech Scientific Press.
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10. Turcotte, M. M., Araki, H., Karp, D. S., Poveda, K., & Whitehead, S. R. (2017). The eco-evolutionary impacts of domestication and agricultural practices on wild species. Philosophical Transactions of the Royal Society B: Biological Sciences, 372(1712), 20160033.



Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	BIOTECHNIQUES					
Type of Course	DSE B					
Course Code	24SACBOT7DA303					
Course Level	300					
Course Summary	<p>The syllabus is designed with the objective to</p> <ul style="list-style-type: none"> • train the students in both theoretical and practical aspects • to handle various equipment related to life science research and to enhance their practical skills. • train the analytical techniques, which has unlimited career opportunities including academic research, working in industry from small tech start-ups to large biotech companies. 					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any	Basic knowledge in science					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Outline the methods and procedures in microscopy	U	PO 1, PO 2, PO 3, PO 9, PO 10
2	Articulate the principles underlying different instruments employed in plant science research	U	PO 1, PO 2, PO 3
3	Explain working and application of various separation and analytical techniques	U	PO 1, PO 2, PO 3, PO 9, PO 10

4	Apply the techniques in enumeration, analysis and purification of plant samples	A	PO 1, PO 2, PO 3, PO 9, PO 10
5	Acquire expertise in various preparative methods and analytical techniques in plant science	A, S	PO 1, PO 9, PO 10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Preparative Techniques in Microscopy (25 Hours)				
1	1.1	Collection, preservation (Dry & Wet) and preparation of plant materials: Squash, Smear, Whole mount, Maceration, and Sectioning. Learning Activity 1. Maceration of a given specimen (<i>Cucurbita</i> stem) and identify different thickening in Xylem vessels or 1. Prepare squash/smears and observe under microscope (Demonstration) or 1. Submit Herbarium and Bottled preserved specimen of plant/plant parts (One each)	6	1
	1.2	Killing and fixing: Properties of good fixative: types of fixative and fixation; killing and fixing agents and their composition (Carnoy's fluid and FAA)	4	1
	1.3	Sectioning- free hand and microtomy, Principle and use of Rotary Microtome (General Account) Learning Activity 1. Hands on training on free hand sectioning of a given plant specimen (stem/root) 2. Familiarize with microtomes used in modern research (use internet data)	6	1, 2
	1.4	Stains and staining techniques – Different stains and their composition- Safranin, Acetocarmine; Types of staining – Single staining, Double staining (Brief Account) Learning Activity 1. Identify different cells of a given plant specimen after single and double staining (stem/root)	4	1

	1.5	Mounting media: Glycerine, DPX and Canada balsam Preparation of slides: Temporary and Permanent Learning Activity 1. Prepare a temporary slide showing anatomical details of plant part (root/shoot)	5	1
2	Instrumentation for analysis (20 Hours)			
	2.1	Principle and application of Compound Microscope Phase contrast Microscopy, Scanning Electron Microscopy- (Brief account).	5	1, 2, 3
	2.2	Photometric Analysis – Principle, working and application of Colorimeter Learning Activity 1. Prepare a standard graph and estimate the concentration of a solution using colorimeter	5	2, 3, 4
	2.3	Principle, working, and application of pH meter Learning Activity: 1. Adjust the pH of a given solution using pH meter/pH pen	5	2, 3
	2.4	Enumeration and Measurement Techniques: Haemocytometer Learning Activity 1. Count the number of pollen grains with the help of haemocytometer	5	4
3	Methods for sample preparation (5 Hours)			
	3.1	Centrifugation - Principle and application of Ultra centrifuges Learning Activity Familiarize with the function of centrifuge	2	2, 4
	3.2	Principle and application of lyophilizer and freeze-drying	3	2
4	Techniques for Analysis and Separation (10 Hours)			
	4.1	Chromatography Techniques: - Principles and applications of Paper chromatography, TLC, Column chromatography, and HPLC Learning Activities 1. Hands-on training on TLC/Paper Chromatography	5	2, 3
	4.2	Electrophoresis: Electrophoretic mobility, Factors affecting electrophoretic mobility. principle and application of Agarose gel electrophoresis	5	2, 3
5	Teacher Specific Content			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Direct Instruction: Lecture, Hands on training Interactive Instruction: Seminar, Group Assignments, Peer teaching and learning, Technology-enabled learning, Virtual lab
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty <hr/> B. End Semester Evaluation (ESE)- 70 marks <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

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	<h2 style="margin: 0;">Department of Botany</h2> <h3 style="margin: 0;">St. Albert's College (Autonomous)</h3> <h3 style="margin: 0;">Ernakulam</h3>
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Programme	BSc.(HONOURS) BOTANY					
Course Name	ENVIRONMENTAL LEGISLATION AND MANAGEMENT					
Type of Course	DSE B					
Course Code	24SACBOT7DA401					
Course Level	400					
Course Summary	This course enables students attain the acquired ability to impart knowledge to local public as a means to preserve environment and resources at grass root level. Helps study the principles and tools evolved for development on sustainable basis. Get an idea on aspects of disaster management and its effect on development. Understand the role of various international & national organizations that help in preserving our environment & resources.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the principles of environmental laws and acts in India.	U	PO 3, PO 6
2	Discuss the Environmental conventions and summits associated with environmental protection.	U	PO 3, PO 6, PO 7, PO 10
3	Understand the various international & national organizations on environment.	U, A	PO 3, PO 6, PO 7, PO 10
4	Study the principles and tools evolved for development on sustainable basis.	U, A	PO 3, PO 6, PO 7, PO 10

5	Analyze the aspects of disaster management and its effect on development.	An	PO 2, PO 3, PO 6, PO 7, PO 10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

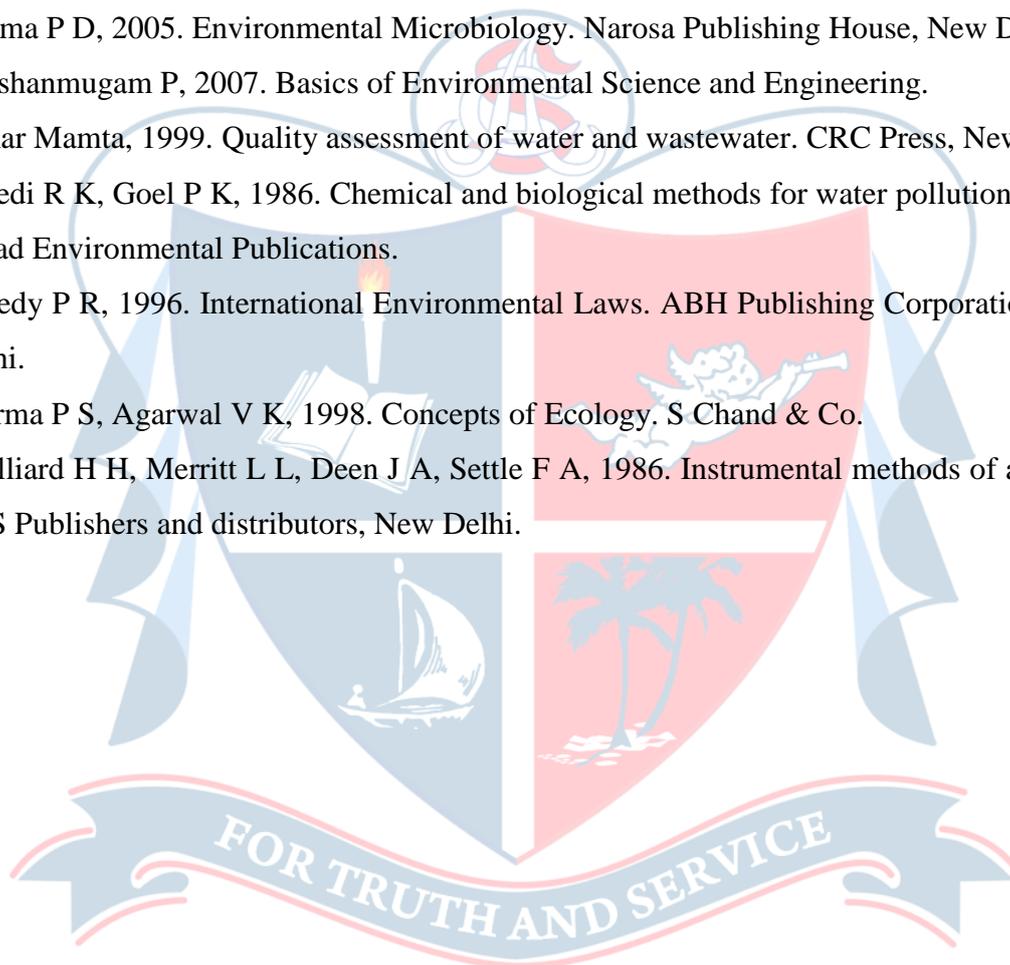
Module	Units	Course description	Hrs	CO No.
1	Environmental legislation and Environmental conventions and summits (16 hours)			
	1.1	Fundamental principles of environmental laws, General structure of environmental laws in India and constitutional responsibilities, The Water (Prevention and Control of Pollution) Act 1974, The Air (Prevention and Control of Pollution) Act 1981, The environment (Protection) act 1986, wild life protection act 1972, Forest Conservation Act 1980. Laws for the waste disposal – solid waste and hazardous waste, biomedical waste.	10	1
	1.2	Stockholm Convention 1972, Montreal Protocol 1987, Ramsar Convention, Rio declaration 1992 and Agenda 21, Earth Summit, Kyoto Protocol.	6	2
2	National and international organizations on environment (14 hours)			
	2.1	UNEP, UNDP, WWF, IUCN, Earth watch, Green Peace.	7	3
	2.2	Information networks - ENVIS centres, National bureau for plant genetic resources (NBPGR), conservation of gene reserve, global environmental management, non-conventional energy use.	7	3
3	Tools in sustainable development (15 hours)			
	3.1	Principles and tools in sustainable development; careful identification of the causes and consequences (short term and long term) of a broad range of problems in developing and industrial countries.	4	4
	3.2	Environmental impact assessment, environmental auditing, remote sensing, geographic information systems, biofarming, environmental planning. Activity 1 Illustrate the steps involved in management of organic waste / control of soil pollution.	11	4

	Disaster management and Development (15 hours)			
4	4.1	Characterization of natural disasters and its management - earthquake, draught, flood and landslide. Activity -1 Study of different types of disasters and enumerate its environmental effects. Activity -2 Conduct a survey to analyze the impacts in a disaster-affected area.	15	5
5	Teacher specific content			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty <p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

References

1. Sabbins F F, 1994. Practical guide to environmental impact assessment. Academic Press Inc. San Diego, California.
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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	ENVIRONMENTAL CONSERVATION AND MANAGEMENT					
Type of Course	DSE B					
Course Code	24SACBOT7DA402					
Course Level	400					
Course Summary	This course introduces ecology as a scientific discipline. By the end of the course, students should be familiar with ecological principles related to how plant populations & communities interact with their environments at local, regional, & global scales.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the different aspects of habitat management. Discuss on conservation, threats/depletion of biodiversity. Distinguish between various conservation strategies at International and National level.	U, A	PO 3, PO 6, PO 7
2	Discuss on effective land use management for sustainable development.	U, A	PO 3, PO 6, PO 7, PO 10
3	Analyze the socio-economic factors involved in managing water resources. Distinguish between conventional and non-conventional sources of water supply management.	A, An	PO 3, PO 6, PO 7, PO 10
4	Study various aspects of ecotourism. Analyze nature-based ecotourism opportunities in Kerala; strategies to	An	PO 3, PO 6, PO 7, PO 10

	maintain them in an ecological sustainable way.		10
5	Evaluate the importance of environmental education in preserving our resources.	E	PO 2, PO 3, PO 6, PO 7, PO 10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Habitat management (15 hours)			
	1.1	Conservation of forests, wild life, air, water, soil and environments.	3	1
	1.2	Threats/depletion of biodiversity, conservation of biodiversity - ex-situ and in-situ; national parks, wildlife sanctuaries, biosphere reserves, sacred groves.	4	1
	1.3	International conservation strategies - CBD, CITES, global biodiversity strategy, GEF Initiatives, national biodiversity action plans, biodiversity registries, biodiversity with special reference to Kerala, cause of extinction of species, endangered species, management of mangrove vegetation.	8	1
2	Land and Water Resources Management (13 hours)			
	2.1	Strategies and planning for soil pollution control, changes in agricultural practices, solid waste management, vermicomposting, bacterial composting. Learning Activity: Familiarize the equipment and the steps involved in estimating soil water content.	7	2
	2.2	Precautions in the use of radioactive substances. Occupational health hazards with relation to solid waste disposal.	2	2
	2.3	Socio-economic factors involved in managing water resources.	2	3
	2.4	Conventional and non-conventional sources of water supply management, rain water harvesting.	2	3
3	Ecotourism (16 hours)			

	3.1	Ecotourism and responsible tourism- From an environmental management perspective rather than tourism as an industry.	4	4
	3.2	Identification of nature-based ecotourism opportunities in Kerala - dam sites, HEP, waterfalls, mangroves, bird sanctuaries, pilgrim tourism, forest area, parks, sacred groves, beaches, wildlife sanctuaries, national parks Learning activity: Visit a conservation area (e.g. National park, wildlife sanctuary). Identification of endangered animal and plant species of Kerala from photographs.	12	4
	Environmental conservation and Education (16 hours)			
4	4.1	Strategies to maintain nature based ecotourist areas in an ecological sustainable way. Coastal management activities in India and Kerala. Learning activity: Field visit to an ecotourism site, observe and analyse the sustainable practices and submit a report	10	4
	4.2	Environmental education: Education to inculcate environmental consciousness among learners.	3	5
	4.3	Non-formal and formal education (business, union, community and other organizations): methodologies (posters, banners, audio-visual aids, street plays, padayatras, corner meetings).	3	5
5	Teacher specific course components			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article

	(<5 years) related to the course <ul style="list-style-type: none"> Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> Very Short Answer (10 out of 12): $2 \times 10=20$ Marks Short Answer (8 out of 10): $8 \times 5= 40$ Marks Essay (1 out of 2): $1 \times 10= 10$marks

References

- Nagore, A. P. (1996). Biological diversity and international Environmental law. ABH Publishing Corp. New Delhi.
- Nayar, M. P. (1996). Hotspots of Endemic Plants of India, Nepal and Bhutan. TBGRI, Trivandrum.
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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	REMOTE SENSING, GIS AND EIA					
Type of Course	DSE B					
Course Code	24SACBOT7DA403					
Course Level	400					
Course Summary	This course enables students to understand the principles, concepts and applications of remote sensing and GIS in environmental studies. Understand the principles, concepts and various steps and methodologies involved in conducting an EIA; EIS, EMP.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		4	-	-	-	60

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the definition, principle, concept and scope of remote sensing.	U	PO 1, PO 3
2	Relate the components of Remote Sensing techniques.	U	PO 1, PO 3
3	Understand the basic concepts, characteristics, components and applications of GIS. Distinguish between different data structures in GIS.	U	PO 1, PO 3
4	Understand the basic concepts, nature and scope of cartography. Distinguish between different types of maps, elements and components of a map.	U	PO 1, PO 2, PO 3

5	Relate the various applications of Remote Sensing and GIS with special reference to conservation and management.	U, A	PO 1, PO 2, PO 3, PO 6
6	Understand the definition, aim, principles and concept of EIA. Analyze the method and steps involved in EIA. Distinguish between EIS and EMP.	U, A, An	PO 1, PO 2, PO 3, PO 6, PO 10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Basics of Remote Sensing technology and Components of Remote Sensing techniques (14 hours)			
	1.1	Definition, principle, concept and scope of remote sensing.	6	1
	1.2	Electromagnetic spectrum, platform for Remote sensing techniques, sensors, image resolution - spatial, spectral, temporal, radiometric resolution.	8	2
2	Basic of GIS and mapping concepts (17hours)			
	2.1	Concepts and components. Characteristics of GIS, applications of GIS. Activity-1 Attend a workshop on Remote Sensing and GIS.	6	3
	2.2	Data structures in GIS - Vector data and raster data.	5	3
	2.3	Definition, nature and scope of cartography, small scale maps, large scale maps, types of maps, elements and components of a map.	6	4
3	Applications of Remote Sensing and GIS (12 hours)			
	3.1	Applications with special reference to conservation and management – land use and land cover, management of invasive species, water resource, wildlife, forest, protected area, natural disaster management, monitoring of air and soil quality, vegetation, and climate change. Activity-1 Conduct a case study on successful public consultation processes.	12	5

4	Introduction to EIA (17 hours)			
	4.1	Definition, aim, principles and concept of EIA.	4	6
	4.2	Method and steps; Impact assessment methodologies: i) Adhoc Method, ii) Overlay Method, iii) Checklist Method, iv) Network Method v) Matrix Method.	8	6
	4.3	Environmental Impact Statement (EIS) and Environmental Management Plan (EMP).	5	6
5	Teacher specific content			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty. <p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> ● Very Short Answer (10 out of 12): 2 x 10=20 Marks ● Short Answer (8 out of 10): 8 x 5= 40 Marks ● Essay (1 out of 2): 1x 10= 10marks

