



KANNUR UNIVERSITY
(Abstract)

B.Sc. Plant Science Programme-Scheme, Syllabus and Pattern of Question Papers of **Core and General Awareness Course** under Choice Based Credit and Semester System (Outcome Based Education System-OBE) in Affiliated colleges with effect from 2019 Admission-Implemented-Orders issued.

Academic Branch

No.Acad.C2/12611/2019/(i)

Civil Station P.O, Dated 22/06/2019

- Read:-
1. U.O.No.Acad.C2/429/2017 dated 10-10-2017
 2. The Minutes of the Meeting of the Curriculum Restructuring Committee held on 28-12-2018.
 3. U.O No. Acad.C2/429/2017 Vol.II dated 03-06-2019
 4. The Minutes of the Meeting of the Board of Studies in **Botany (UG)** held on 06/06/2019
 5. Syllabus of **B.Sc. Plant Science** Submitted by the Chairperson, Board of Studies in **Botany (UG)** dated 15/06/2019

ORDER

1. A Curriculum Restructuring Committee was constituted in the University vide the paper read (1) above to co-ordinate the activities of the Syllabus Revision of UG programmes in Affiliated colleges of the University.

2. The meeting of the Members of the Curriculum Restructuring Committee and the Chairpersons of different Boards of Studies held, vide the paper read (2) above, proposed the different phases of Syllabus Revision processes, such as conducting the meeting of various Boards of Studies, Workshops, discussion etc.

3. The Revised Regulation for UG programmes in Affiliated colleges under Choice Based Credit and Semester System (in OBE-Outcome Based Education System) was implemented with effect from 2019 Admission as per paper read (3) above.

4. Subsequently, as per paper read (4) above, the Board of Studies in **Botany (UG)** finalized the Scheme, Syllabus & Pattern of Question Papers for Core and General Awareness Course of **B.Sc. Plant Science** Programme to be implemented with effect from 2019 Admission.

5. As per paper read (5) above, the Chairperson, Board of Studies in **Botany (UG)** has submitted the finalized copy of the Scheme, Syllabus & Pattern of Question Papers of **B.Sc. Plant Science** Programme for implementation with effect from 2019 Admission.

6. The Vice Chancellor after considering the matter in detail and in exercise of the powers of the Academic Council conferred under Section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with accorded sanction to implement the Scheme, Syllabus & Pattern of Question Papers(Core and General Awareness Course) of the **B.Sc. Plant Science** programme under Choice Based Credit and Semester System(in OBE-Outcome Based Education System) in the Affiliated colleges under the University with effect from 2019 Admission, subject to reporting to the Academic Council.

7. The Scheme, Syllabus & Pattern of Question Paper of the **B.Sc. Plant Science** Programme are uploaded in the University website (www.kannuruniversity.ac.in)

Orders are issued accordingly.

Sd/-
DEPUTY REGISTRAR (ACADEMIC)
For REGISTRAR

To

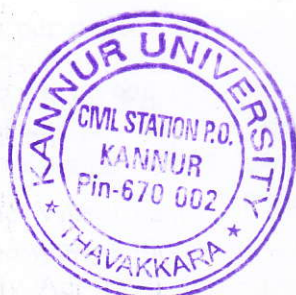
The Principals of Colleges offering **B.Sc. Plant Science** programme

Copy to:-

1. The Examination Branch (through PA to CE)
2. The Chairperson, Board of Studies in **Botany (UG)**
3. PS to VC/PA to PVC/PA to Registrar
4. DR/AR-I, Academic
5. The Computer Programmer (for uploading in the website)
6. SF/DF/FC

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SECTION OFFICER





KANNUR UNIVERSITY

BOARD OF STUDIES, BOTANY (UG)

B. Sc. PLANT SCIENCE SYLLABUS

CHOICE BASED CREDIT AND SEMESTER SYSTEM-

OUTCOME BASED EDUCATION

(2019 ADMISSION ONWARDS)

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PREFACE

The restructuring of undergraduate courses of Botany/Plant Science programme has been done in accordance with the CBCSS pattern and Outcome Based Education concept suggested by Kerala State Higher Education Council and UGC. The Board has prepared the syllabi and scheme of examination of sixteen Core Courses for Botany/Plant science (UG) programme, five Complementary Elective Courses for B. Sc. Zoology and B. Sc. Forestry and five Generic Elective Courses for UG programmes other than B.Sc. Botany/Plant Science. Five General Awareness Courses have been designed additionally for B Sc Plant Science which is an LRP programme. The Board of studies in Botany (UG), Kannur University considered the view points of the subject experts, students, teachers and other stakeholders, in a democratic way, while restructuring the curriculum and syllabus.