References

1. Singh, S. K. (2019). Remote Sensing and GIS. New Delhi, India: PHI Learning Pvt. Ltd.
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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	MEDICINAL AND AROMATIC PLANTS AND SPICES					
Type of Course	DSE B					
Course Code	24SACBOT7DA404					
Course Level	400					
Course Summary	This course delves into the study of various medicinal plants, aromatic herbs, and spices, emphasizing their cultivation, properties, uses, and commercial applications. It covers the identification, cultivation techniques, processing methods, and value addition of MAPs and spices.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-		60
Pre-requisites,if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Remember the importance of medicinal and aromatic plants and spices.	K	PO2
2	Describe taxonomy and uses of medicinal plants	K	PO 2
3	Describe taxonomy and uses of common aromatic plants.	K	PO 2
4	Outline the common extraction and characterization techniques in phytochemistry	A	PO2, PO4

5	Identify common medicinal and aromatic plants and spices in the field	K	PO1, PO2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Medicinal plants(15 Hours)				
1	1.1	Definition, significance of medicinal plants in Indian systems of medicine.	5	1
	1.2	Taxonomy and uses of important medicinal plants - <i>Tinospora cordifolia</i> , <i>Papaver somniferum</i> , <i>Aegle marmelos</i> , <i>Plumbago rosea</i> , <i>Adhatoda vasica</i> , <i>Withania somnifera</i> , <i>Kaempferia galanga</i> , <i>Sida acuta</i> , <i>Azadirachta indica</i> , <i>Glycyrrhiza glabra</i> , <i>Phyllanthus niruri</i> , <i>Datura stramonium</i> , <i>Hemidesmus indicus</i> , <i>Aloe vera</i> , <i>Tylophora indica</i> , <i>Acorus calamus</i> .	10	2
Aromatic plants(15 Hours)				
2	2.1	Definition, significance of aromatic plants in Kerala	5	3
	2.2	Taxonomy and uses of important aromatic plants - <i>Vetiveria zizanooides</i> , <i>Cinnamomum zeylanica</i> , <i>Syzygium aromaticum</i> , <i>Santalum album</i> , <i>Ocimum bacilicum</i> , <i>Rosa</i> , <i>Mentha piperita</i>	10	3
3	Spices(15 Hours)			
	3.1	Spices; significance, role of spices in Indian economy	2	5
	3.2	Taxonomy and uses of important spices in Kerala - Pepper, Cardamom, Nutmeg, Curcuma, Cinnamon and Campoge.	8	5
	3.3	Government agencies, research centres dealing with medicinal and aromatic plants and spices. Job opportunities in research centers	5	5

4	Phytochemistry(15 Hours)			
	4.1	Introduction to phytochemical approaches – morphological-organoleptic-microscopic- to study medicinal and aromatic plants	3	4
	4.2	Cold extraction Hot extraction—soxhlet Solvents - petroleum ether, chloroform, ethanol, water. Separation technique-TLC, Column, HPLC. Characterization technique-GC/MS, HPTLC, UV Spectra, IR Spectra(Brief study only)	8	4
	4.3	Study of active principles- alkaloids, Phenols (Introduction, properties, occurrence, classification, functions and pharmacological uses.)	4	4

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Activity
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> • Very Short Answer (10 out of 12) : 2 x 10=20 Marks • Short Answer (8 out of 10) : 8 x 5= 40 Marks • Essay (1 out of 2): 1x 10= 10 marks

References

1. Atal.C.K. and Kapur, B.M. 1982. Cultivation and Utilization of Medicinal Plants.
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Suggested readings

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	INTRODUCTION TO SOIL SCIENCE					
Type of Course	DSE B					
Course Code	24SACBOT7DA405					
Course Level	400					
Course Summary	The Introduction to Soil Science course provides students with foundational knowledge of soil composition, properties, and their significance in agriculture, environmental science, and land management. It covers various aspects of soil science, including soil formation, classification, fertility, and management practices.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-		60
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Holistic understanding of soil properties, their interrelationships, and their critical roles in supporting plant life and maintaining ecosystem health	U	PO2,PO7
2	Gain a profound knowledge of the intricate relationships among soil organisms, the environment, and plant life	A	PO 2, PO7

3	Ability to proficiently gather and process soil samples, conduct accurate nutrient estimations, and evaluate fixation capacities	E	PO 2
4	Expert proficiency in employing cutting-edge tools to enhance precision, sustainability, and remediation strategies in soil science	A	PO2, PO7
5	Identify common medicinal and aromatic plants and spices in the field	K	PO1, PO2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Soil physical and chemical properties(22 Hours)				
1	1.1	Definition and significance of soil properties, Role of soil properties in plant growth and ecosystem functions	1	1
	1.2	Soil Physical Properties- Soil texture, horizons, structure, water, porosity, thermal properties and colour Activity: • Description soil profile in the field • Estimation of soil pH, electrical conductivity, moisture content and maximum water holding capacity	6	1
	1.3	Soil Chemical Properties- pH, Cation Exchange Capacity, Nutrients, Organic Matter. Soil classification, Soil development and evolution • Chemical analysis of soil samples- Organic Carbon, Available or Mineralizable Nitrogen, Available Phosphorus, Available or Exchangeable Potassium, Available Sulphur • Determination of Available Zn, Fe, Mn and Cu in Soil by AAS or other methods • Visit a soil museum and submit a comprehensive report with photographs	15	1
Soil biology(14 Hours)				

2	2.1	Introduction to Soil Ecology- Definition and scope of soil ecology, Significance of soil organisms in ecosystem functioning.	2	2
	2.2	Soil formation, classification of Kerala soil.	2	2
	2.3	Soil as a habitat for microorganisms, plants, and animals, Soil-plant-atmosphere continuum. Interactions between soil organisms.	4	2
	2.4	Soil food webs and trophic dynamics. Influence of soil fauna on soil structure and nutrient cycling	3	2
	2.5	Soil enzymes, origin, activities and importance, soil characteristics influencing growth and activity of microflora.	3	2
3	Analytical techniques and instrumental methods in soil analysis(10 Hours)			
	3.1	Soil Sample Preparation- Methods for sample collection and preservation, Homogenization and grinding techniques, Digestion and extraction procedures	4	3
	3.2	Spectroscopic Techniques- UV-Visible spectroscopy in soil analysis, Infrared spectroscopy for soil organic matter And Atomic absorption spectroscopy (AAS) for metal analysis	3	3
	3.3	Advanced Instrumentation for Soil Analysis- Inductively Coupled Plasma Mass Spectrometry (ICP- MS), Scanning Electron Microscopy (SEM), and Differential Scanning Calorimetry (DSC) for thermal analysis	3	3
4	Recent Advances in Soil Science(14 Hours)			
	4.1	Remote sensing technologies for soil monitoring- Unmanned aerial vehicles (UAVs) and satellite imagery	2	4
	4.2	Precision Agriculture and Digital Soil Mapping	2	4
	4.3	Applications of nanomaterials in soil improvement	3	4

	4.4	Nanosensors for monitoring soil condition	2	4
	4.5	Phytoremediation and microbial-assisted remediation, AI in Monitoring Soil Quality	2	4
	4.6	Soil analysis techniques aid in determining soil stability and suitability for construction projects	3	4
5	Teacher specific Module			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction)
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty <p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> • Very Short Answer (10 out of 12) : 2 x 10=20 Marks • Short Answer (8 out of 10) : 8 x 5= 40 Marks • Essay (1 out of 2): 1x 10= 10 marks

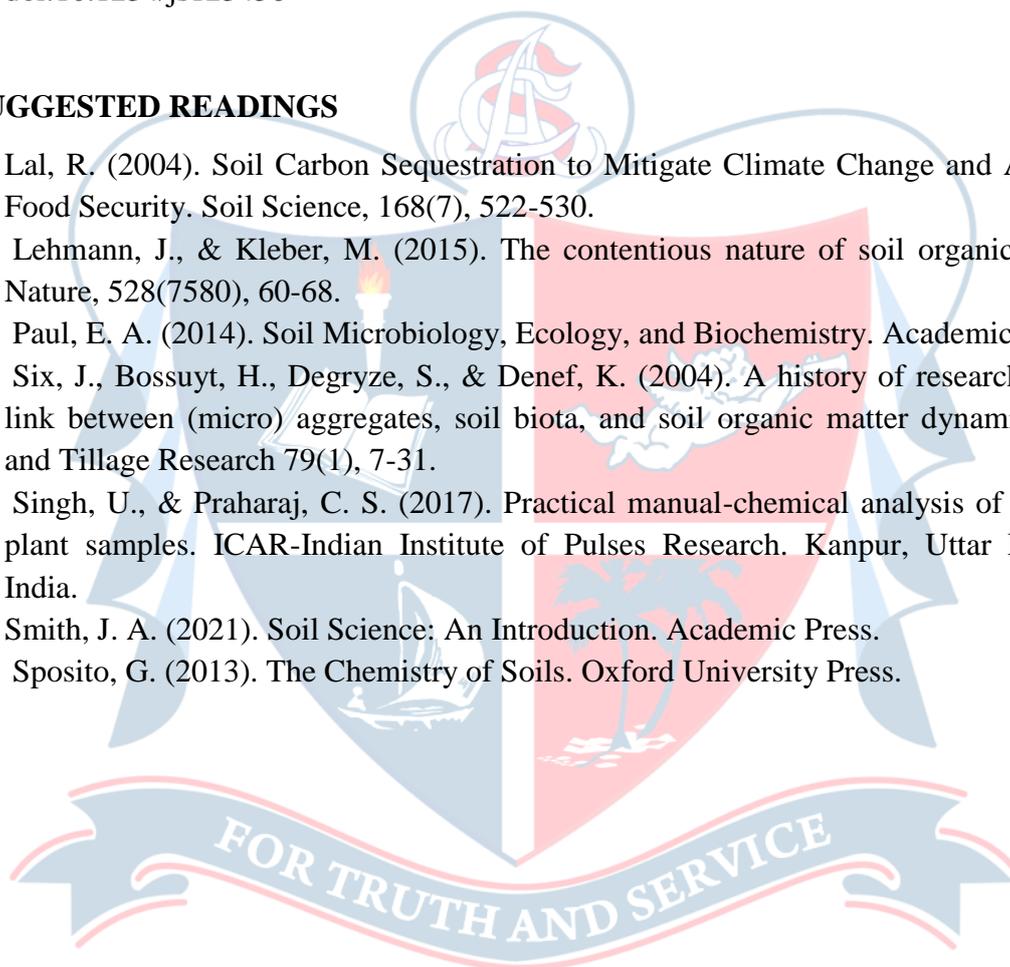
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2. Brown, P. R. (2015). Soil Texture and Structure. In Fundamentals of Soil Science (pp. 56-78). Wiley.
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Programme	BSc.(HONOURS) BOTANY					
Course Name	HOME GARDENING					
Type of Course	DSE B					
Course Code	24SACBOT7DA406					
Course Level	400					
Course Summary	The Home Gardening course is designed to equip individuals with the foundational knowledge and practical skills necessary to create and maintain a successful home garden. It covers various aspects of gardening, including plant selection, soil management, basic horticultural practices, and sustainable gardening techniques tailored for home environments					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-		60
Pre-requisites,if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the factors affecting home gardens	U	PO 1, PO2
2	Remember essential Crops and Planting Techniques	K	PO 2
3	Write the gardening Techniques and Maintenance	A	PO2,PO6,PO7
4	Construct miniature of modern horticultural techniques	C	PO2

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Introduction to Home Gardening(15 Hours)				
1	1.1	Introduction to gardening in Indian contexts: regional variations, climate considerations, and traditional practices. Importance of home gardening	5	1
	1.2	Soil types, monsoon patterns, and adapting gardening techniques to local conditions.	10	1
Essential Crops and Planting Techniques(15 Hours)				
2	2.1	Popular Vegetables and Herbs in Indian Gardens Overview of common vegetables and herbs suitable for Indian climates and soils.	5	2
	2.2	Seed Starting and Propagation Methods - Seed saving, seedling care, and propagation techniques suitable for Indian gardens.	10	2
3 Gardening Techniques and Maintenance(15 Hours)				
	3.1	Water conservation and irrigation methods - Efficient water usage, drip irrigation, and rainwater harvesting.	5	3
	3.2	Pest Control and Soil Enrichment - Traditional pest control methods, organic fertilizers, and soil enrichment	10	3
4 Harvesting and Beyond(15 Hours)				
	4.1	Harvesting and Storage Practices in India - Timing harvests, storage methods, and traditional food preservation techniques.	5	4
	4.2	Season Extension and Year-Round Gardening - Techniques for extending the growing season, managing different seasons, and year-round gardening	5	4
	4.3	Advances in Horticultural Crops – Plasticulture, Hydroponics & Aeroponics	5	4

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Activities, Field Visit
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 30 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)- 70 marks</p> <ul style="list-style-type: none"> • Very Short Answer (10 out of 12) : 2 x 10=20 Marks • Short Answer (8 out of 10) : 8 x 5= 40 Marks • Essay (1 out of 2): 1x 10= 10 marks

References

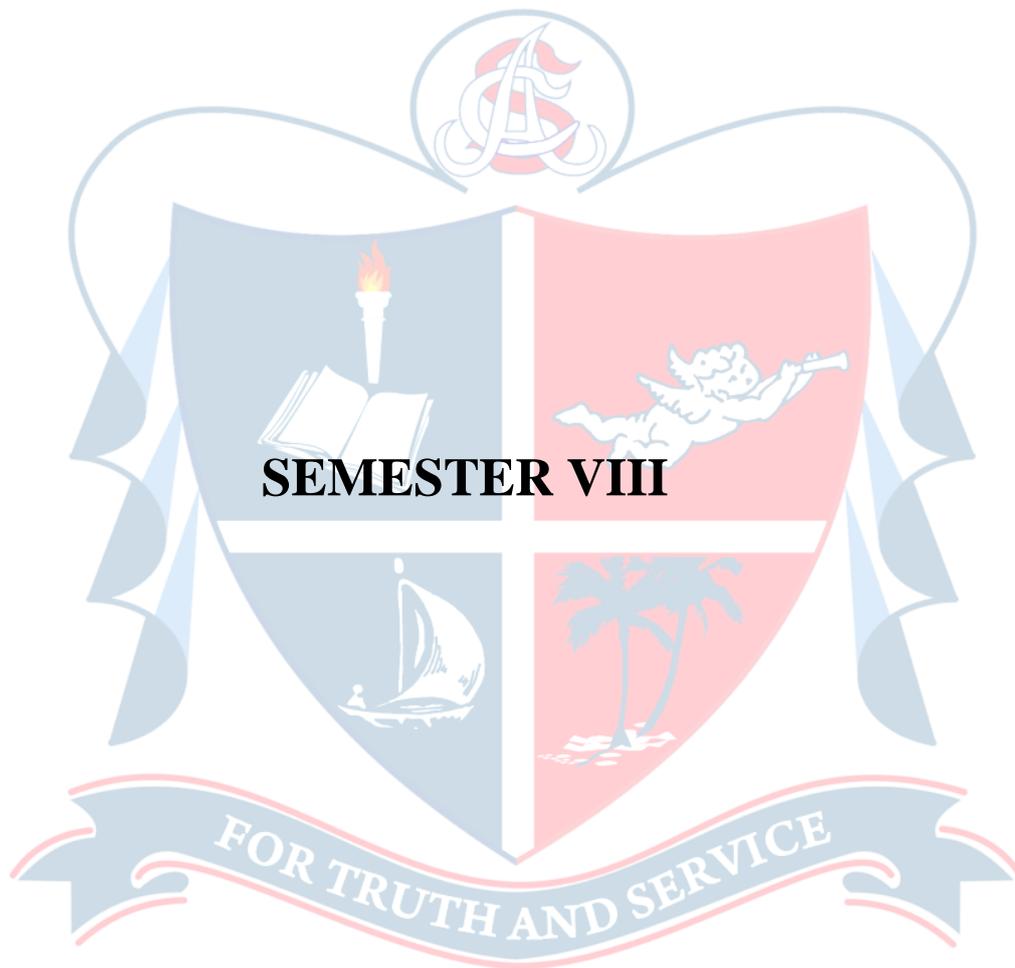
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Suggested readings

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2. Carpenter, P.L., Walker, T.D and Lanphear, F.O. 1975. Plants in the Landscape. W.H. Feeman and Co., San Francisco.
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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT METABOLISM					
Type of Course	DCC					
Course Code	24SACBOT8CC401					
Course Level	400					
Course Summary	<p>The course is designed to make students aware of advances and applications in Plant Metabolism. After completion of the course, the students would be able to; Recall and articulate key concepts related to plant metabolism, including the pathways involved in energy production, biosynthesis of essential compounds, and regulatory mechanisms governing metabolic processes in plants. Grasp the fundamental principles underlying plant metabolism, including the biochemical pathways, enzyme kinetics, and metabolic regulation that drive cellular processes in plants. Equipped to apply their knowledge of molecular and cellular processes to understand how plants assimilate nutrients, synthesize biomolecules, and respond to environmental stimuli at the molecular level. Gain insight into the diverse range of plant responses to internal and external stimuli, as well as the regulatory mechanisms that govern these responses, including signal transduction pathways and gene regulation. Evaluate energy conversion processes in plants, including photosynthesis and respiration, and understand how these processes contribute to the overall metabolism and growth of plants. Synthesize information from various cellular processes in plants, integrating knowledge of metabolism, cellular signaling, gene expression, and physiological responses to gain a holistic understanding of plant metabolism</p>					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any	Introduction to plant cells, cell interaction, cytoskeleton, nucleic acids Knowledge about light reaction and dark reaction					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Recall the concepts of plant metabolism	K	PO 1
2	Comprehend the fundamental Principles of Plant metabolism	U	PO 2
3	Apply Molecular and Cellular Processes in Plants	A	PO3
4	Analyze Plant Responses and Regulatory Mechanisms	An	PO1
5	Evaluate Energy Conversion and Metabolic Processes	E	PO2, PO3
6	Synthesize various Cellular Processes in Plants	C	PO1
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Biological membranes, Cell cycle and Plant Genome (12 hours)				
1	1.1	Biological membranes: Fluid-mosaic model, membrane Lipids, carbohydrates and proteins. Endomembrane system and membrane trafficking (brief study only). Cell cycle checkpoints: Cyclins and CDKs, regulation-G1/S and G2/M regulation, and spindle checkpoint.	6	1,2,3,4, 5,6
	1.2	Nuclear Genome: Genome organization: Chromatin loops, 250 nm fibre and chromosome. Chromatin and the epigenetic regulation of gene expression. Plant Cytoplasmic Genomes: Mitochondria and Plastid genome: The endosymbiotic theory.	6	1,2,3,4, 5,6
Plant Physiology and Development (25 hours)				