The curriculum and syllabus for the B.Sc. Programme in Botany/Plant Science is designed for six semesters. There are twelve theory courses, three practical courses and one Project, Field study and Viva voce course as Core Courses, which will help the students to earn 56 credits out of the 120 mandatory credits to complete a UG Programme as per UG Regulations-2019 of Kannur University. During the first four semesters, four theory courses with 3 credits and one practical course with 4 credits are included. During the 5th and 6th semesters, 40 credits are offered through eight theory courses, two practical courses and one Project, Field study and Viva voce course. Each practical course is a four credit course. Although, the course 6B16 BOT/PLS with three credits will be evaluated during the sixth semester practical examination; the components of learning activities and evaluation are spread throughout the six semesters. The General Awareness Courses for Plant Science is comprising of four theory courses of three credits and one practical course of four credits and will be completed by the third and fourth semesters of the Programme. The Generic Elective Course of the fifth semester is a two credit course, with application oriented content. There is no modification in the credits and duration of the Complementary Elective Courses; but the content is reorganised for more applications in the future endeavours of Zoology and Forestry students. .

The syllabus has been developed to arouse the curiosity of the students and inculcate in them a sense of spirit, wonder and appreciation to the dynamics of nature. Twelve theory Core Courses are designed to unfold gradually the unifying principles underlying the rich diversity of living beings and reveal the commonness among the organisms at molecular, organelle, cellular, tissue and organ levels and bio-chemical and genetic levels, so as to

understand the unity of all living beings. The practical courses are designed to develop the skills in observation and experimentation,

Restructuring was done to make it contemporary and on par with the emerging concepts of twenty first century and urgent needs of the society. During the designing and restructuring, maximum efforts are made by the Board of Studies, to maintain a holistic and interdisciplinary approach, continuity of knowledge, evolutionary link, emphasis to instrumentation and experimentation and ecological significance. The modifications of the higher secondary education at national and state level are also considered.

The most significant part of this curriculum is the three year self study option given for a student on a socially or ecologically relevant topic, which is termed as General Assignment, in the syllabus. Field trips without much damage to the nature are to be designed, utilising the digital skills of the student. Suggestions are given for the methodology adopted for the teaching, learning and evaluation. Question paper patterns are prepared in such a way that the outcomes listed in each course will be evaluated properly.

The syllabus of Botany/Plant science aims to give the students an orientation towards building up awareness about the dire need to protect environment. The theoretical and practical exposure the pupils receive during the programme ensures the outcomes are easily met with. The new curriculum is strongly experiment oriented to foster self study and scientific temper.

Sd/-

Dr. C. R. Lalitha

Chairperson, Board of Studies- Botany, UG

MEMBERS OF THE BOS BOTANY (UG)

(w.e.f. 06 August 2018)

Dr. C. R. Lalitha (Chairperson)

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Mr. Biju P.

Dr. Harikrishnan E.

Mr. Jose kutty E. J.

Dr. Manjula C.

Dr. Prasanth K .P

Dr. Renjana P. K.

Dr. Swapna K. S.

Dr. Tomson Mani

Dr. Chandramohan K. T. (BoS PG Chairman)

KANNUR UNIVERSITY

VISION AND MISSION STATEMENT

VISION:

To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and application of knowledge with special focus on the development of higher education in Kasargod and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

MISSION:

- To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- To uphold democratic, multicultural, secular, environmental and gender sensitive values as the foundational principles of higher education and to cater to the modern notions of equity, social justice and merit in all educational endeavors.
- To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.
- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- To associate with the local self-governing bodies and other statutory as well as non-governmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

UG PROGRAMME OUTCOMES

PO 1. Critical Thinking:

1. Acquire the ability to apply the basic tenets of logic and science to thoughts, actions and interventions.
2. Develop the ability to chart out a progressive direction for actions and interventions by learning to recognize the presence of hegemonic ideology within certain dominant notions.
3. Develop self-critical abilities and also the ability to view positions, problems and social issues from plural perspectives.

PO 2. Effective Citizenship:

1. Learn to participate in nation building by adhering to the principles of sovereignty, socialism, secularism, democracy and the values that guide a republic.
2. Develop and practice gender sensitive attitudes, environmental awareness, the ability to understand and resist various kinds of discriminations and empathetic social awareness about various kinds of marginalisation.
3. Internalise certain highlights of the nation's and region's history; especially of the freedom movement, the renaissance within native societies and the project of modernisation of the post-colonial society.

PO 3. Effective Communication:

1. Acquire the ability to speak, write, read and listen clearly in person and through electronic media in both English and in one Modern Indian Language
2. Learn to articulate analysis, synthesis, and evaluation of situations and themes in a well-informed manner.
3. Generate hypothesis and articulate assent or dissent by employing both reason and creative thinking.

PO 4. Interdisciplinarity:

1. Perceive knowledge as an organic comprehensive, interrelated and integrated faculty of the human mind
2. Understand the issues of environmental contexts and sustainable development as a basic interdisciplinary concern of all disciplines.
3. Develop aesthetic, social, humanistic and artistic sensibilities for problem solving and evolving a comprehensive perspective.

NOMENCLATURE CHANGES

Before 2009	2009 and 2014	Proposed revision 2019
Main with Electives	Core With Electives	Core Course (CC) With Discipline Specific Electives (DSEC)
Subsidiary	Complementary	Complementary Elective Courses (CEC)
Part I English	Common Course (English Language)	English Common Courses including Ability Enhancement Courses (AEC) and Skill Enhancement Courses (SEC)
Part II Second Language	Common Course Additional Language	Additional Common Courses (ACC)
	General Course for LRP	General Awareness Courses (GAC)* for LRP
	Open Courses	Generic Elective Courses (GEC)

CREDIT DISTRIBUTION FOR B Sc. PLANT SCIENCE PROGRAMME

Course Name	Semester	Credits	No of courses (T-theory; P-Practical; cr-credit)
Core Course (CC) With Discipline Specific Electives (DSEC)	I, II, III, IV, V, VI	56	15 11 T (7 x 3cr + 5x 4cr) 3P x 4cr 1Project x 3cr
Complementary Elective Courses (CEC)	I, II, III, IV	24 (12 + 12)	5 4T x 2 cr + 1P x 4cr
English Common Courses including Ability Enhancement Courses (AEC) and Skill Enhancement Courses (SEC)	I, II	14	4 2T x 4cr + 2T x 3cr
Additional Common Courses (ACC)	I, II	8	2 2T x 4cr
Generic Elective Courses (GEC)	V	2	1 1T x 2cr
General Awareness Courses (GAC)	III, IV	16	5 4T x 3cr + 1 P x 4cr
Total		120	

COMPLEMENTARY ELECTIVE COURSES FOR THE UG PROGRAMME IN PLANT SCIENCE

Complementary Elective I: CHEMISTRY
Complementary Elective II: ZOOLOGY

KANNUR UNIVERSITY

PROGRAMME SPECIFIC OUTCOMES OF

B.Sc. PLANT SCIENCE PROGRAMME

- PSO1:** Skill development for the proper description using botanical terms, identification, naming and classification of life forms especially plants and microbes.
- PSO2:** Acquisition of knowledge on structure, life cycle and life processes that exist among plant and microbial diversity through certain model organism studies.
- PSO3:** Understanding of various interactions that exist among plants animal and microbes; to develop the curiosity on the dynamicity of nature.
- PSO4:** Understanding of the major elements of variation that exist in the living world through comparative morphological and anatomical study
- PSO5:** Ability to explain the diversity and evolution based on the empirical evidences in morphology, anatomy, embryology, physiology, biochemistry, molecular biology and life history.
- PSO6:** Skill development for the collection, preservation and recording of information after observation and analysis- from simple illustration to molecular database development.
- PSO7:** Making aware of the scientific and technological advancements- Information and Communication, Biotechnology and Molecular Biology for further learning and research.
- PSO8:** Internalisation of the concept of conservation and evolution through the channel of spirit of inquiry.
- PSO9:** Ability to apply the knowledge in botany in the field of cultivation of ornamentals, medicinal plants and other economically important plants.
- PSO10:** Acquires the management principles in mushroom cultivation and plantation crop management.

KANNUR UNIVERSITY
BSc PLANT SCIENCE PROGRAMME-LRP
WORK AND CREDIT DISTRIBUTION STATEMENT

Semester	Course Title*	Credits	Hours per week	Total Credits	Total Hours
I	English Common Course 1	4	5	18	25
	English Common Course 2	3	4		
	Additional Common Course 1	4	4		
	Core Course 1: Cytology and Angiosperm Anatomy	3	2 + 2		
	Complementary Elective I Chemistry-1	2	2 + 2		
	Complementary Elective II Zoology- 1	2	2 + 2		
II	English Common Course 3	4	5	18	25
	English Common Course 4	3	4		
	Additional Common Course 2	4	4		
	Core Course 2: Reproductive Botany	3	2 + 2		
	Complementary Elective I-Chemistry 2	2	2 + 2		
	Complementary Elective II- Zoology 2	2	2 + 2		
III	General Awareness Course 1	3	3 + 2	13	25
	General Awareness Course 2	3	3 + 2		
	Core Course 3: Plant Diversity I– Algae and Bryophytes	3	3 + 2		
	Complementary Elective I- Chemistry 3	2	3 + 2		
	Complementary Elective II- Zoology 3	2	3 + 2		
IV	General Awareness Course 3	3	3 + 2	29	25
	General Awareness Course 4	3	3 + 2		
	Core Course 4- Plant Diversity II – Pteridophytes and Gymnosperms	3	3 + 2		
	Complementary Elective I-Chemistry 4	2	3 + 2		
	Complementary Elective II- Zoology 4	2	3 + 2		
	Core Course Practical 1	4			
	General Awareness Course Practical	4			
	Complementary Elective I- Chemistry Practical 5	4			
Complementary Elective II- Zoology Practical 5	4				
V	Angiosperm Systematics and Ethnobotany	3	3+4	16	25
	Plant Physiology and Metabolism	4	4+1		
	Microbiology, Mycology, Lichenology and Phytopathology	4	4+2		
	Research Methodology, Instrumentation and Biostatistics	3	4+1		
	Generic Elective Course	2	2		
VI	Environmental Science and Phytogeography	4	4+2	26	25
	Genetics, Molecular Biology and Plant Breeding	4	5+3		
	Biotechnology and Bioinformatics	4	5+2		
	Evolution and Palaeobotany	3	3+1		
	Core Practical II	4			
	Core Practical III	4			
Project, Field Study and Viva voce				3	
Total				120	150

SUGGESTED METHODOLOGY FOR TEACHING, LEARNING AND EVALUATION

TEACHING-LEARNING

The whole programme is an Outcome Based Education. Different methods are to be used for teaching learning evaluation; in order to attain the fixed outcomes in each course.