2	2.1	<p>Photosynthesis: The Light Reactions: PSI and PSII structure and composition, Mechanisms of Electron Transport, Proton Transport and ATP Synthesis in the Chloroplast. The Carbon Reactions: Rubisco-structure and function, The Calvin–Benson Cycle. Biosynthesis of starch and sucrose. The C2 Oxidative Photosynthetic Carbon Cycle and its role. Brief account of adaptive mechanisms to overcome the oxidative property of Rubisco.</p>	8	1,2,3,4,5,6
	2.2	<p>SRespiration: Substrate level phosphorylation (Brief study) Plant Mitochondrial electron transport, and ATP synthesis – organization of electron transfer complexes (complex I – V). Inhibitors of oxidative phosphorylation. Cyanide-Resistant Respiration ATP synthase, Binding change mechanism of ATP synthesis (Oxidative phosphorylation). Comparison of mitochondrial and chloroplast electron transport</p>	8	1,2,3,4,5,6
	2.3	<p>Signals and Signal Transduction -Plant signaling molecules and receptors (GPCR, Ion channel). Second messengers and signal transduction- MAPK cascades. Two-component signaling systems in plants : Cytokinin signal transduction. Structure and function of plant photoreceptors: phytochromes, cryptochromes, and phototropins. Floral induction and development (ABC Model).</p>	5	1,2,3,4,5,6
		<p>Plant Senescence and Cell Death- Leaf Abscission and Whole Plant Senescence (Brief account only). Types of cell death, PCD in plants (Brief account only), Leaf Senescence and its regulatory mechanism, Positive and Negative Senescence Regulators. Protein degradation in cells. (Brief account only)</p>	4	1,2,3,4,5,6
3	Biochemistry (8 hours)			
	3.1	<p>Overview of: Nitrate Assimilation, Ammonium Assimilation, Amino acid biosynthesis in plants: research and prospects,Symbiotic Nitrogen Fixation</p>	4	1,2,3,4,5,6

	3.2	Lipid Metabolism -Fatty acid biosynthesis- an overview, Lipid metabolism in oil seeds – oxidation of fatty acids, glyoxylate cycle, gluconeogenesis.	10	1,2,3,4,5,6
4	Practical (30 hours)			
	4.1	Estimation of Free amino acids in senescing leaves/ Ripening fruits.	30	3,2
	4.2	Separation of photosynthetic pigments by TLC/column chromatography and calculate the Rf value.		
	4.3	Estimation of amylase activity in germinating seeds		
	4.4	Estimation of total chlorophyll in various leaf samples		
	4.5	Extraction and estimation of leg-hemoglobin from root nodules		
	4.6	Study of meiosis by smear preparation of PMCs.		
	4.7	Visit a molecular biology lab and submit a report		
	4.8	Isolation of DNA from plant samples.		
	4.9	Activity (any one) Write a report on latest advances in plant metabolism (a copy of the original paper to be submitted along with the document. Design and perform an experiment related to plant metabolism. Prepare and submit a report with geo-tagged photos. Prepare and submit an innovative project proposal based on plant metabolism. Presentation and submission of a report on a research paper related to recent advances in plant metabolism. Present and submit a report on emerging trends and technologies in plant metabolism. Prepare and submit an animated video/ audio visual documentary, explaining any plant metabolic process.		
5	Teacher specific course components			

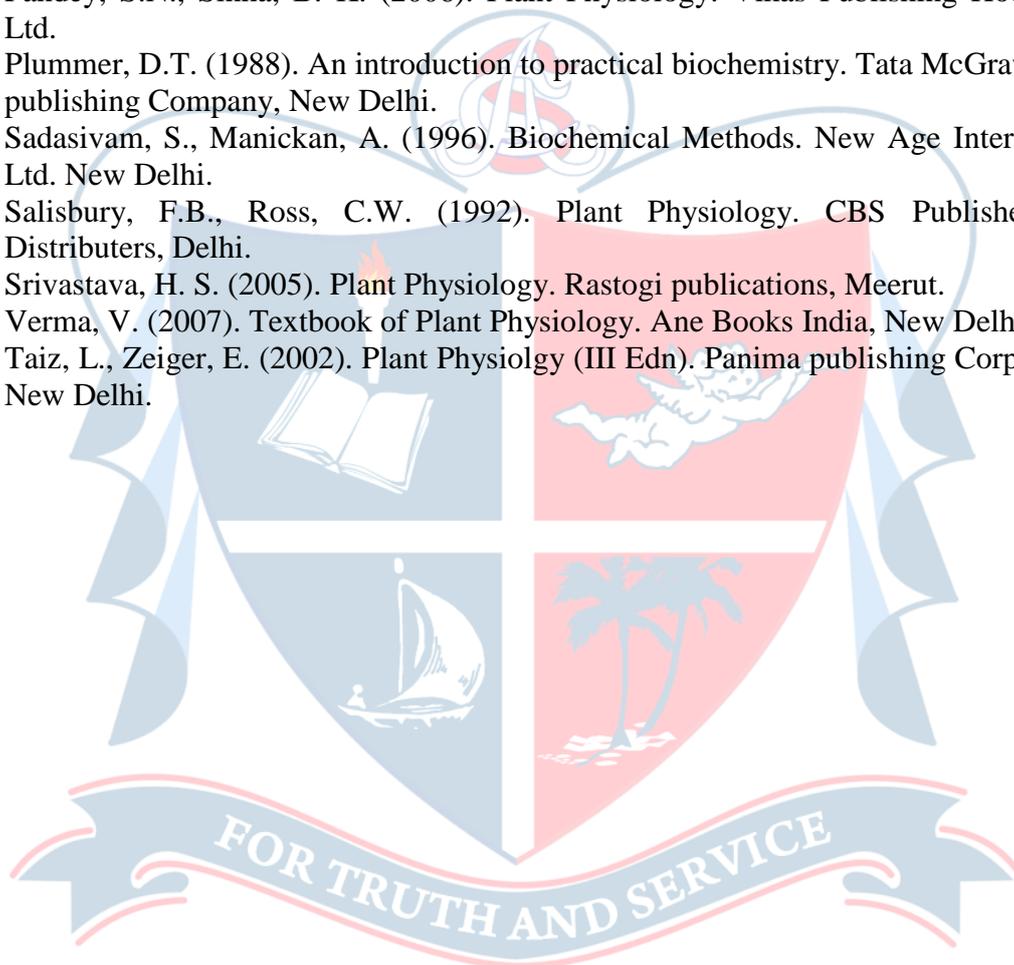
Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture- based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> ·Involvement and responses in class room transactions ·Home Assignments/preparedness ·Oral presentation/Viva/Quiz/Open book test/written test <p>Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course</p> <ul style="list-style-type: none"> ·Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> ·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1=10$ Short Essay (6 out of 8) : $6 \times 5= 30$ Essay (1 out of 2) : $1 \times 10= 10$</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> ·Practical based assessments: 30 marks ·Record: 5 marks

References

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4. Taiz, L., Moller, I. M., Murphy, A., and Zeiger, E. (2023). Plant Physiology and Development. 7th ed. USA: Sinauer Associates Inc. Publishers.

Suggested readings:

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Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT BREEDING AND PLANT PROPAGATION TECHNIQUES					
Type of Course	DCC					
Course Code	24SACBOT8CC402					
Course Level	400					
Course Summary	The course Plant breeding and Plant propagation techniques deals with plant and crop improvement techniques.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Outline divisions and components of Horticulture.	U	PO 1
2	Describe the role of breeding methods in producing improved varieties of crop plants.	U	PO 2
3	Illustrate how different plant growing structures are employed in Horticulture	A	PO2
4	Examine how cell differentiation occur in callus	An	PO1

5	Design aquaponics, hydroponics and aeroponics based irrigationsystems for improved crop yield	A	Po1, PO2, PO3
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Plant breeding (15 hours)				
1	1.1	Introduction to Plant Breeding: Objectives and achievements, Domestication and centres of origin of cultivated plants. Plant introduction - Primary and Secondary	4	1
	1.2	Breeding for resistance - Biotic (disease)- Vertical and horizontal Abiotic (drought) stresses.	4	2
	1.3	Mutation breeding: Achievements and limitations, Physical and chemical mutagens, Spontaneous and induced mutations, effects of mutation. Gamma gardens- Structure, Principles and working.	7	2
Horticulture (15 hours)				
2	2.1	Introduction to Horticulture: Nature and scope. Objectives ofhorticulture. Divisions of horticulture, Fruit and vegetable zones of India. Career opportunities in horticulture. NHM, AHM, VFPC, IRR	3	1
	2.2	Basic components of Horticulture a. Soils: Types, Physical characteristics b. Climate: – Light, temperature, photoperiod, relative humidity, rainfall, altitude c. Common garden implements and tools d. Manures, Fertilizers: chemical fertilizers and organic fertilizers methods of application. e. Irrigation and water management: system of irrigation, surface irrigation, sub soil irrigation, overhead system of irrigation. Artificial propagation of plants (brief account)-	8	1
	2.3	Plant growing structures Greenhouse, Polyhouses, Mist chambers, Hot beds. Modern trends in horticulture-Aquaponics,	4	5

		Hydroponics, Aeroponics, Nutrient Film Technique. Horticulture therapy.		
3	Tissue culture (15 hours)			
	3.1	Important milestones in plant tissue culture. Types of cultures: organised structures - meristem, shoot tip, node, embryo, root cultures (Brief study); unorganised structures - callus, suspension and protoplast cultures (Brief study)	4	4
	3.2	Techniques and stages of micropropagation Advantages, disadvantages an of micropropagation	2	2
	3.3	Differentiation of cells in callus - tracheid formation, chloroplast differentiation. Factors influencing vascular differentiation. Organogenic differentiation: factors influencing shoot bud differentiation, induction of organogenic differentiation. Advances and applications of tissue culture	9	4
4	Practical (30 hours)			
	4.1	Students are expected to do minimum 5 practicals 1. Identification of soil types based on particle size 2. Preparation of bio fertilizer and field application (Trichoderma culture and application). 3. Preparation and application of growth regulators (Coconut milk and root hormones). 4. Students are expected to submit any artificially propagated plants done by him (Cutting/Budding / Grafting/ Layering). 5. Identify and submit a layout of suitable irrigation techniques applicable in our local area. 6. Submit a photographic report on novel plant propagation tools. 7. Prepare aquaponics/ Hydroponics/ Aeroponics/ Nutrient Film 8. Hybridization techniques in self and cross pollinated plants 9. Visit a plant breeding station to familiarize with breeding programmes. Submit a report of the visit. 10. Preparation of MS medium from stock solutions. 11. Isolation, preparation, sterilization and inoculation of different explants like shoot tip, node, anther, embryo and cambium. 12. Production of mutated cells/tissues/plants	30	2,3,4,5

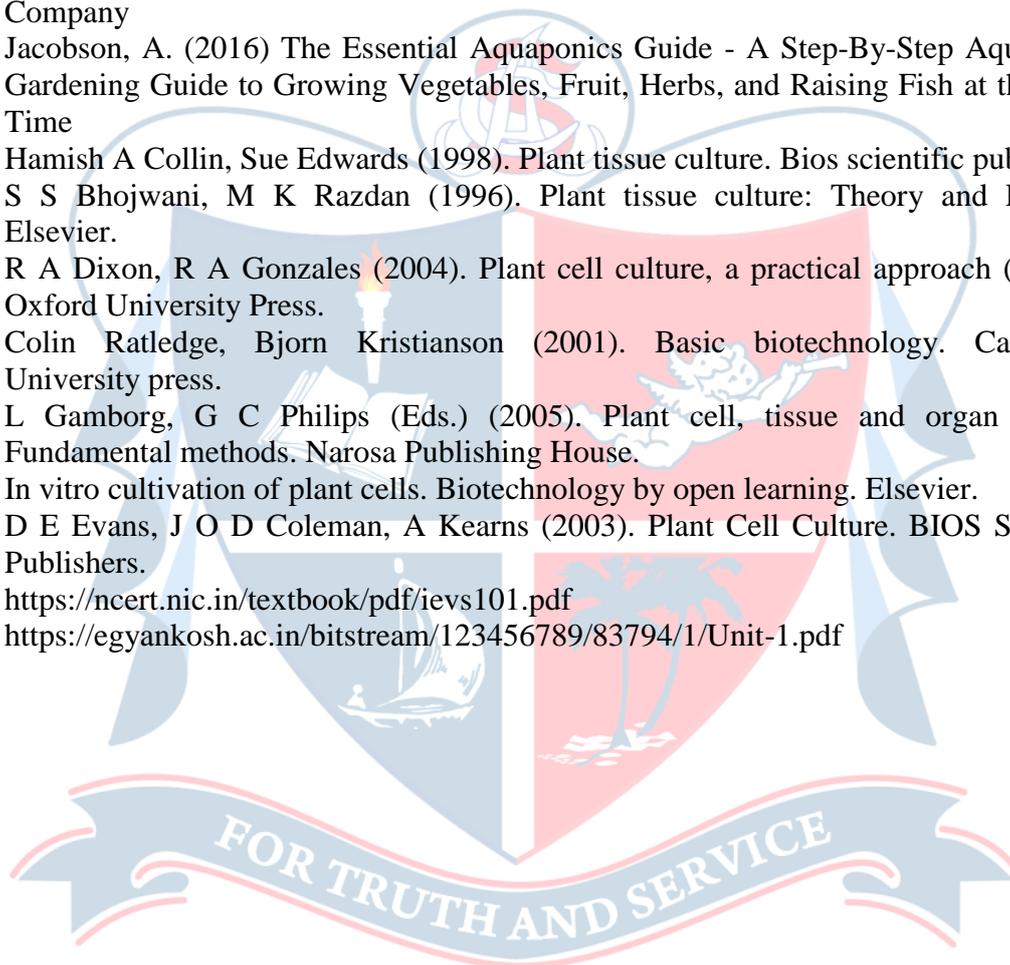
5	Teacher specific course components		
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Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test <p>Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks</p> <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE) Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1 = 10$ Short Essay (6 out of 8) : $6 \times 5 = 30$ Essay (1 out of 2) : $1 \times 10 = 10$ Practical: 35 marks</p> <ul style="list-style-type: none"> · Practical based assessments: 30 marks · Record: 5 marks

References

1. Adams, C. R., Early, M. P., & Bamford, K. M. (2008). Principles of horticulture. Butterworth-Heinemann.
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Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PHYTOCHEMISTRY AND PHARMACOGNOSY					
Type of Course	DCE					
Course Code	24SACBOT8CE401					
Course Level	400					
Course Summary	<p>Phytochemistry is the study of the chemicals produced by plants, particularly the secondary metabolites which are synthesized as a measure for self-defense, and its medicinal, industrial, and commercial applications. The proper understanding of phytochemicals is essential for drug discovery and for the development of novel therapeutic agents against major diseases.</p> <p>Pharmacognosy is the study and science of medicine from natural sources. Natural medicines have been used for many thousands of years to enhance human health and treat diseases, and modern pharmaceutical medicine is largely dependent on drugs originally discovered in and isolated from natural sources. Pharmacognosy remains a central feature in traditional medicine and pharmacology, with the former remaining the primary source of medicine in developing countries and emerging economies. This course introduces phytochemistry, discusses the relationship of phytochemistry with other sciences and the importance of pharmacognosy.</p>					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites,if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	The student will be able to describe the importance of phytochemicals and pharmaceutical drugs.	U	PO 1
2	The student will be able to explain the principle involved in the extraction and isolation techniques.	U	PO 1
3	The student will be able to classify the different phytochemicals and pharmaceutical drugs.	A	PO2
4	The student will be able to carry out various phytochemical tests and procedures using different laboratory equipment.	An	PO3
5	The student will be able to evaluate various drugs and estimate the presence of phytochemicals. The student will be able to investigate the various adulterants present in pharmaceutical drugs	E	PO1,PO2, PO3,PO6
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Phytochemistry: Introduction to Phytochemistry, Plant Secondary Metabolites (15Hours)				
1	1.1	A Definition, history and scope of Phytochemistry.	3	1,2
	1.2	Recent advances in the field of chemotaxonomy.	3	1,2
	1.3	Classification, occurrence, structure and function of medicinally important plant products: glycosides, tannins, alkaloids, phenolic compounds, saponins, terpenoids, steroids, flavonoids, gums and mucilage.	7	1,2
Extraction and characterization of phytochemicals (15 Hours)				