Theory: Student: Review of Literature, Assignment, Presentation, e-learning, Discussion and Debate with peer group, teachers and experts.

Teacher: Lecture, Demonstration, Presentation, Discussion and Debate.

Practical: Student: Identification, Comparison, Differentiation and Categorisation of different plants and their parts by observing Permanent Slides, Hand sectioning etc., Demonstration, Experimentation, Field visit, Report Writing and Keeping records

Teacher: Demonstration, Experimentation, Field visit, Certification

Project: The finalization of the topic should be done at the beginning of the fourth semester and the list should be kept with the HOD for the perusal of the University Examination authorities. There should be at least three projects from a department. The selection of the topic and group should be student centered as far as possible. A project log book/register is to be maintained by each student and submitted along with the project report during the final submission.

Student: Suggestion of Topic, Discussion with the Project guide and Peer group, Review of Literature, Project planning and Designing, Experimentation, Data Analysis and Project Report Preparation and Presentation.

Teacher: Confirmation of Topic, Demonstration, Planning of Experimentation, Guidance and Correction and Certification.

Field Study/ Study Tour: The plant diversity studies should be carried out with the support of Field Study/ Study Tour. During each year there should be a field study of 1-5 days duration, with a minimum of 5 days for the completion of the programme.

General Assignment: Every student should choose one of the topics for self study from the beginning of the programme. A report should be submitted by the end of Sixth Semester.

Suggested topics include: Studies on mangroves/Sacred groves/Campus flora; Cultivation of RET/Fruit/Vegetable/Medicinal plants/Mushroom; Topics related to Social responsibility- River restoration, PBR preparation, Landscaping and Green Auditing.

EVALUATION

EVALUATION	WEIGHTAGE
EXTERNAL	80
INTERNAL	20

EXTERNAL EVALUATION

External assessment by the University level examinations on specified times announced by the University for all the courses, theory, practical and Project/Viva Voce. Each student should go through the evaluation process according to the Kannur University Regulations for UG Students, 2019.

END SEMESTER EVALUATION-THEORY

The components of external evaluation and their unit wise and difficulty wise weightage is mentioned along with the Model Question Paper of each theory and practical course and the time of examination will be in accordance with the calendar prepared by the University for each academic year. At the end of each semester, there will be an examination for theory courses. The duration of examinations for all theory and practical courses in Botany/Plant science will be three hours, except for the Generic Elective Course of fifth Semester.

EXTERNAL -PRACTICAL

Practical Courses have external examination during the IV Semester Practical Examination (Core Practical I and General Course Practical and Complementary Elective Practical) and also during the VI Semester Practical Examination (Core Practical II and Core Practical III). There will be two external practical examiners and an internal examiner/skilled assistant for every practical examination of three hour duration. The external evaluation should be carried out by the team of these three examiners.

COMPONENTS	WEIGHTAGE
1: RECORD SCIENTIFIC ACCURACY --- 40 NEATNESS AND LEGIBILITY ---10 COMPLETENESS ---20	70
2: FIELD STUDY REPORT / HERBARIUM	30

EXTERNAL - PROJECT/FIELD STUDY/VIVA VOCE

The Project/Field Study/General Viva Voce will be conducted during the Sixth Semester Practical Examination.

Sixth Semester Viva should be based on:

Project work

General Assignment and Field Study

General Learning Activity of three years.

For the external evaluation the components and weightage of Project/Field Study/ Viva Voce can be discussed and determined finally by the Board of Examiners; the suggested components and their weightage is given below. The project viva should be based on the Project and importance should be given to the Scientific method undertaken in that project. The general viva should be on based the changes in the outlook of the student after the learning activity of the 3 year UG programme, field study and general assignment. Time taken for each practical batch should be 3 hrs, by giving nearly 15 minutes for each student. The project/field study/viva voce evaluation should be conducted by external examiners and internal examiner.

COMPONENTS	WEIGHTAGE
1: PROJECT REPORT WITH ALL GENERAL PARTS – RELEVANCE, OBJECTIVE, METHODOLOGY, DATA ANALYSIS, DISCUSSION CONCLUSION AND REFERENCE ETC -----10 PRESENTATION SKILL-----30 VIVA----- 30	70
2: GENERAL ASSIGNMENT- VIVA	10
3: FIELD STUDY REPORT -----10 VIVA-----10	20

ELIGIBILITY TO APPEAR FOR PRACTICAL EXAMINATION

1. Certified Bonafide Record (For Fourth And Sixth Semesters)
2. Herbarium and Field Book (Sixth Sem)
3. Certified Bonafide Project Report (Sixth Sem)
4. Report on General Assignment (Sixth Sem)
5. Field Study Reports (Sixth Sem)

CONTINUOUS INTERNAL EVALUATION

Internal evaluation is a continuous evaluation in all types of courses- theory/ practical / Project/ Field study. The teacher has flexibility in deciding the components and their weightage in accordance with the University Regulations, 2019. Internal evaluation should be very transparent to the students and the components and relative weightage should be announced at the beginning of each learning activity by the concerned teacher. Internal evaluation should be published in the notice board, one week before the closure of each semester.