2	2.1	Solvents- Petroleum ether, Chloroform, Ethanol, Acetone, Water	3	2
	2.2	Extraction techniques- Cold extraction, Hot extraction	3	2
	2.3	Separation techniques- TLC, Column Chromatography, HPLC; Characterization techniques- GC-MS, LC-MS/MS, UV-VIS Spectrometry, IR Spectrometry, N M R	9	2
3	Pharmacognosy-Introduction, classification and evaluation of drugs, sources, and techniques of drug production (15 Hours)			
	3.1	Definition, history, scope, and development	1	1,2,3,6
	3.2	Plants in Medicine: Indigenous traditional drugs, traditional system of medicine, herbal medicine, folk medicine, unani, siddha, ayurveda, homoeopathy and Chinese medicine (Brief) Ethnopharmacology	4	
	3.3	Therapeutic classification of crude drugs, Morphological, microscopical and organoleptic evaluation of crude drugs; Drug preparation and storage. Collection and preparation of crude drugs for the market. Quality control of drugs- Adulteration of drugs, tools for identification.	4	
	3.4	Plant kingdom as source of drugs- plant secondary metabolites as drugs	2	
	3.5	Techniques for production of drugs– purification, filtration, adsorption, solubilization, absorption, suspension and emulsification. Histochemical localization of starch grains- rice, potato	4	
5	Practical (30 hours)			
		Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.	15	1,2,3,6

5	Teacher specific course components
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Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture- based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test <p>Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course</p> <ul style="list-style-type: none"> · Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1 = 10$ Short Essay (6 out of 8) : $6 \times 5 = 30$ Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> · Practical based assessments: 30 marks · Record: 5 marks

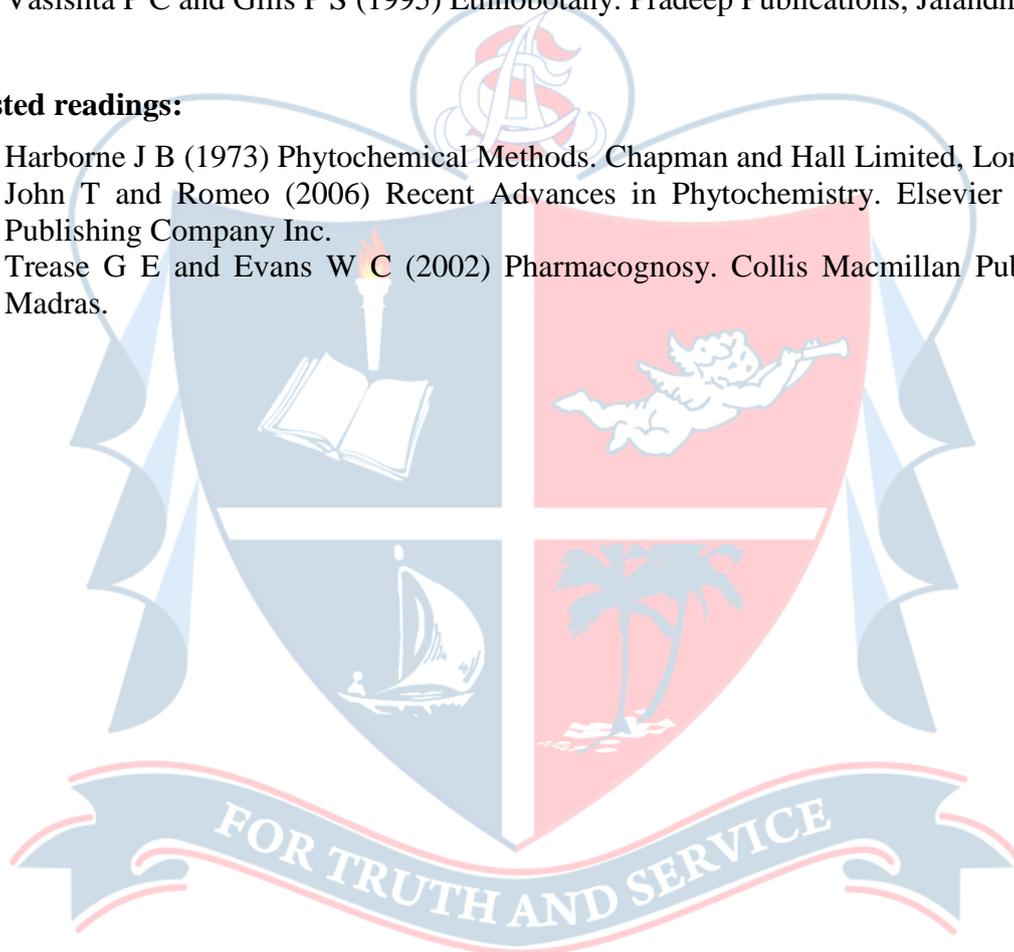
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Suggested readings:

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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	OMICS IN PLANT SCIENCES					
Type of Course	DCE					
Course Code	24SACBOT8CE402					
Course Level	400					
Course Summary	The course will provide a comprehensive overview of data resources, tools and techniques that have revolutionized Plant Science research especially in the fields of genome editing, high throughput sequencing, metabolomics etc. There will be sessions on genomics, transcriptomics, proteomics and metabolomics with emphasis on dealing with large-scale dataset production and challenges in high-throughput data handling and analysis. The goal of this course is to broadly review molecular and omics technologies applied in Plant science research.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites,if any	Basic understanding of molecular biology tools used in Bioinformatics					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Compare key technologies used to generate omics data	U	PO 1, PO2

2	Implement and use methods for detection and annotation of genomic variants	A	PO 1
3	The student will be able to classify the different phytochemicals and pharmaceutical drugs.	A	PO3
4	Recommend a omics experiments to address the biological question	E	PO1,PO2
5	Design an omics-based experiment to address a certain biological question - and take a lead role in analyzing resulting data	C	PO2, PO3
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Phytochemistry: Introduction to Phytochemistry, Plant Secondary Metabolites (15Hours)			
	1.1	Introduction to Omics, Historical development in Biological Research, Genomics, Proteomics, Transcriptomics, Metabolomics-Applications in Plant science (overview).	3	1
1	1.2	Structural genomics- Genome organization, genome mapping: (Principle and Application) SSR, ISSR, AFLP, SNP, Physical and genetic maps (An overview with special reference to crop improvement). Role of Genome sequencing techniques in structural genomics: Sanger's dideoxy sequencing, whole genome shotgun sequencing, Pyrosequencing. Genome annotation. Activity : Submit a comparative account on the different genome sequencing strategies with special reference to Arabidopsis thaliana / Rice genome projects.	8	2,3
	1.3	Functional genomics- mRNA profiling, Gene expression analysis using RT-PCR, Applications of Functional genomics	4	4
	Transcriptomics and proteomics (25 hours)			

2	2.1	Transcriptomics- RNA structure and types. Overview of Transcriptomics studies in plants with special reference to breeding plants to combat biotic and abiotic stress	3	3,4,5
	2.2	Transcriptome analysis: Role of techniques like Southern blotting, Q-PCR, Microarray Basics of Functional analysis of transcriptome data. Transcriptome projects-Human, Mouse, Cancer, Fungal (Overview and Major Outcomes) Activity: Prepare a report on any of the above genome projects and submit for evaluation	7	3,4,5
	2.3	Proteomics-Introduction to proteomics, Types (Quantitative, Functional- Brief account)	2	3
	2.4	Structural Proteomics: Methods of sample preparation: Protein extraction-TCA precipitation, phenol chloroform method; Protein separation- (brief Account) SDS-PAGE, 2-D	4	3,4
	2.5	Protein identification-Western Blotting, Mass Spectroscopy. Peptide sequencing (Edman Degradation) Protein structure elucidation- X-ray crystallography, NMR spectroscopy	7	3,4,5
	2.6	Functional proteomics - protein-protein interaction (GFP tagging, reporter assay)	2	3,4,5
3	Metabolomics (15 hours)			
	3.1	Metabolomics: Introduction to metabolomics: Metabolome, Metabonomics (Terms and Concepts). Application of metabolomics analysis in medicinal plant science.	3	4,5
	3.2	Metabolomes Databases- PmDB, Metabolite profiling, Metabolome fingerprinting. Activity: Predicting protein structure from sequences downloaded from NCBI.	7	4,5
	3.3	Role of Biomarkers in metabolomics, Tools of metabolome studies: NMR, MS, GC, LC, IR	5	4,5
4	Application of omics (5 hours)			

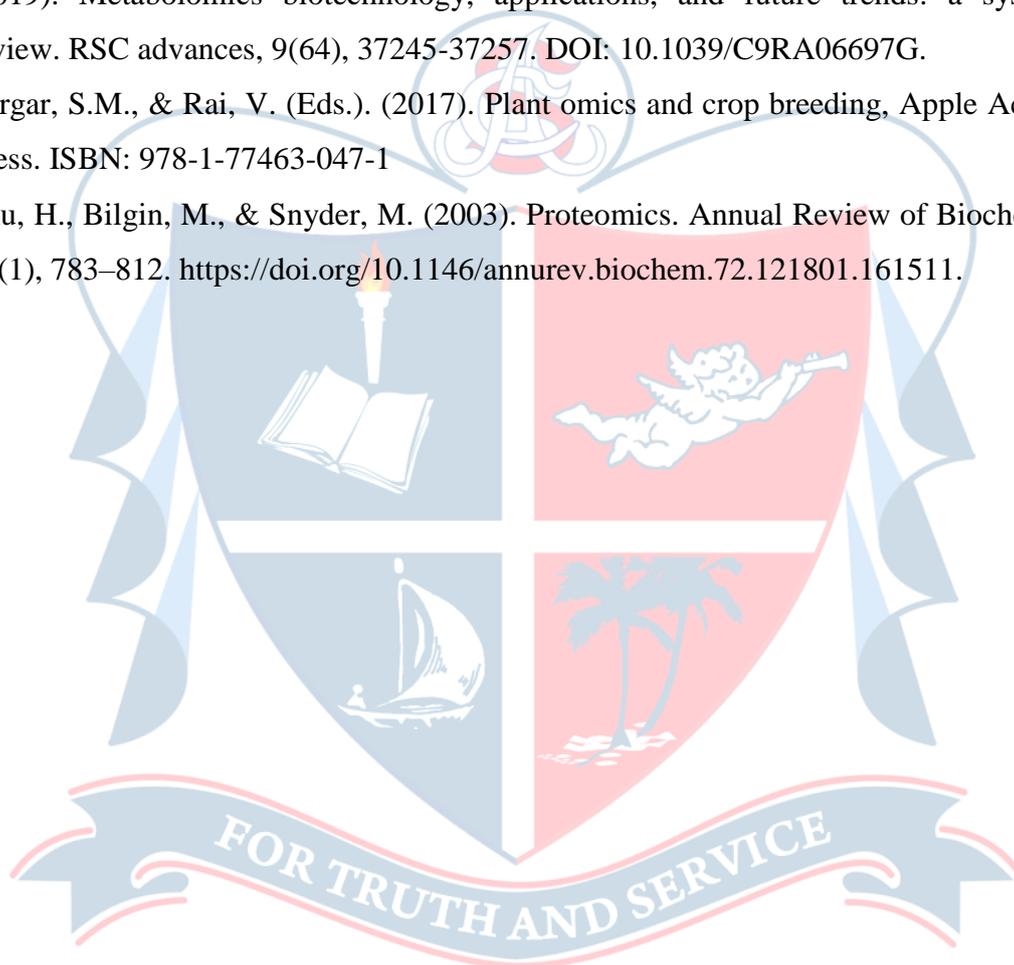
	4.1	Application of Omics in different fields of biotechnology including agriculture, environment, pharmaceuticals, medicine and forensics	3	4
	4.2	Metabolome projects of plant and human, Future perspectives of metabolomics.	2	4
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> ·Involvement and responses in class room transactions ·Home Assignments/preparedness ·Oral presentation/Viva/Quiz/Open book test/written test <p>Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course</p> <ul style="list-style-type: none"> ·Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> ·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1=10$ Short Essay (6 out of 8) : $6 \times 5= 30$ Essay (1 out of 2) : $1 \times 10= 10$</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> ·Practical based assessments: 30 marks ·Record: 5 marks

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Programme	BSc.(HONOURS) BOTANY					
Course Name	MODERN TRENDS IN PLANT SYSTEMATICS					
Type of Course	DCE					
Course Code	24SACBOT8CE403					
Course Level	400					
Course Summary	The morphological characters alone should not be considered in systematic classification of plants. Modern trends help plant taxonomists to look for more precise techniques in order to understand the relation between the genera and families. Complete knowledge of taxonomy is possible with the principles of various disciplines like cytology, palynology, phenology, biochemistry and numerical taxonomy. These have been found to be useful in solving some of the taxonomical problems by providing additional characters.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites,if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the conceptual basis of plant classification and the concept of family, genus and species and the taxonomic diversity within species	U	PO 1, PO2
2	Develop working skills in modern techniques in plant systematics	A	PO 2,PO9

3	Choose appropriate tools of modern systematics for plant identification	A	PO 10
4	Determine evolutionary relationship between a group of species using molecular taxonomic tools and techniques	A	PO2
5	Construct phylogenetic trees based on molecular systematic data	C	PO 1, PO2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Conceptual basis of plant systematics (6)				
1	1.1	Definition, Concepts and theories of classification and biosystematics. History and theories of classification Theophrastus, Linnaean and post Linnaean era- Phylogenetic classification - Angiosperm Phylogeny Group (APG)- Detailed Account.	7	1
	1.2	Hierarchy in classification. Concept of Family, Genera, Species, Subspecies and other infra-specific categories. Species concepts: Typological, Nominalistic and Biological species concepts (in plant perceptive).	6	1
	1.3	The new global taxonomy initiatives: Systematic Agenda-2020- Missions.	3	3
Interdisciplinary approaches in plant systematics (14)				
2	2.1	Chemotaxonomy- Classification based on phytochemicals- phenolics, alkaloids, terpenoids and nonprotein amino acids. Serology and Taxonomy. Scope and limitations..	5	3
	2.2	Cytotaxonomy – chromosome number, chromosome size, chromosome banding and behaviour of chromosomes during division	5	3
	2.3	Palyno Taxonomy- Pollen morphological characters and their significance in taxonomy and evolution- Polarity, symmetry, NPC of pollen, exine	4	3

		stratification, excrescences, L/O pattern. PollenAtlas		
3	Ultrastructural and Numerical systematics (15 hours)			
	3.1	Stereo Microscopes, Scanning Electron Microscopy, Transmission Electron Microscopy, Microphotography (Image analyser software) for micromorphological studies - Trichomes and seed morphology	5	2,3
	3.2	Numerical Taxonomy (Phenetics): Theory and principles- Operational Taxonomic Unit (OTU) Cluster analysis; UPGMA Methods; NTSYS, Applications, Merits and Demerits, Cluster analysis, Dendrogram.	4	4,5
	3.3	Molecular taxonomy - concepts, scope and limitations, Plant DNA barcoding- Molecular markers- isozymes, AFLP, Internal Transcribed Spacer (ITS), rbcL, matK. NCBI, Similarity search tools- BLAST, FASTA, Cladistics (Monophyletic, polyphyletic and paraphyletic groups), Phylogenetic tree construction, methods and tools- MEGA, PHYLIP. Interpreting data. Detailed study.	6	4,5
4	Practicals (30 hours)			
	4.1	Students should submit a review on plant classification- past to present.	3	1
	4.2	Students should refer to research articles and find out some cases where chemotaxonomic markers helped to establish their taxonomic identity	3	3
	4.3	Students should familiarise themselves with the application of chemical data from TLC/ HPTLC/ HPLC/GC for taxonomy.	4	3
	4.4	Semipermanent pollen preparations by acetolysis method /any other alternative methods and study of different pollen morphotypes.	5	3
	4.5	:Study of plant surface attributes (trichomes/spines/etc.) / pollen characters with the help of Stereo Microscope /SEM.	5	3

	4.6	Practical based on numerical taxonomy- Construct OTU tables examining morphological characters of selected plants.	5	4,5
	4.7	Construct phylogenetic trees using MEGA/PHYLIP or Sequence similarity searching through NCBI BLAST	5	4,5
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test <p>Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course</p> <ul style="list-style-type: none"> · Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE) Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1=10$ Short Essay (6 out of 8) : $6 \times 5= 30$ Essay (1 out of 2) : $1 \times 10= 10$</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> · Practical based assessments: 30 marks · Record: 5 marks

References

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Suggested readings

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	<h2 style="margin: 0;">Department of Botany</h2> <h3 style="margin: 0;">St. Albert's College (Autonomous)</h3> <h3 style="margin: 0;">Ernakulam</h3>
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Programme	BSc.(HONOURS) BOTANY					
Course Name	AGROECOLOGY					
Type of Course	DCE					
Course Code	24SACBOT8CE404					
Course Level	400					
Course Summary	This course provides a comprehensive exploration of the principles and applications of agroecology, offering undergraduate botany students a foundational understanding of how ecological processes can be strategically applied to agricultural systems. As the global agricultural landscape evolves, agroecology emerges as a transformative approach that integrates ecological principles with sustainable farming practices.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Recognize the foundations of Agroecology	U	PO 1
2	Apply Agroecological principles to Agriculture	A	PO 1,PO2