INTERNAL -THEORY

The percentile system can be adopted for calculating the internal component, test paper.

COMPONENTS	WEIGHTAGE
1: TEST PAPER	50
2: VIVA (for I and II Sem) ASSIGNMENT (for III and IV Sem) SEMINAR (for V and VI Sem)	50

INTERNAL – PRACTICAL

The internal evaluation may be regular internal assessment on hourly basis or unit wise, whichever is communicated with the student.

COMPONENTS	WEIGHTAGE
1: REGULARITY	25
2: PRACTICAL SKILL- (sectioning, drawing, labeling, record keeping etc)	50
3: REGULAR VIVA/MODEL EXAMINATION	25

INTERNAL - PROJECT/FIELD STUDY/VIVA VOCE

Internal evaluation of the project should start with the beginning of the project and can be finalized by the project viva.

COMPONENTS	WEIGHTAGE
1: PARTICIPATION	50
2: VIVA	25
3: FIELD STUDY AND GENERAL ASSIGNMENT REPORTS	25

Sd/-

Dr. C. R. Lalitha

Chair person, Board of Studies- Botany, UG



KANNUR UNIVERSITY
BOARD OF STUDIES, BOTANY (UG)

SYLLABUS FOR
B.Sc. PLANT SCIENCE CORE COURSES

CHOICE BASED CREDIT AND SEMESTER SYSTEM-
OUTCOME BASED EDUCATION
(2019 ADMISSION ONWARDS)

B. Sc PLANT SCIENCE PROGRAMME- CORE COURSES

Semester	Course Code	Title	Marks			Credit	Theory	Practical	TOTAL
			Internal	External	Total		hrs/wk		
1	1B01PLS	Cytology and Angiosperm Anatomy	10	40	50	3	2	2	4
2	2B02PLS	Reproductive Botany	10	40	50	3	2	2	4
3	3B03PLS	Plant Diversity I– Algae and Bryophytes	10	40	50	3	3	2	5
4	4B04PLS	Plant Diversity II – Pteridophytes and Gymnosperms	10	40	50	3	3	2	5
4	4B05PLS	CORE PRACTICAL I	20	70	100	4	nil	2	
		Record + Field Study		10					
5	5B06PLS	Angiosperm Systematics and Ethnobotany	10	40	50	3	3	4	7
5	5B07PLS	Plant Physiology and Metabolism	10	40	50	4	4	1	5
5	5B08PLS	Microbiology, Mycology, Lichenology and Phytopathology	10	40	50	4	4	2	6
5	5B09PLS	Research Methodology, Instrumentation and Biostatistics	10	40	50	3	4	1	5
5	5D01PLS	Generic Elective Course					2		2
6	6B10PLS	Environmental Science and Phytogeography	10	40	50	4	4	2	6
6	6B11PLS	Genetics, Molecular Biology and Plant Breeding	10	40	50	4	5	3	8
6	6B12PLS	Biotechnology and Bioinformatics	10	40	50	4	5	2	7
6	6B13PLS	Evolution and Palaeobotany	10	40	50	3	3	1	4
6	6B14PLS	CORE PRACTICAL II	20	70	100	4		4	
		Record + Field Study		10					
6	6B15PLS	CORE PRACTICAL III	20	70	100	4		4	
		Record + Lab Experiment Study		10					
6	6B16PLS	Project, Field Study and Viva Voce	10	40	50	3			
		TOTAL	190	760	950	56			

CORE COURSE- 1- CYTOLOGY AND ANGIOSPERM ANATOMY

Semester	Course Code	Hours per week	Credit	Exam Hours
1	IB01BOT/PLS	2+ 2	3	3

Course Outcomes

1. Knowledge on general terms with updated information used in cell biology.
2. Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.
3. Skill development for the proper description of internal structure using botanical terms, their identification and further classification.
4. Induction of the enthusiasm on internal structure of locally available plants.
5. Understanding various levels of organization in a plant body with an outlook in the relationship between the structure and function through comparative studies.

MODULE 1: INTRODUCTION TO CYTOLOGY

2 hrs

Introduction to the study of cell biology - History of the progress of cell biology. Organization of prokaryotic and eukaryotic cells, Development of the cell theory.

MODULE 2: CELL STRUCTURE

10 Hrs

General structure of higher plant's cell.

Cell wall: Primary and Secondary wall, Ultra structure and function, Pits and pit apertures, Plasmodesmata.

Plasma membrane- Ultra structure and functions.

Cytoplasm- Physical, chemical and biological properties.

Nucleus and Nucleolus: Ultra structure of the interphase nucleus, The nuclear envelope: Nuclear pore complex, Nucleolus: Structure and functions.

Structure, chemical composition, functions and significance of **Chloroplast, Mitochondria, Endoplasmic reticulum, Golgi apparatus, Vesicles, Lysosomes, Microbodies-Peroxisomes, Glyoxysomes and Ribosomes.**

Origin of Mitochondria and Chloroplast- Endosymbiotic Theory. Membrane transport- Phagocytosis and Pinocytosis.

Cytoskeleton, Centrioles and Vacuoles: A general account.

Non living inclusions – Cystolith, Raphides; Aleurone grains. Starch grains – Eccentric, Concentric and Compound.