3	Implement sustainable soil and crop management practices	A	PO2 2, PO3
4	Apply both cognitive understanding and practical skills in integrated livestock and pest management for sustainable agriculture	A	PO2, PO5
5	Analyze and promote sustainable agricultural practices	An	PO 1, PO6, PO7, PO8
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Fundamentals of Agroecology: Principles and Applications (15 hours)				
1	1.1	Introduction to Agroecology- Definition and scope, historical development and evolution of agroecology, Distinctive features of agroecology as a discipline, ecological, Social and economic benefits, Sustainability in agriculture	4	1,5
	1.2	Basic principles and concepts- Agroecological Principles and elements and their implications in Agricultural systems.	4	2
	1.3	Soil Management for Sustainable Agriculture- Soil health and sustainability, Importance of soil as a living ecosystem, Soil structure, texture and composition, Erosion control methods, cover cropping and mulching, contour plowing and terracing.	5	3
	1.4	Crop Diversity and Rotation- Types and benefits of cover crops, incorporating cover crops in rotation, improving soil health and structure, Benefits of crop rotation.	2	2,3,5
Sustainable Farming Practices and livestock integrations (18 hours)				
2	2.1	Agroforestry- Introduction to Agroforestry, Principles of agroforestry, Alley cropping, wind breaks and integrating trees and crops	5	2,5

		for mutual benefits, Biodiversity enhancement, carbon sequestration and climate resilient farming, Economic and social benefits		
	2.2	Water Management in Agriculture- Importance of water in agriculture, Role of water in plant growth and development. Efficient Irrigation techniques- Drip irrigation, sprinkler and furrow irrigation, Water conservation practices in irrigation. Rain water harvesting techniques, sustainable use of water resources	6	2,3,5
	2.3	Livestock Integration in Agroecosystems- Silvio pasture and agroforestry systems with livestock, Grazing and mixed farming practices, grazing management for optimal land use	4	4,5
	2.4	Balancing crop and livestock systems, Inter dependence between crops and livestock, Nutirentcycling and Waste utilisation	3	4,5
3	Food Systems and Security (12 hours)			
	3.1	Environmental impact assessment of agricultural practices, mitigation strategies for minimizing negative effects	3	5
	3.2	Ensuring food security- understanding the ecological footprints of different farming systems	3	1,5
	3.3	Social and economic aspects of sustainable agriculture- Socioeconomic impact of agricultural practices, community engagement and involvement of communities in sustainable agriculture.	4	5
	3.4	Ethical values and practices involved in agriculture	2	5
4	Practicals (30 hours)			
	4.1	Soil texture and composition analysis using hydrometer and particle size distribution	2	

				3,5
	4.2	Field visit: Visit Designated Field areas with cover crop and discuss the benefits of over crop and mulching	10	2,5
	4.3	Field Visit: Visit field to study the impact of tree crop interaction and their impact on soil properties	10	2,5
	4.4	Analyse the water retention and distribution efficiency of different irrigation systems	3	3,5
	4.5	Analyse the nutrient content in soil in farms with and without livestock integration.	5	4,5
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> ·Involvement and responses in class room transactions ·Home Assignments/preparedness ·Oral presentation/Viva/Quiz/Open book test/written test <p>Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course</p> <ul style="list-style-type: none"> ·Any other method as may be required for specific course / student by the course faculty

	<p>Practical: 15 marks</p> <ul style="list-style-type: none"> ·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8) : 6 x 5= 30 Essay (1 out of 2) : 1x 10= 10</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> ·Practical based assessments: 30 marks ·Record: 5 marks

References

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Suggested readings:

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	FOREST BOTANY					
Type of Course	DCE					
Course Code	24SACBOT8CE405					
Course Level	400					
Course Summary	This course will help develop a comprehensive understanding of plant science as applied to forest ecosystems. Covering taxonomy, morphology, physiology, ecology, genetics, and practical applications, the course equips students with the knowledge and skills necessary for sustainable forest management.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Develop a comprehensive understanding of forest ecosystems, exploring tree morphology and recognizing diverse forest types with a focus on stratification and physiogamy.	U,A,An	PO2, PO6, PO10
2	Hone skills in plant identification, classification, and recognize the significance of endemic species, understanding their causes, threats, and consequences.	K, U, A, An	PO2, PO6, PO7

3	Explore forest ecology, ecological interactions, and recognize threats to biodiversity, while formulating effective conservation strategies and understanding genetic resource documentation	E, An, C, S	PO2, PO6, PO7
4	Apply theoretical knowledge practically, calculating biodiversity indices, examining leaf modifications, and gaining field experience through forest visits. Understand physiological adaptations of forest plants to environmental stress and their role in carbon sequestration.	A, An, S, I	PO2, PO4, PO5, PO6, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to forest Botany (12 hours)				
1	1.1	Introduction to forest ecosystems, Morphology or trees,	5	1
	1.2	Importance of forest- Radiation, temperature, precipitation patterns and wind, forest products- Major and Minor	5	1,2
	1.3	Forest types- stratification and physiognomy	5	2
Forest Plant Diversity (12 hours)				
2	2.1	Tree identification and classification based on morphology of stem and leaves and architecture	5	2,4
	2.2	Shrub and herbaceous plant diversity- adaptations, role, interactions. Shannon wiener index	5	2,3
	2.3	Endemic and rare species- causes, significance, Threats, Red data book, consequences of loss	5	2,3
Forest conservation, management and physiology (15 hours)				
3	3.1	EForest succession, community- structure and dynamics. Forest productivity, ecological succession. Ecological interaction in forest-	5	3

		geographic and climatic factors, nutrient cycling, impact of abiotic factors. Mutualism, competition, predation, role of decomposers		
	3.2	Adaptation in forest environment- Structure of leaves, stem wood , bark and roots in trees, adaptations with special reference to shade tolerance, leaf modifications, Root systems, seed dispersal mechanisms , epiphytic adaptations and mycorrhiza associations	5	3,4
	3.3	Threats to biodiversity- Climate change, Global warming and forests depletion. Deforestation, role of invasive species Conservation strategies for forest plants:Documentation and evaluation of forest genetical resources (FGR), in situ and ex situ conservation of gene resources. Application of remote sensing and biotechnological Approaches	5	3,4
4	Practicals (30 hours)			
	4.1	Calculate Shannon Wiener index for biodiversity index for two distinct ecosystems.	5	4
	4.2	Examine leaf modification and their adaptive significance.	3	4
	4.3	Collect water samples and perform water quality analysis using titrimetric methods.	3	4
	4.4	Visit a local forest and explore different interactions, its stratifications.	10	4
	4.5	Collect soil samples from different forest ecosystems and analyse the soil properties.	9	4
5	Teacher specific course components			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
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Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> • Involvement and responses in class room transactions • Home Assignments/preparedness • Oral presentation/Viva/Quiz/Open book test/written test <p>Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course</p> <ul style="list-style-type: none"> • Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> • Lab involvement and practical skills • Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1 = 10$</p> <p>Short Essay (6 out of 8) : $6 \times 5 = 30$</p> <p>Essay (1 out of 2) : $1 \times 10 = 10$</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> • Practical based assessments: 30 marks • Record: 5 marks

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Suggested readings

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	AQUATIC BOTANY					
Type of Course	DCE					
Course Code	24SACBOT8CE406					
Course Level	400					
Course Summary	This syllabus aims to cover key aspects of aquatic botany, providing students with a comprehensive understanding of the diversity, ecology, and conservation of plants in aquatic environments.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any	Nil					75

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	The learner will acquire comprehensive understanding of aquatic ecosystems, including physiochemical properties, flora and biological productivity.	U,A,An	PO1, PO3, PO10
2	Acquire skills in identifying and classifying aquatic plants and their ecology	S,U,A	PO1, PO2, PO3, PO4, PO10

3	The learner will be able to proficiently analyse different types of water pollution, understand their sources and propose effective management and conservation strategies.	S,U,A	PO1, PO2, PO6, PO8
4	The learner will be able to acquire knowledge and develop an understanding of the physiology and adaptations in aquatic plants	U,A,An	PO1, PO2, PO3
5	The student will be able to recognize threats to aquatic plant biodiversity and implement conservation strategies considering factors like climate change, aquaculture and habitat degradation.	U,A,E,C	PO1, PO5 PO6, PO7 PO9
6	Demonstrate practical skills through activities such as setting up a natural aquarium, conducting water quality analysis and plan participate in mangrove restoration	S,A,C,I	PO2, PO4, PO5, PO6, PO7, PO9, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Fundamentals of Agroecology: Principles and Applications (15 hours)				
1	1.1	Overview of Aquatic Ecosystems Fresh water- Lentic ecosystem and Lotic Ecosystem Rivers and Ponds: Physicochemical properties. Riparian flora, Biological productivity. Concept of watershed and watershed management Swamps and marshes: Types of swamps. Physicochemical conditions. Nutrient cycling. Lakes and reservoirs: Characteristics and stratification. Marine- definition, range of salinity, stratification Mangroves and Estuaries	5	1,3
	1.2	Identification and Classification of Aquatic Plants Classification based on growth form--freshwater higher vascular plants-floating (rooted and free floating), submerged and emerged, sea weeds, sea grasses and mangroves, invasive aquatic plants. Classification based on morphology-amphiphytes, Helophytes, nymphaeids, Isoetids, neuston etc. Micro	6	2,3

		and Macro algae: distribution and importance. Seaweeds and Seagrasses: structure, types and economic importance		
	1.3	Functions of aquatic ecosystems. Importance in nutrient cycling, impact of soil chemistry and role in soil chemistry. Dynamics of plant aquatic community, common aquarium plants	4	1,4
Aquatic Pollution and Management (15 hours)				
2	2.1	Water pollution: types- Thermal pollution, Oil pollution, Radioactive pollution, Detergent pollution, interaction of pollutants and factors affecting toxicity Sources: Characteristics of effluent sewage, industrial and agricultural discharges. Emerging pollutants, heavy metals, pesticides, plastic and microplastics, oil spills, etc.	5	3,4
	2.2	Biological concern: Eutrophication (change in the plant diversity in aquatic systems, change in DO levels), algal blooms, bioaccumulation and biomagnification, change in water quality (BOD, COD, DO), monitoring and control of pollutants, effect of waste disposal on marine ecosystem.	6	3,4
	2.3	Sustainable Management of Aquatic Environments. Conservation of freshwater ecosystems. Restoration of freshwater wetlands. Ramsar convention, Ramsar sites. Role of Pollution Control Board (PCB) Conservation of Mangroves: need, Impact of human, role of institutions and NGO's in India	4	3,5
3	Conservation, physiology and Adaptations (15 hours)			
	3.1	Threats to Aquatic Plant Biodiversity: Climate change, Harmful aspects related to aquaculture activities, introduction of exotic species, destruction of mangroves, Expanding hydropower etc	5	5,6
	3.2	Conservation Strategies for Aquatic Plants: Conservation of freshwater ecosystems, habitat restoration ecology, habitat protection, wetland conservation, riparian buffer zones, invasive species management etc.	5	5,6
	3.3	Physiology and Adaptations in Aquatic plants. Fine structure and properties of algal plastids. Morphological and anatomical modifications in aquatic plants. Physiological adaptations in mangroves.	5	4,6

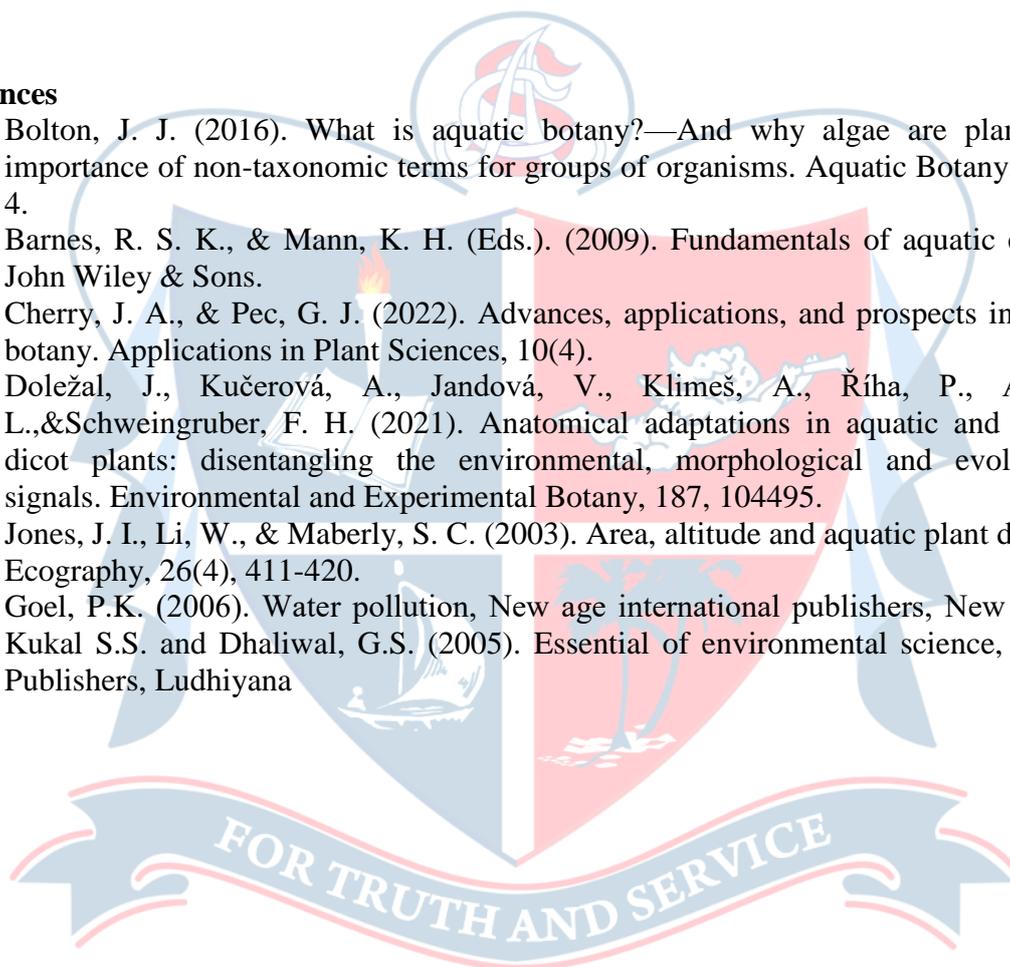
4	Practicals (30 hours)			
	4.1	Collect common aquatic plants- Identify and set up and natural aquarium	5	2,6
	4.2	Collect aquatic plants and plants form mangroves and conduct anatomical studies to understand anatomical adaptations	5	2,6
	4.3	Field visit to observe and identify aquatic ecosystems	10	1,5
	4.4	Conduct water quality analysis between different aquatic ecosystems using titrimetric methods	3	3,6
	4.5	Visit mangroves to understand the ecological significance and the need for restoration activities	7	5
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching.</p>
Assessment Types	<p>MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks</p> <ul style="list-style-type: none"> ·Involvement and responses in class room transactions ·Home Assignments/preparedness ·Oral presentation/Viva/Quiz/Open book test/written test <p>Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course</p> <ul style="list-style-type: none"> ·Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> ·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty

B. End Semester Evaluation (ESE) Theory: 50 marks Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8) : 6 x 5= 30 Essay (1 out of 2) : 1x 10= 10 Practical: 35 marks ·Practical based assessments: 30 marks ·Record: 5 marks
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References