MODULE-3: ANGIOSPERM ANATOMY

1 Hr

Introduction, objective and scope of plant anatomy

MODULE-4: PLANT TISSUES

8 Hrs

Meristems-classification-characteristics -meristems and development of the plant body- root apex- dicot, monocot- vegetative shoot apex-theories- floral apex.

Mature tissues – classification-characteristics- simple, complex and special tissues – secretory cells.

MODULE-5: STRUCTURE OF PLANT BODY

15 Hrs

Brief introduction to Primary vegetative body of the plant - root, stem, leaf in Dicots and Monocots.

Tissue systems in Plants- Epidermal and Vascular tissue systems. Nodal anatomy, Floral anatomy, Abscission of leaf. Detailed description of secondary growth in root and stem - general development- structure of vascular cambium-unusual secondary growth- *Bignonia, Boerhaavia, Dracaena*.

Ecological anatomy – Hydrophytes, Xerophytes, Halophytes and Epiphytes.

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- 11.Raven, PH; Johnson, GB; Losos, JB; Singer, SR (2005), *Biology*, Seventh edition, Tata McGraw- Hill, New Delhi
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Practicals- 2hrs/week

1. Onion Peeling
2. Non living inclusions – Cystolith, Raphides, Aleurone grains; Starch grains –Eccentric, concentric, compound
3. Apical meristem – Root apex and stem apex.
4. Simple permanent tissues – Parenchyma, Chlorenchyma, Aerenchyma, Collenchyma and Sclerenchyma.
5. Complex permanent tissues : Xylem and Phloem
6. Secretory tissues – Resin canal, Nectory, Laticifers – articulated and non-articulated Latex vessels.
7. Lysigenous – Citrus and schizogenous – Pinus cavities.
8. Epidermal structures – Trichomes, Glands, Stomata- dicot, monocot, anomocytic, diacytic, paracytic, anisocytic.
9. Primary structure –
 - a. Dicot stem –*Centella, Cephalandra, Eupatorium* or any dicot stem;
 - b. Monocot stem – Bamboo, Grass, *Asparagus* or any monocot stem;
 - c. Dicot root – *Tinospora, Ficus, Pea*;
 - d. Monocot root – *Colocasia, Hedychium, Pandanus* or any monocot root.
 - e. Leaf Anatomy – Dicot leaf: *Ixora*; Monocot leaf: Grass
10. Secondary structure –
 - a. Stem (Normal type) – *Tinospora, Vernonia* or any other normal type.
 - b. Root (Normal type) – *Tinospora, Ficus, Carica, Ricinus* or any other normal type.
 - c. Anomalous secondary thickening – *Bignonia, Boerhaavia. Dracaena*
11. For the comparison of organs/ tissues/ tissue systems/ anomalous sec./ primary structure, the students have to submit any two photographs from their own preparation.

WEIGHTAGE OF QUESTION PAPER :
1B01BOT/PLS: CYTOLOGY AND ANGIOSPERM ANATOMY

Unit	Marks
Module 1 and 3	6
Module 2	18
Module 4	16
Module 5	30

Difficulty level	Easy	Average	Difficult
Weightage of Marks	20	40	10
Creation level and related verbs	Knowledge Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	Understanding Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	Application and higher levels Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY FIRST SEMESTER BSc DEGREE EXAMINATION

IB01BOT/PLS: CYTOLOGY AND ANGIOSPERM ANATOMY

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

Part A - Objective type questions *Answer All*

(4 X 1 = 4)

- Eukaryotic ribosomes split up into
a) 60S and 40S b) 40S and 30S c) 50S and 30S d) 60S and 30S
- Tunica Corpus theory was proposed by
a) A. Schmidt b) M. J. Schleiden c) T. Schwann d) R. Virchow
- Intrafascicular Cambium arises from
a) Cortex b) Pith c) Medullary ray d) Bark
- Velamen Tissue is present in the roots of
a) Orchids b) Hydrophytes c) Mangroves d) Ferns

Part B- Short Essay Questions *Answer Any Eight*

(8 x 2=16)

- Explain cell theory.
- Identify any two applications of plant anatomy.
- Briefly describe the nonliving inclusions of plant cells.
- Enumerate the similarities between the adaptations of Xerophytes and Halophytes.
- Draw a neat labeled diagram of lenticel.
- Give an account on Nodal anatomy.
- Distinguish the vascular bundles of root with that of stem.
- Discuss the ultra structure of cell wall.
- Recognise the type of anomaly in secondary thickening of *Bignonia* stem.
- Illustrate the structure of Endoplasmic reticulum with the help of a neat labeled diagram.
- State the major functions of parenchyma.
- Classify the concentric vascular bundles with examples.

Part C- Essay Questions *Answer Any Four*

(4 x 3=12)

17. Differentiate the structure of prokaryotic and eukaryotic ribosomes.
18. Explain the structure of xylem tissue.
19. Summarise the anatomical changes that happen during the secondary growth in Dicot root.
20. Cite the anatomical adaptations of Hydrophytes.
21. Compare the anatomy of Dicot and Monocot leaf .
22. Relate the structure and function of Plasma membrane with the help of neat labeled diagram of Fluid Mosaic Model.

Part D-Long Essay Questions *Answer Any One*

(1 x 8=8)

23. Classify the meristems based on position, time of origin and function; with a brief description of each type.
24. Comment on the statement that mitochondria and chloroplast have a prokaryotic origin with the help of structural and functional comparison.
25. Compare and Contrast the anomalous secondary thickening present in *Boerhaavia* stem with that of *Dracaena* stem.

CORE COURSE-2—REPRODUCTIVE BOTANY

Semester	Course Code	Hours per week	Credit	Exam Hours
2	2B02BOT/PLS	2+ 2	3	3

Course Outcomes

1. Observation and classification of the floral variations from the premises of college and house.
2. Understanding the various reproductive methods sub-stages in the life cycle of plants
3. Observation and classification of the morphological variations in fruits and seeds of angiosperms.
4. Enthusiasm to understand evolution based on the variations in reproduction among plants.

MODULE 1. CELL REPRODUCTION AND CELL CYCLE 5 Hrs

Mitosis - Prophase: formation of the mitotic apparatus, **Metaphase:** alignment of the centromeres- **Anaphase:** separation of the chromatids **Telophase:** reformation of the nuclei
Significance of mitosis. **Cytokinesis. Meiosis – Stages of Meiosis I and II,** genetic consequences and Significance of Meiosis. Cell Cycle – Phases, Interphase and Mitotic phase.

MODULE 2. REPRODUCTION AND LIFECYCLES IN PLANT KINGDOM 3 Hrs

General Account on Vegetative methods: Buds, Bulbils, Fragmentation; Asexual reproduction- Spores- Zoospores, Hypnospores, Chlamyospores; and Sexual –Isogamy, Anisogamy and Oogamy, Different Life cycles -haplontic diplontic, haplodiplo biontic life cycles.

MODULE 3. SEX ORGAN OF ANGIOSPERMS -FLOWER 8 Hrs

Definition, Salient features and Parts of the Flower- Bract, Calyx, Corolla, Androecium, Gynoecium. Floral arrangement- types. Relative position, cohesion, adhesion, Symmetry of flower. Aestivation.

Flower a modified shoot- Placentation- types.

Inflorescence: Racemose, Cymose, Special type and Mixed types.

MODULE 4. EMBRYOLOGY OF ANGIOSPERMS 15 Hrs

Introduction and Historical account of Embryology.

Structure and functions of Microsporangium and wall layers. Microsporogenesis and development of male gametophyte.

Megasporogenesis and development of female gametophyte (*Polygonum*, *Allium* and *Peperomia*). Types of ovules.

Pollination-mechanism. Fertilisation. Endosperm – structure, development and types (Nuclear, Cellular, Helobial, Special type – Ruminant). Embryo – Structure and development of Dicot embryo, Monocot embryo. Polyembryony- Classification and Significance, Apomixis, Agamospermy- Apospory and Parthenocarpy.

Palynology - Pollen structure and Morphology, Acetolysis of pollen grain. Economic importance, Pollen allergy.

MODULE 5. END PRODUCTS OF SEXUAL REPRODUCTION

5 Hrs

Fruits -classification based on morphology and dehiscence- simple, aggregate and multiple.
Seeds – Definition, Types, Structure and germination.

Reference

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2. Darlington C.D.,1965. *Cytology*. Churchill.London
3. Eames A. J. - *Morphology of Angiosperms* - Mc Graw Hill, New York.
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5. Maheswari , P. - *Embryology of Angiosperms* - Vikas Pub:
6. Nair P .K .K - *Pollen Morphology of Angiosperms* - Scholar Publishing House, Lucknow
7. Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
8. Saxena M. R. – *Palynology – A treatise* - Oxford & I. B .H., NewDelhi.
9. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
10. Swanson, C. P.,1957. *Cytology and Genetics*. Englewood cliffs, NewYork
11. Venkateswaralu, V. - *Morphology of Angiosperms* - Chand & Co.

Practicals- 2hrs/week

1. Identify with a note the different types of inflorescence, fruits and placentations.
2. T.S of mature anther
3. Dicot embryo, Monocot embryo and Embryosac
4. Acetolysis of pollen grains
5. Dissection of Embryo from Flower buds
6. Onion root smear mitosis
7. Flower bud meiosis demonstration only
8. Digitalisation of any one -Flower/inflorescence/placentation/flower as a modified shoot/anthers/pollinia or any other

WEIGHTAGE OF QUESTION PAPER:
2B02BOT/PLS: REPRODUCTIVE BOTANY

Unit	Marks
Module 1	10
Module 2	5
Module 3	15
Module 4	30
Module 5	10

Difficulty level	Easy	Average	Difficult
Weightage of Marks	20	40	10
Creation level and related verbs	Knowledge Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	Understanding Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	Application and higher levels Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY SECOND SEMESTER BSc DEGREE EXAMINATION

2B02BOT/PLS: REPRODUCTIVE BOTANY

TIME: 3Hrs

MAXIMUM MARKS: 40

Draw diagrams wherever specified

Part A - Objective type questions *Answer All*

(4 X 1 = 4)