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT BIO-ANALYTICS AND ADVANCED INSTRUMENTATION					
Type of Course	DCE					
Course Code	24SACBOT8CE407					
Course Level	400					
Course Summary	This course equips the students with essential skills for molecular and cellular research like microscopy, centrifugation, radioisotope application, chromatography and mathematical concepts. The course prepares the students for roles in both research and professional settings.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		75
Pre-requisites, if any	The student must have completed courses in cell biology, biochemistry and plant physiology.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Utilize the microscopy and imaging techniques	A	PO2, PO8
2	Apply the expertise in experimental techniques and specifically in chromatography and advanced imaging methods	A	PO2, PO5
3	Establish the basics of biochemical mathematics and	A	PO1,

	acid- base chemistry, applying mathematical and statistical concepts in biological research		PO6
4	Demonstrate practical skills in applying biochemistry techniques, including plant pigment separation, and critically evaluate and interpret diverse micrographs.	A	PO2, PO10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Imaging techniques and Cell fractionation (15 hours)				
1	1.1	Principles of microscopy- Types of microscopes: Optical, electron, and fluorescence microscopes, Importance of resolution and magnification. Light Microscopy, Basics of light microscopy. Brightfield and phase contrast microscopy.	5	1,3
	1.2	Fluorescence Microscopy: Principles of fluorescence and fluorochromes. Applications in cell biology: Live cell imaging, immunofluorescence. Principles of Excitation emission and fluorophore selection. Commonly used fluorescent dyes. Confocal microscopy, FRET.	5	1
	1.3	Electron Microscopy: Transmission and scanning electron microscopy. Sample preparation techniques: Fixation, embedding, sectioning, Applications of Fluorescence Microscopy: Chromosome analysis: Banding techniques. Fluorescence in situ hybridization (FISH) Live cell imaging, super resolution microscopy	5	1
Centrifugation and basic spectroscopy (20 hours)				
2	2.1	Centrifugation Basics, Principles of centrifugation. Different types of centrifuges: Fixed angle, swinging bucket. Factors influencing centrifugation.	5	2
	2.2	Differential and density gradient centrifugation: Techniques for separating cellular components. Sucrose density gradient and CsCl ₂ gradient centrifugation.	5	2
	2.3	Autoradiography and pulse chase experiment. Basic Principles and applications in studying cellular	5	2

		dynamics.		
3	Chromatography and Biochemical Methods (10 hours)			
	3.1	Basics of chromatography. Principles: overview of chromatography principles. Types of chromatography: Gas, liquid, affinity, size exclusion.	3	2
	3.2	Paper chromatography and column chromatography: basics, techniques and applications	3	2
	3.3	Characterization Techniques- Mass spectrometry: Principles and applications.	2	2
	3.4	Introduction to Biochemical Mathematics: Basics of mathematical concepts applied in biochemistry.	2	2
4	Practicals (30 hours)			
	4.1	Prepare and observe microscopic slides of different specimens of different types of plant cells	5	1
	4.2	Collect and evaluate micrographs from different types of microscopes	3	1
	4.3	Separate different cellular components from a given sample using centrifugation	4	2
	4.4	Estimate protein concentration using lowry's method	3	2
	4.5	Separate plant pigments using thin layer chromatography	5	2
	4.6	Lab visit: Visit a well-established lab with advanced bioinstrumentation facility	10	1,2,3,4
5	Teacher specific course components			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-
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	based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory: 25 marks ·Involvement and responses in class room transactions ·Home Assignments/preparedness ·Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (\leq 5 years) related the course ·Any other method as may be required for specific course / student by the course faculty</p> <p>Practical: 15 marks ·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty</p>
	<p>B. End Semester Evaluation (ESE) Theory: 50 marks Short answer (10 out of 12): $10 \times 1=10$ Short Essay (6 out of 8) : $6 \times 5= 30$ Essay (1 out of 2) : $1 \times 10= 10$</p> <p>Practical: 35 marks ·Practical based assessments: 30 marks ·Record: 5 marks</p>

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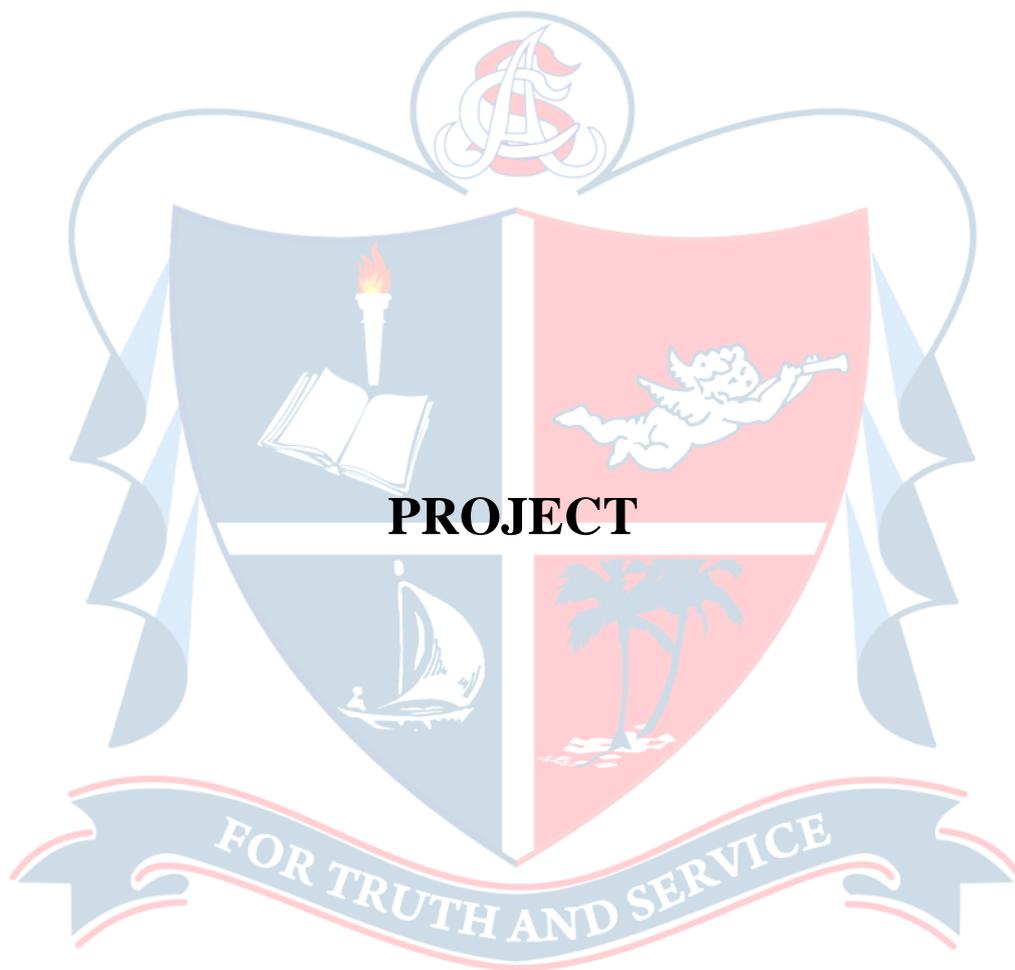
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Suggested readings

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Department of Botany St. Albert's College (Autonomous) Ernakulam

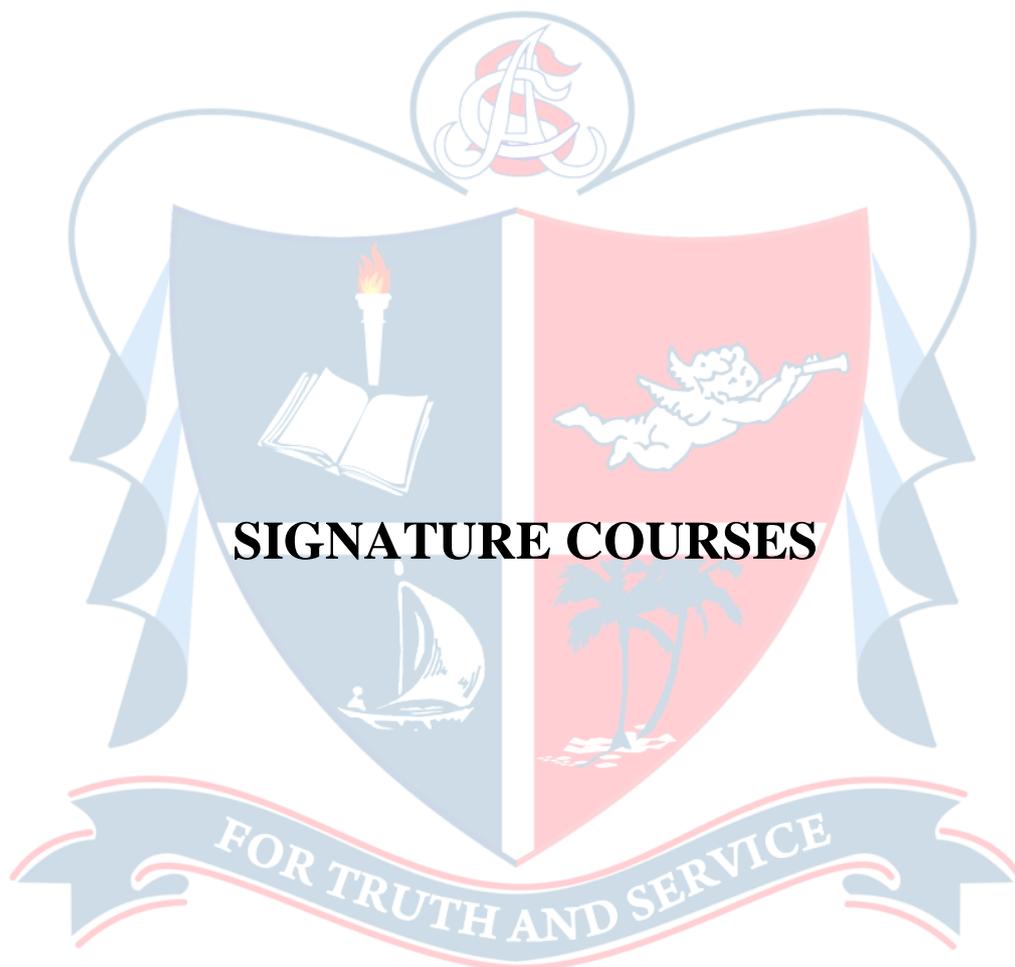
Programme	BSc.(HONOURS) BOTANY
Course Name	PROJECT
Course Code	24SACBOT8PR401
Summary	<p>The project undertaken in the 8th semester is a crucial element of an individual's academic journey, providing hands-on experience and a deep dive into practical applications of their field of study. This project allows students to synthesize their knowledge, tackle real-world problems, and develop innovative solutions, enhancing their technical proficiency and research capabilities. Working closely with scientists, faculty members, researchers and industry experts, in a collaborative environment, students gain invaluable insights and professional skills. This culminating experience not only reinforces their academic learning but also prepares them for future careers or advanced studies, ensuring they are well-equipped to meet the demands of their chosen professions</p>
Project with 12 credits (200 marks)	<p>A) Continuous Comprehensive Assessment (CCA) :60 marks (If the student is doing project in any institutions out side the college, internal marks may be obtained from the project supervisor of that institute)</p> <p>a. Project Proposal (10 marks) Criteria:</p> <ul style="list-style-type: none"> • Clear definition of the project objectives and scope. • Feasibility and relevance of the project topic. • Detailed methodology and work plan. <p>b. Literature Review (10 marks) Criteria:</p> <ul style="list-style-type: none"> • Depth of literature review. • Critical analysis of existing research. <p>c. Methodology and experimental design(15marks) Criteria:</p> <ul style="list-style-type: none"> • Appropriateness of methodology • Robustness of the chosen methodology • Experimental Designs- Controls and variables <p>d. Data collection and analysis(15 marks) Criteria:</p> <ul style="list-style-type: none"> • Quality of Data collection • Data Analysis techniques • Critical analysis and interpretation of data.

	<p>e. Professionalism and Team work(5 marks) Criteria:</p> <ul style="list-style-type: none"> • Punctuality • Ability to work independently and as part of a team • Creativity and ethical conduct • Adherence to work place rules <p>f. Supervisor Evaluation (5 marks) Criteria:</p> <ul style="list-style-type: none"> • Feedback from the internship supervisor regarding the intern's performance, growth, and contributions. • Supervisor's overall satisfaction with the intern's work and professionalism <p>(B) End Semester Evaluation (ESE): 140 marks</p> <p>a. Introduction, novelty and relevance of the project. (20 marks) Criteria:</p> <ul style="list-style-type: none"> • Clarity and comprehensiveness of the project • Novelty of the project. • Relevance and depth of background information. <p>b. Objective and Literature Review (10 marks) Criteria:</p> <ul style="list-style-type: none"> • Clarity and relevance of the objectives • Depth of literature review. • Critical analysis of existing research. • Identification of Research gaps <p>c. Methodology and Experimental Work (20 marks) Criteria:</p> <ul style="list-style-type: none"> • Clarity and description of methodology • Depth of literature review. • Critical analysis of existing research. • Identification of Research gaps <p>d. Data collection and presentation (15 marks) Criteria:</p> <ul style="list-style-type: none"> • Clarity and description of methodology • Depth of literature review. • Critical analysis of existing research. • Identification of Research gaps <p>e. Results (10 marks)</p> <ul style="list-style-type: none"> • Clarity, accuracy and presentation of results <p>f. Discussion (10 marks)</p> <ul style="list-style-type: none"> • Depth and insightfulness of discussion • Interpretation of results <p>g. Conclusion and future prospects (10 marks)</p> <ul style="list-style-type: none"> • Summary of findings • Recommendation for future work <p>h. References (10 marks)</p> <ul style="list-style-type: none"> • Uniformity of style. <p>i. Presentation (30 marks)</p> <ul style="list-style-type: none"> • Clarity, logical structuring • Formatting- grammar and spelling
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	<p>j. Viva Voce (5 marks)</p> <ul style="list-style-type: none"> • Description, explanation, handling of questions and critical thinking, ability to communicate ideas clearly and coherently
<p>Project with 8 credits (100 marks)</p>	<p>A) Continuous Comprehensive Assessment (CCA): 30 marks (If the student is doing project in any institutions out side the college, internal marks may be obtained from the project supervisor of that institute)</p> <p>a. Project Proposal (3 marks) Criteria:</p> <ul style="list-style-type: none"> • Clear definition of the project objectives and scope. • Feasibility and relevance of the project topic. • Detailed methodology and work plan. <p>b. Literature Review (2 marks) Criteria:</p> <ul style="list-style-type: none"> • Depth of literature review. • Critical analysis of existing research. • Identification of Research gaps <p>c. Methodology and experimental design (10 marks) Criteria: Appropriateness of methodology Robustness of the chosen methodology Experimental Designs- Controls and variables</p> <p>d. Data collection and analysis (10 marks) Criteria:</p> <ul style="list-style-type: none"> • Quality of Data collection • Data Analysis techniques • Critical analysis and interpretation of data. <p>e. Professionalism and Team work (3 marks) Criteria:</p> <ul style="list-style-type: none"> • Punctuality • Ability to work independently and as part of a team • Creativity and ethical conduct • Adherence to work place rules <p>f. Supervisor Evaluation (2 marks) Criteria:</p> <ul style="list-style-type: none"> • Feedback from the internship supervisor regarding the intern's performance, growth, and contributions. • Supervisor's overall satisfaction with the intern's work and professionalism <p>B) End Semester Evaluation (70 marks)</p> <p>a. Introduction, novelty and relevance of the project. (10 marks) Criteria:</p> <ul style="list-style-type: none"> • Clarity and comprehensiveness of the project • Novelty of the project. • Relevance and depth of background information. <p>b. Objective and Literature Review (5 marks) Criteria:</p> <ul style="list-style-type: none"> • Clarity and relevance of the objectives

<ul style="list-style-type: none">• Depth of literature review.• Critical analysis of existing research.• Identification of Research gaps <p>c. Methodology and Experimental Work (10 marks)</p> <p>Criteria:</p> <ul style="list-style-type: none">• Clarity and description of methodology• Depth of literature review.• Critical analysis of existing research.• Identification of Research gaps <p>d. Data collection and presentation (10 marks)</p> <p>Criteria:</p> <ul style="list-style-type: none">• Clarity and description of methodology• Depth of literature review.• Critical analysis of existing research.• Identification of Research gaps <p>e. Results (5 marks)</p> <ul style="list-style-type: none">• Clarity, accuracy and presentation of results <p>f. Discussion (5 marks)</p> <ul style="list-style-type: none">• Depth and insightfulness of discussion• Interpretation of results <p>g. Conclusion and future prospects (3 marks)</p> <ul style="list-style-type: none">• Summary of findings• Recommendation for future work <p>h. References (2 marks)</p> <ul style="list-style-type: none">• Uniformity of style. <p>i. Presentation (15 marks)</p> <ul style="list-style-type: none">• Clarity, logical structuring• Formatting- grammar and spelling <p>j. Viva Voce (5 marks)</p> <p>Description, explanation, handling of questions and critical thinking, ability to communicate ideas clearly and coherently</p>







Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT INTERACTIONS					
Type of Course	DSE					
Course Code	24SACBOT5DE307					
Course Level	300					
Course Summary	The course intends to delve into the interactions of plants with other organisms like fungi, bacteria, viruses and animals. The course will give a better insight into the ecological significance of such interactions and their role in maintaining ecosystems. Ultimately the course will give an idea as to how these interactions impact on plant biotechnology, genetics, ecology and crop productivity. There will be a glimpse of the role Artificial Intelligence can play in improving crop performance.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	The students will know interactions between plants and other organisms.	K, U	1
2	The students will explain the positive and negative effects of interactions between plants and other organisms.	U, An	1,2

3	The students will analyse and interpret the significance of interactions in stabilizing ecosystems.	A, An	1,2,4
4	The students will appraise the role of interactions in agricultural productivity.	A, An	1,2,4
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Plant Interactions (General) and Plant Microbe Interactions- I (17 hrs)			
	1.1	Plant Interactions: Introduction and Key concepts, Types	2	1
	1.2	Natural Selection and Interactions: Factors behind natural selection and significance of interactions	2	3
	1.3	Plant-Plant interactions: Positive and negative. Allelopathy. Role of VOCs.	2	3
	1.4	Horizontal Gene Transfer: Role in adaptation and evolution	1	1
	1.5	Plant Virus Interactions: Viral movements, general response of plants to viruses, defense mechanisms	3	1, 2
	1.6	Plant Bacteria Interactions	3	1, 2
	1.7	Harmful Bacteria: Pathogens, invasion and disease	2	1, 2
	1.8	Beneficial Bacteria: Nitrogen fixation and other roles; Rhizosphere and PGPR	2	1, 2
2	Plant Microbe Interactions- II (15 hrs)			
	2.1	Plant Fungal Interactions: Positive and negative types	3	1, 2
	2.2	Fungal Endophytes: Diversity and Distribution	4	1, 2

	2.3	Mycorrhiza: Types of mycorrhiza, nutrient uptake and plant growth	4	1, 2
	2.4	Lichens: Structure; types; Ecological and economic importance	4	1, 2
	Modern Approaches and Scope of Plant Science (18 Hours)			
3	3.1	Pollination: Interaction involved; The Aspect of Plant; Significance	2	2, 3
	3.2	Pollination: The Aspect of Pollinator; types of pollinators	3	2, 3
	3.3	Major Pollinators and Pollination mechanisms	3	2, 3
	3.4	Pollination by abiotic agents	2	2, 3
	3.5	Plant Insect interactions (other than pollination)	3	1, 2
	3.6	Interactions with other animals and their impact	3	1, 2
	3.7	Defaunation & Anachronism in plants	2	1, 2, 3
	Ecological Relevance of Plant Interactions (10 hrs)			
4	4.1	Ecosystem Function: Plants as a part of Ecosystem and their role in stability of ecosystems	4	3
	4.2	Significance in crop productivity	3	4
	4.3	Prospects in agriculture: Interventions of AI in plant growth promotion	3	4
5	Teacher specific course components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
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Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course · Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> · Lab involvement and practical skills · Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1 = 10$</p> <p>Short Essay (6 out of 8): $6 \times 5 = 30$</p> <p>Essay (1 out of 2): $1 \times 10 = 10$</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> · Practical based assessments: 30 marks · Record: 5 marks

References

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Suggested readings:

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Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	MEDICINAL PLANTS FOR PRIMARY HEALTH CARE					
Type of Course	DSE					
Course Code	24SACBOT5DE308					
Course Level	300					
Course Summary	Plants are used as a source of medicine from time immemorial. They are an important source of unique active principles used for curing a plethora of diseases. This course provides an insight into the wide array of medicinal plants renowned for their medicinal properties found in the surroundings, their identification, traditional uses, modern applications and side effects. This course empowers the student to raise their apothecary in their homesteads. Explore the vivid medicinal plants and embark on a journey of wellness and connection with nature.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Learning Approach	
		3	0	1		60
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify the wide array of medicinal plants in their locality	U	1
2	Describe the healing properties of medicinal plants	U	1,3
3	Incorporate herbal remedies into daily life .	A	2
4	Develop a homestead medicinal garden.	S	6

5	Develop skill to identify medicinal plants suitable for disease conditions.	S	2,10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Introduction to herbal medicines ,Initiatives for promotion of medicinal plants (15 hours)			
1	1.1	Herbal medicines: history and scope - definition of medical terms	2	1,2
	1.2	Role of medicinal plants in Ayurveda, Naturopathy , Sidha , Unani systems of medicine;	4	2, 3
	1.3	Introduction to basic concepts of folk medicine, methods of disease diagnosis and treatment.	2	2,3
	1.4	Promotion of medicinal plant sector at national level: National Medicinal Plant Board and State Medicinal Plant Boards - objectives and functions.	3	1
	1.5	Other organizational initiatives for promotion of MAPs at National and International levels	3	1
	1.6	Medicinal plant bank, role of CIMAP , IMPPAT ,OSADI, DIMSAR, GEBMAP	1	1
	Applications of medicinal plants (11hours)			
2	2.1	Medicinal plants used in treatment of livestock diseases	2	1,3
	2.2	Medicinal plants as plant growth regulators	2	1,3
	2.3	Medicinal plants in cosmetic industry, plants in aromatherapy .	4	1,3
	2.4	Plant based pesticides. Plants as food – nutraceuticals	1	4
	2.5	Demand and supply of medicinal plants. Herbal industries.	2	1
3	Plants in human health care (19 hours)			

3	3.1	Plants and human health with special reference to Plants in infant care— <i>Ruta graveolens</i> , <i>Coleus aromaticus</i> Plants in women health care- <i>Sida rhombifolia</i> , <i>Asparagus racemosus</i> , Plants in geriatric care- <i>Embllica officinalis</i> , <i>Terminalia chebula</i> Plants as brain stimulants - <i>Centella asiatica</i> , <i>Baccopa monierri</i> .	8	1,3
	3.2	Plants as antimicrobials, antipyretics, analgesics, antirheumatics, immunomodulators.	7	1,3
	3.3	Medicinal gardening – common medicinal plants in Kerala homesteads , propagation and maintenance.	2	4
	3.4	Poisonous plants - Types of plant poison; action of poisons; treatment of poisons; some poisonous plants; their toxicity and action	2	4
Practicals (15 hrs)				
4	4.1	Make any two plant based products which can be used as medicine, cosmetics, food.	7	2,3,4,5
	4.2	Make an album of medicinal plants in homesteads in your locality.	8	4,5
5	Teacher specific course components			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.
Assessment Types	MODE OF ASSESSMENT C. Continuous Comprehensive Assessment (CCA) Theory: 25 marks ·Involvement and responses in class room transactions ·Home Assignments/preparedness ·Oral presentation/Viva/Quiz/Open book test/written test Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course ·Any other method as may be required for specific course / student by the

	<p>course faculty</p> <p>Practical: 15 marks</p> <ul style="list-style-type: none"> ·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty
	<p>D. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): 10 x 1=10</p> <p>Short Essay (6 out of 8): 6 x 5= 30</p> <p>Essay (1 out of 2): 1x 10= 10</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> ·Practical based assessments: 30 marks . Record: 5 marks

References

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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT DEVELOPMENT					
Type of Course	DSE					
Course Code	24SACBOT5DE309					
Course Level	300					
Course Summary	Plant development is the process by which structures originate and mature as a plant grows. It encompasses the study of how complex multicellular plants are developed from a single zygotic cell. This course provides an overview of mechanisms underlying the meristem function during growth and development, cell specification, differentiation and organogenesis in the flowering plants. It also describes the approaches used to study plant development. Much of Developmental Biology research in recent decades has focused on the use of model organisms like <i>Arabidopsis thaliana</i> that has been included in brief. This course will be highly useful for the students to enhance their knowledge and develop their research interest in the field of Developmental Biology.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		60
Pre-requisites, if any	Should have basic knowledge of Botany and Botanical skills					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Define the basic concepts in plant development	K	1
2	Explain the processes involved in the lifecycle of Angiosperms	U	1,3
3	Describe the palynological aspects and pollination mechanisms	U	1

4	Apply the knowledge of NPC system to identify pollen grains, as well as identify the types of anthers, ovules, embryos, endosperm and seeds	Ap	1,2
5	Analyse the role of homeotic genes in floral development	An	1,2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to plant development (12 hours)				
1	1.1	Processes involved: Cell division, elongation and differentiation; Mechanism of differentiation; Factors affecting differentiation; Significance of differentiation;	6	CO1
	1.2	Cell fate, potency and commitment; Stem cells; Meristems: Characteristics, types based on position and activity;	5	CO1
	1.3	Model organism for developmental studies (<i>Arabidopsis thaliana</i> -brief account only)	1	CO1
Life cycle of Angiosperms: Pre- and Post-fertilization events (28 hours)				
2	2.1	Flower: Essential organs, their structure, types and function; Pre-fertilization events in anther: Development, structure and types of anthers, microsporogenesis (pollen tetrad formation, types of tetrads) and microgametogenesis (pollen germination, pollen tube formation)	6	CO2
	2.2	Palynological aspects: Pollen morphology, exine sculpturing, pollenkitt, NPC system of classification; Pollination: Definition, types, agents (abiotic and biotic), adaptation of flowers to the mode of pollination	5	CO3
	2.3	Pre-fertilization events in ovule: Development, structure and types of ovules, megasporogenesis (megaspore formation) and megagametogenesis (embryo sac development, types: monosporic, bisporic and tetrasporic)	6	CO2

	2.4	Double fertilization: Syngamy and triple fusion, their significance	1	CO2
	2.5	Post-fertilization events: Embryo development: types of embryogeny, dicot and monocot embryogeny, Endosperm development, types, Xenia and Metaxenia; Polyembryony: types, causes and significance	6	CO2
	2.6	Seed: dormancy (types, causes, importance) germination (types, requirements); Apomixis and Parthenogenesis	4	CO2
Morphogenesis and Organogenesis in Plants (5 hours)				
3	3.1	Organogenesis in plants, transition to flowering, floral meristems	2	CO5
	3.2	Floral development, Homeotic genes in plants; ABC model of floral development	3	CO5
4	Practicals (15 hours)			
	4.1	Dissection of flower to study the essential organs Types of anthers, ovules, embryos, endosperm and seeds Identification of pollen based on NPC formula Pollen germination studies Dissection of embryo Seed germination studies	15	CO4
5.	Teacher specific course content			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> · Involvement and responses in class room transactions · Home Assignments/preparedness · Oral presentation/Viva/Quiz/Open book test/written test <p>Field study report /Group discussion on a recent research or review</p>

	<p>article (≤ 5 years) related the course</p> <ul style="list-style-type: none"> ·Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> ·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. Semester End examination</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): 10 x 1=10</p> <p>Short Essay (6 out of 8): 6 x 5= 30</p> <p>Essay (1 out of 2): 1x 10= 10</p> <p>Practical: 35 marks</p> <ul style="list-style-type: none"> ·Practical based assessments: 30 marks · Record: 5 marks

References:

1. Bob B Buchanan, Wilhelm Gruissem, Russel L Jones (2000). Biochemistry and Molecular Biology of Plants. L K International Pvt. Ltd.
2. Lincoln Taiz, Eduardo Zeiger (2002). Plant Physiology (II Edn). Sinauer Associates, Inc. Publishers.
3. Maheswari P (1950). An Introduction to the Embryology of Angiosperms. McGraw Hill.
4. R M Twyman (2001). Instant notes in Developmental Biology. Viva Books Private Limited.
5. Robert J Brooker (2009). Genetics: Analysis & Principles (III Edn.). McGraw Hill
6. S S Bhojwani, S P Bhatnagar (1999). The Embryology of Angiosperms (IV Edn). Vikas Publishing House Pvt Ltd.
7. Scott F Gilbert (2000). Developmental Biology (VIII Edn). Sinauer Associates.
8. Scott F Gilbert (2000). Developmental Biology (IX Edn). Sinauer Associates.



Department. of Botany St. Albert's College (Autonomous), Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	BIO-RESOURCES AND ECO-TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT					
Type of Course	SEC					
Course Code	24SACBOT5SE302					
Course Level	300					
Course Summary	The course Bio-resources and Eco-technologies for sustainable development is designed in such a way to develop skills in graduate-level students to use and prepare bio-resources and eco-technologies (eco – friendly bio-formulations) for sustainable development. The course deals with important categories of micro and macroscopic agents that can act as biofertilizers and biocontrol agents, their preparation and application methods. The course will certainly contribute to the knowledge/ skill and economic growth of the learner.					
Semester	V	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		-		45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Relate the different concepts and approaches of sustainable agriculture / Sustainable development	U	PO3,PO7,PO8
2	Fundamental understanding of the bio-resources and its applications for attainment of social objectives (energy, environment, product, sustainability).	U	PO7,PO8, PO9,
3	Acquire knowledge with respect to the properties of the bio-resources and the eco-technologies.	A	PO1, PO2, PO3, PO9,

4	Exhibiting knowledge of the systems used for bio-resources and eco-technologies contributing for sustainable development.	A/	PO3,PO7,PO8
5	Practice bio-formulation production and their application methods in sustainable crop production / development.	U/A/S	PO1, PO2, PO3, PO9,
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Module 1. Ecotechnology for Sustainable Development	1.1	Introduction to bio-resources and eco-technologies for Sustainable agriculture/ development.	1	CO1
	1.2	Sustainable Agriculture/ development definition and scope. Sustainable Development Goals.	1	CO1
	1.3	Different approaches of sustainable agriculture/ natural farming: organic farming .	1	CO1
Module-2: Biofertilizers and Biocontrol agents	2.1	Biofertilizers: Concept, types and prospects; Bacterial biofertilizers — morphology, isolation, cultivation, association, inoculation and methods of application of Azotobacter, Rhizobium.	4	CO3/CO4/CO 5
		Learning activity: Hands-on training on isolation and culturing and use of rhizobium culture	3	

	2.2	<p>Phosphorous Solubilising Microorganisms (PSMs): Introduction, isolation, culture, mass production and inoculation of Trichoderma.</p> <p>Arbuscular Mycorrhizas (AM): Morphology, association, cultivation, inoculation, role and application.</p> <p>Learning activity- 1.Hands on experience in the local production and use of trichoderma, Mass multiplication process of Trichoderma.</p> <p>2.Identification and estimation of arbuscular mycorrhizal infection in roots.</p>	4 3 3 2	CO3/CO4/CO 5
	2.3	<p>Cyanobacteria and Azolla as Biofertilizers: Morphology, association, cultivation and inoculation; Factors affecting biofertilizer efficiency; Mass production and quality control of biofertilizers.</p>	3	CO3/CO4/CO 5
	2.4.	<p>Biopesticides: Definition, types, merits and demerits; Biofungicides-fungal fungicides, fungal nematicides (Examples, role and application).Bioherbicides: concept, current status and prospects; Mass production and commercial formulations; Role of bio-control agents in Integrated Pest Management.</p> <p>Learning activity: Preparation of any three local plant based biopesticides and its usage</p>	4 3	CO3/CO4/CO 5
	2.5	<p>Bacterial insecticides: Classification and mode of action with special reference to Bacillus thuringensis; Methods of uses and symptoms of infection. Fungal and viral insecticides: Biology and their use in insect control; Commercial formulations.</p>	4	CO3/CO4/CO 5

Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA) Theory/ Hands on Work- 25 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE) Theory: 50 marks</p> <p>Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8): 6 x 5= 30 Essay (1 out of 2): 1x 10= 10</p>

Suggested Readings:

1. Kumaresan v and Arumugam N, 2015. Bioresources. Saras Publications, Nagercoil. P230.
2. Kaushik, B. D., Kumar, D., & Shamim, M. (Eds.). (2019). Biofertilizers and biopesticides in sustainable agriculture. CRC Press.
3. Mason, J. (2003). Sustainable agriculture. Landlinks Press.
4. Nick, B. & Glare, T. (2020). Biopesticides for sustainable agriculture. Burleigh Dodds Science Publishing.
5. Arora, N. K., Mehnaz, S., & Balestrini, R. (Eds.). (2016). Bioformulations: for sustainable agriculture (pp. 1-283). Berlin: Springer.
6. Giri, B., Prasad, R., Wu, Q. S., & Varma, A. (Eds.). (2019). Biofertilizers for sustainable agriculture and environment. Cham: Springer International Publishing.
7. Kannaiyan, S. (Ed.). (2002). Biotechnology of biofertilizers. Springer Science & Business Media.
8. Aziz, A., Beg, M.R. (2022). Green Building: Future Ahead. In: Agarwal, P., Mittal, M., Ahmed, J., Idrees, S.M. (eds) Smart Technologies for Energy and Environmental Sustainability.
9. Green Energy and Technology. Springer, Cham. https://doi.org/10.1007/978-3-030-80702-3_10.
10. Vinutha bai, N., R. Ravindra, (2014) *Energy efficient and green technology concepts, International Journal of Research in Engineering and Technology* p 253-258, Volume: 03 Special Issue: 06 eISSN: 2319-1163 pISSN: 2321-7308.
11. Arceivala, S.L. (2014). *Green Technologies: For a Better Future*. Mc-Graw Hill Publications



Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	BOTANICAL ILLUSTRATION AND PRESERVATION TECHNIQUES					
Type of Course	SEC					
Course Code	24SACBOT5SE303					
Course Level	300					
Course Summary	<p>The course has been designed for genuinely interested students who want to develop their ability to draw and paint plants in their natural form. The course aims to develop the knowledge of the flora through field studies as well as botanical illustration. This is a course where botanical illustration is studied at a basic level. Morphological and anatomical studies in plants are linked to the botanical illustrations that the students themselves work with. The students would develop skills in botanical illustration based on their own perception and conscious vision. The dry and wet preservation techniques are required for future reference in herbaria and museums. Dried or preserved plant materials complement any home decor in both formal and informal arrangements which require very little care and last almost indefinitely if done carefully. Flower arrangements, wreaths, pressed pictures, potpourri and wall hangings are just some of the creative possibilities with preserved plant materials.</p>					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	-	1	60
Pre-requisites, if any	Previous basic knowledge of plant morphology and anatomy, along with requirements related to art.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Define the basic terminology used to describe plants as	K	1

	well as the elements and principles associated with art.		
2	Explain the various techniques related to pencil, colour pencil and water colours.	U	1,3
3	Describe the different methods of plant preservation.	U	1,2
4	Analyse and apply the most suitable method of preservation for the particular collected plant specimens.	A/An	1,2
5	Create a portfolio of botanical illustrations using observation and drawing skills of any plant of interest.	C/S	1,3,4
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	History of Botanical Art and an Introduction to the Angiosperms (18 hours)			
1	1.1	History of botanical art inside and outside India with special reference to Hortus Malabaricus; Contribution of Prof. Manilal and Dr. V.V. Sivarajan to plant taxonomy; Introduction to some indigenous and exotic plants and their binomial nomenclature;	3	CO1
	1.2	Plant morphology in Dicots and Monocots: Habit, Shoot system- Leaf, flower, inflorescence, fruit and Root system;	8	CO1
	1.3	Plant anatomy in Dicots and Monocots: Tissues in stem, root and leaf: simple and complex	7	CO1
	Basic art elements and principles (18 hours)			
2	2.1	Basic art elements and principles: line, shape, form, texture, tone, proportion, scale and composition	4	CO1, CO2
	2.2	Sketches in pencil and colour pencil; colour layering, blending, shading, adding depth and perspective	5	CO1, CO2, CO5
	2.3	Water colouring techniques: colour mixing, flat and graded washes, highlights and dry brush detail, soft	5	CO1, CO2, CO5

		and hard edges;		
	Plant preservation techniques (9 hours)			
3	3.1	Plant preservation techniques and their significance: wet (for museum specimens) and dry (herbarium methodology)	6	CO3, CO4
	3.2	Alternative techniques- freeze-drying, dessicants like silica gel, epoxy resin.	3	CO3, CO4
	Hands-on training (15 hours)			
4		<ol style="list-style-type: none"> 1. Field trip or nature walk for observation and collection of plant specimens. 2. Dissection and/ or sectioning of parts of various plants collected for observation. 3. Sketching and/ or colouring of the individual plant parts using pencil, colour pencil and water colours, and labelling them. 4. Botanical illustration of an entire plant with all prominent parts (Portfolio to be created and submitted). <p>Preservation methods- any one wet and one dry technique to be carried out (Both specimens to be submitted).</p>	30	CO1, CO2, CO3, CO4, CO5
	Teacher specific course content			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Interactive lectures, Group discussions, Problem-based learning, Flipped classroom, Discussion-based Learning, Case-based Learning, Experiential Learning, Inquiry-Based Learning, Game-Based Learning, Socratic Method, Peer Teaching, Simulations, Online Learning, Blended Learning, and other innovative approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/ Hands on Work- 25 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments

	<ul style="list-style-type: none"> ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty
	<p style="text-align: center;">B. End Semester Evaluation (ESE) Theory: 50 marks Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8): 6 x 5= 30 Essay (1 out of 2): 1x 10= 10</p>

References:

1. Adelene Fletcher, (2018) Kew: The Watercolour Flower Painter's A to Z: An Illustrated Directory of Techniques for Painting 50 Popular Flowers, Search Press
2. B P Pandey, (2022) College Botany - Volume III, S Chand
3. B P Pandey, (1987) A Textbook of Botany: Angiosperms, S Chand
4. Christabel King, (2015) The Kew Book of Botanical Illustration, Search Press
5. Martyn Rix, (2021) Indian Botanical Art: An Illustrated History, Roli Books
6. V V Sivarajan & Indira Balachandran, (1994) Ayurvedic Drugs and their Plant Sources, Oxford and IBH Publishing Co. Pvt. Ltd.
7. V V Sivarajan, (1991) Introduction to the Principles of Plant Taxonomy, Cambridge University Press
8. Wendy Hollender, (2020) The Joy of Botanical Drawing: A Step-by-Step Guide to Drawing and Painting Flowers, Leaves, Fruit, and More, Watson-Guptill
9. Wilfrid Blunt & William Stearn, (2021) Botanical Art Techniques: A Comprehensive Guide to Watercolor, Graphite, Colored Pencil, Vellum, Pen and Ink, Egg Tempera, Oils, Printmaking, and More, 2020, American Society of Botanical Artists, Timber Press



Department of Botany St. Albert's College (Autonomous) Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	MOLECULAR TAXONOMY AND SYSTEMATICS					
Type of Course	DSE					
Course Code	24SACBOT6DE305					
Course Level	300					
Course Summary	Plant Taxonomy is fundamental to all other Biological studies. It is a synthetic discipline taking inputs from other branches. Present course provides an understanding on the aims, different components of taxonomy and systematics, its methods, advancements and relevance in the contemporary period.					
Semester	VI	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	2		75
Pre-requisites, if any	Basic knowledge in morphological terms and classical taxonomy					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the modern tools and techniques employed in molecular systematics.	K	1
2	Interpret phylogeny, evolution and biodiversity conservation using morphological, molecular data	U	1,2
3	Develop skills in plant identification, floristic work and curation.	A, An	1,2
4	Explore possible applications and future research potentiality in plant systematics.	A	1,2

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Fundamentals of Molecular Systematics (11 Hours)				
1	1.1	Fundamentals and importance- Classical taxonomy as base for molecular systematics. Applications of molecular systematics.	1	2
	1.2	Phylogeny of angiosperms- Terms and concepts: primitive and advanced, homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly and clades. Introduction of Angiosperms Phylogeny- Group Classification- Basal; petaloid and commelinid monocots; Eudicots; Superrosids; Superasterids. (a brief account on the characteristics and evolutionary trends of clades)	6	2, 3
	1.3	Cladistic Taxonomy: Concept; Use of morphological, molecular and data from other branches in cladistics; Taxon and character selection; Character clans; Character stage; Cladogram analysis.	4	1, 2
Methodologies in Molecular Systematics (9 Hours)				
2	2.1	Molecular systematics- Concepts and methods- Collection and storage of cells and tissues; Methods of estimating genetic diversity- molecular markers (Isozymes, RFLP, RAPD).	3	1,2, 3, 4
	2.2	Generating molecular data- gene mapping; gene sequencing; analysis of molecular data- alignment of sequences, homoplasy. phylogeny reconstruction, gene trees, species trees, role of Chloroplast and Mitochondrial DNA in systematics; Role of RNA in systematics; DNA barcoding.	6	1,2, 3, 4
Modern Trends in Plant Systematics and Geographical distribution (10 Hours)				
3	3.1	Computer aided taxonomy- Virtual herbaria; Taxonomic databases- need for such databases; Taxonomic Information Systems; Tree of life; Taxonomic Databases Working Groups (TDWG) Database at Royal Botanical Garden; ETI database; Taxonomic softwares- Linnaeus, Darwin, Species 2000, SA 2000; Databases on biodiversity.	6	1, 3, 4
	3.2	Biogeography - Basic terminologies; Continental drift; Endemism- types and causes; Vicariance; Dispersal; Phytogeographic regions of India and the	4	2, 4

		world. Phytogeography and applications; IUCN Red List, Conservation priorities.		
4	Teacher-specific course components (15 Hours)			
5	Practical (30 Hours)			
		<ul style="list-style-type: none"> • Preparation of descriptive statistics table in systematics • To construct dendrograms/ cladograms using suitable software of a family or genus • Familiar with virtual herbaria • Familiar with various databases/ softwares used in systematics • Visit to BSI/ centers of molecular taxonomic research and submit a report. 		

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> • Involvement and responses in class room transactions • Home Assignments/preparedness • Oral presentation/Viva/Quiz/Open book test/written test • Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course • Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p> <ul style="list-style-type: none"> • Lab involvement and practical skills • Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks</p> <p>Short answer (10 out of 12): $10 \times 1=10$</p>

	<p>Short Essay (6 out of 8): 6 x 5= 30 Essay (1 out of 2): 1x 10= 10 Practical: 35 marks .Practical based assessments: 30 marks . Record: 5 marks</p>
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References

- Simpson MG. 2006. *Plant Systematics*. Elsevier, Amsterdam.
- Jones, Jr. S.B. and Luchsinger, A.E. 1986. *Plant Systematics*. 2 nd edition. McGraw-Hill Book Co., New York.
- Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. and Donoghue, M.J. 2002. *Plant Systematics - A Phylogenetic Approach*. 2 nd edition. Sinauer Associates Inc., Cary, NC
- Angiosperm Phylogeny Group. 2016. An Update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants: APG IV, Botanical Journal of the Linnaean Society 181:1- 20.
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- Crawford, D.J. 2003. *Plant Molecular Systematics*. Cambridge University Press, Cambridge, UK
- Nei, M. and Kumar S. 2000. *Molecular Evolution and Phylogenetics*. Oxford University Press, New York.
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- Soltis, D., Soltis P., Endress, P., Chase M.W., Manchester S., Judd W., Majure L., and Mavrodiev, E. 2017. *Phylogeny and Evolution of Angiosperms* (Revised and Updated edition). University of Chicago Press: 1427 E. 60th Street Chicago, IL 60637 USA.
- Lawrence, G.H.M. 1951. *Taxonomy of Vascular Plants*. MacMillan, New York.
- Stace, C.A. 1989. *Plant Taxonomy and Biosystematics*. 2 nd edition. Hodder Arnold, London.
- Radford, A.E. 1986. *Fundamentals of Plant Systematics*, Harper & Row Publications, USA.

	<h2 style="margin: 0;">Department of Botany</h2> <h1 style="margin: 0;">St. Albert's College (Autonomous)</h1> <h2 style="margin: 0;">Ernakulam</h2>
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Programme	BSc.(HONOURS) BOTANY					
Course Name	BIOLOGICAL TECHNIQUES AND INSTRUMENTATION					
Type of Course	DSE					
Course Code	24SACBOT6DE306					
Course Level	300					
Course Summary	The course gives a wide exposure on the various tools and techniques used in biological sciences. It is designed in such a way that it caters students from all streams of knowledge. A pragmatic approach is followed in designing the curriculum. The curriculum includes the working principles and applications of the inevitable tools and techniques of biological sciences.					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		3		1		60

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the basic working principle of various tools and techniques used in biological studies and use them to acquire data, and design experiments.	K,U,A	1,2
2	Apply the biophysical knowledge and principles to interpret experimental data	A	1,2
3	Draw scientific conclusions from the data obtained.	U, A	1,2
4	Demonstrate skills in biological techniques and operation of various instruments.	U,A	1,2,10

5	Undertake Research work independently with confidence.	U,C	1,2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Basic biological equipments and techniques				
1	1.1	Light microscopes- simple and compound; image formation in a compound microscope, resolving power	3	1,4
	1.2	Haemocytometer, colony counter, Pipettes, micropipettes – fixed, variable and multichannel; pH meter	3	1,2,3,4
	1.3	Separation techniques - Chromatography – General principle, Types – Paper chromatography, TLC	2	1,2,4,5
	1.4	Sterilization techniques – Laminar air flow chamber, wet heat and dry heat sterilization, Filter sterilization and chemical sterilization	2	1,4,5
	1.5	Tissue culture – Basic principles, culture media and applications	3	1,2,3,4,5
Advanced equipments and techniques				
2	2.1	Phase contrast and Electron Microscope	2	1,4
	2.2	Working principle and applications of Colorimeter and Spectrophotometer; Nanodrop	3	1,2,3,4,5
	2.3	Distillation, soxhlet extraction, rotary evaporator.	2	1,4,5
	2.4	Centrifugation-principle, types of centrifuges and applications	2	1,4,5
	2.5	Electrophoresis – Agarose and PAGE	2	1,2,3,4,5
	2.6	Column chromatography and HPLC	2	1,2,3,4,5

	2.7	DNA isolation – Principle and procedure of DNA isolation from plant material.	2	1,2,3,4,5
	2.8	Polymerase chain reaction – Thermal cycler, principle, working and application	2	1,2,3,4,5
3	Practicals 15 hours			
	3.1	Counting cells using haemocytometer	2	1,2,3,5
	3.2	Separation of amino acids using TLC	2	1,2,3,4,5
	3.3	Demonstration of separation of biomolecules using HPLC	3	1,2,3,4,5
	3.4	Demonstration of Agarose gel electrophoresis	3	1,3,4,5
	3.5	Isolation and quantification of Plant DNA	3	1,2,3,4,5
	3.6	Demonstration of PCR	2	1,2,3,4,5
4	Teacher specific components			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <p>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches.</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory: 25 marks</p> <ul style="list-style-type: none"> • Involvement and responses in class room transactions • Home Assignments/preparedness • Oral presentation/Viva/Quiz/Open book test/written test • Field study report /Group discussion on a recent research or review article (≤ 5 years) related the course • Any other method as may be required for specific course / student by the course faculty <p>Practical: 15 marks</p>

	<ul style="list-style-type: none"> ·Lab involvement and practical skills ·Record/Any other method as may be required for specific course / student by the course faculty
	<p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8): 6 x 5= 30 Essay (1 out of 2): 1x 10= 10</p> <p>Practical: 35 marks ·Practical based assessments: 30 marks . Record: 5 marks</p>

References

1. Vasantha Pattabhi and N.Goutham (2002) *Biophysics*. Kluwer Academic Publishers New York, Boston, Dordrecht, London, Moscow, Narosa Publishing House.
2. David Sheehan (2009) *Physical Biochemistry: Principles and Application*. Wiley-Blackwell
3. Bajpai P. K. *Biological instrumentation and methodology*. S. Chand & Co. Ltd.
4. Rodney Cotterill (2002) *Biophysics: An Introduction*. Wiley
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Department of Botany
St. Albert's College (Autonomous)
Ernakulam

Programme	BSc.(HONOURS) BOTANY					
Course Name	PLANT ECOLOGY AND ESSENTIALS OF ENVIRONMENTAL STUDIES					
Type of Course	VAC					
Course Code	24SACBOT6VA302					
Course Level	300					
Course Summary	<p>This course introduces ecology as a scientific discipline. By the end of the course, students should be familiar with ecological principles related to how plant populations & communities interact with their environments at local, regional, & global scales.</p> <p>The course provides an in-depth exploration of key topics in environmental sciences and an understanding of various forms of pollution, their sources, impacts on human health and the environment, and mitigation strategies. It will cover principles and practices of conservation biology, including the importance of biodiversity, ecosystem services, and the impacts of habitat destruction, invasive species, and climate change. Students will learn about conservation strategies and will examine environmental policies and laws. The course will explore the intersection of environmental sciences and human rights, including the right to a healthy environment, environmental justice, and the disproportionate impacts of environmental degradation. By fostering critical thinking and interdisciplinary approaches, students will be empowered to advocate for environmental justice and contribute to a more sustainable and equitable world.</p>					
Semester	6	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	-	-	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the basic concepts of plant ecology and environmental studies	U	PO1, PO2,PO6,PO7
2	Describe the adaptations of plants growing in various habitats	U	PO7
3	To understand the different types of vegetations and its relevance in ecosystem functioning and services	U/E	PO2, PO3, PO7
4	Critically assess the sustainable uses of resources and its utilization	E	PO7, PO8,PO9
5	Develop the relevance of responsible citizenship and duties with respect Environment, biodiversity and natural resources protection	A/I	PO7/PO9
6	Devise and develop sustainable Kerala developmental model with emphasis on hill land/ forest and tourism sectors	U/A	PO6/PO7,PO8, PO9
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
Module-1- Basics of Plant ecology, Environmental studies and Plant communities	1.1	Definition and scope of plant ecology, branches of ecology, ecological hierarchy-individual, population, community, ecosystem. Ecology v/s Environmental studies	2	CO1
	1.2	The environment, components of environment, Environment of plants, Climatic factors, Edaphic factors, topographic factors and biotic factors	2	CO1, CO2
	1.3	Types of ecosystems- Terrestrial (Grassland, desert and forest), Aquatic (freshwater and marine)	4	CO2, CO3
	1.4	Adaptations of plants- hydrophytes, xerophytes, epiphytes, halophytes with special reference to Mangroves (Morphological, anatomical and physiological).	5	CO2

	1.5	Plant succession, autecology and synecology (brief account only)	3	CO1,
	1.6	Units of vegetation, Plants as ecological indicators, Forests and forest management, Forest conservation	4	CO1
Module-2:Environment &Sustainable Development	2.1	Environmental studies general perspectives. Natural resources of environment	4	CO1
	2.2	Tools for environmental assessment- EIA, Environment audit, Environmental management system, environmental policy, Environmental risk assessment	4	CO4,CO5,CO6
	2.3.	Sustainable development- definition, principles. The three pillars of sustainability. Global Responses to Sustainable Development (Paris Convention- goals of Sustainable Development).	5	CO4
	2.4.	Indicators of sustainable development, a brief introduction to green technology . Sustainable development-Kerala model, Rainwater harvesting and responsible tourism.	5	CO4
Module-3:Environmental legislation and Laws	3.1.	Environment (protection) Act 1986 and Environment (Protection) Amendment Rules, (2023) Wildlife (protection) Act, 1972, amended in 2022, Forest (Conservation) Act, 1980, Forest (Conservation) Amendment Bill 2023 Biological Diversity (Amendment) Act, 2023 [brief account only].	4	CO5
	3.2.	Corporate Environmental Responsibility (brief account only)	3	CO5,CO6
Module-4	Teacher specific course components			

<p>Teaching and Learning Approach</p>	<p>Classroom Procedure (Mode of transaction)</p> <ul style="list-style-type: none"> ● Lectures ● Invited talks: Invite guest speakers from environmental organizations, human rights NGOs, and academia to share practical insights and experiences. ● Seminars ● Debate: Facilitate discussions and debates on ethical dilemmas related to environmental science and human rights. ● Technology Integration: Utilize technology for virtual field trips, data analysis, and collaboration on global environmental and human rights issues. ● Case Study: Learner has to present a case study of environmental issues. ● The learner has to identify the issue ● Distinguish the cause(s) ● Investigate the effects ● Evaluate the responses ● Educate/Propose solutions to mitigate the issue ● Project-Based Learning, Experiential Learning, Peer Teaching, group discussions, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches
<p>Assessment Types</p>	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p>Theory/Hands on Work- 25 Marks</p> <ul style="list-style-type: none"> ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty <p>B. End Semester Evaluation (ESE)</p> <p>Theory: 50 marks Short answer (10 out of 12): 10 x 1=10 Short Essay (6 out of 8): 6 x 5= 30 Essay (1 out of 2): 1x 10= 10</p>

References

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Suggested readings:

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2. Shireesh Pal Singh. 2011. Human Rights Education in 21st Century. Discovery Publishing House Pvt. Ltd. New Delhi.
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