- Buds arising from the peduncle can be used as a propagule in
a) Jack Fruit b) Pine apple c) Coconut d) Banana
- Double fertilization was discovered by
a) P. Maheswari b) S. G. Nawaschin c) Amici d) S. S. Bhojwani
- An example for aggregate fruit
a) Coconut b) Jack Fruit c) *Annona* d) Pine apple
- Bract is modified as a large coloured showy structure in
a) Orchids b) *Anthurium* c) Lilly d) *Ocimum*

Part B- Short Essay Questions *Answer Any Eight*

(8 x 2=16)

- Define haplontic life cycle and cite an example
- Discuss the most important two stages in an amphimictic life cycle.
- List out different levels of cohesion in gynoecium of angiosperms.
- Write down the racemose features of Verticillaster and Thyrsus.
- Draw a neat labeled diagram of mature anther T S.
- Give an account on pollen allergy
- Distinguish the mature embryos of Monocot and Dicot.
- Discuss the changes that happen to the female gametophyte after pollination.
- What are the major economic importance of Pollen grains.
- Illustrate diagrammatically different types of endosperms.

15. State the major processes during seed germination.
16. Differentiate the endospermous seeds from non endospermous seeds.

Part C- Essay Questions *Answer Any Four* (4 x 3=12)

17. Discuss the cell cycle.
18. Comment on 'Flower is a modified shoot'.
19. Compare and contrast Orthotrpus and Anatropus ovules with examples.
20. Distinguish different types of endosperms.
21. Sketch the life cycle of a mango plant with different types of apomixis.
22. Distinguish the lomentum fruit from the legume type.

Part D-Long Essay Questions *Answer Any One* (1 x 8=8)

23. Summarise the changes that happen for the nucleus during the prophase of Meiosis I, with the help of diagrams and add a note on significance of Meiosis.
24. Describe megasporogenesis and female gametophyte formation in *Polygonum* with the help of neat labeled diagram.
25. Distinguish different types of Racemose inflorescence with the help of diagrammatic sketches and brief description of salient features of each type.

CORE COURSE-3—PLANT DIVERSITY I- ALGAE AND BRYOPHYTES

Semester	Course Code	Hours per week	Credit	Exam Hours
III	3B03BOT/PLS	3+ 2	3	3

Course Outcomes

1. Understanding diversity in morphology, anatomy, reproduction and life cycle in lower groups of plants, algae and bryophytes.
2. Skill Development in collection and preservation of algae and bryophytes.
3. Realizing the economic/ecological importance of Algae and Bryophytes.
4. Understanding the evolutionary lineages in algae and bryophytes

MODULE 1: INTRODUCTION AND CLASSIFICATION OF ALGAE 5Hrs

Introduction: General characters, Diversity-habitat, thallus structure, pigments, reserve food, flagella types, life cycle and alternation of generations in algae. Evolutionary trends and affinities with microbes and bryophytes. Classification upto group level by Fritsch and Lee.

MODULE 2: STUDY OF SELECTED ALGAL TAXA 20Hrs

Salient features, thallus structure and reproduction of algae in the following groups with special reference to the types mentioned: Chlorophyceae – *Chlamydomonas*, *Volvox*, *Ulothrix*, *Zygnema*, *Oedogonium*, *Chara*; Xanthophyceae – *Vaucheria*; Bacillariophyceae - *Pinnularia*; Phaeophyceae – *Sargassum*; Rhodophyceae - *Polysiphonia*.

MODULE 3: GENERAL METHODS IN PHYCOLOGY 5Hrs

Algal collection-phytoplankton and seaweeds, qualitative and quantitative estimation, preservation-phytoplankton and sea weeds, staining techniques , Culturing, Salient features for the identification and classification Collection, Preservation, Counting and Culture of algae- Walne's medium, Preservation of macroalgae by herbarium and other methods.

MODULE 4: IMPORTANCE OF ALGAE 3Hrs

Significance of algae economic importance of algae

Beneficial: algae as food, SCP, fodder, green manure, role in N₂ fixation, medicine and biofuels. Commercial products from Algae - carrageenin, agar-agar, alginates and diatomaceous earth. Role of algae in pollution studies: as indicators of pollution and as bioremediation agents.

Harmful: Biofouling, harmful and toxic algal blooms – neurotoxins and parasitic algae, evolutionary trends, origin and evolution of algae. Eutrophication – algal bloom.

MODULE 5: INTRODUCTION AND CLASSIFICATION OF BRYOPHYTES 5Hrs

Introduction, general characters and classification of bryophytes. Diversity-habitat, thallus structure and Sporophyte structure. Salient features for the identification and classification. Evolutionary trends and affinities with Algae and Pteridophytes.

MODULE 6: STUDY OF SELECTED BRYOPHYTE TAXA 10Hrs

Distribution, morphology, anatomy, reproduction and life cycle of the following types (developmental details are not required): Hepaticopsida - *Riccia*, *Marchantia*; Anthocerotopsida - *Anthoceros*; Bryopsida - *Funaria*. Evolution of gametophyte and

sporophyte among Bryophytes.

MODULE 7: METHODS IN BRYOPHYTE STUDIES

3Hrs

General methods in collection, qualitative and quantitative estimation, Preservation, Staining techniques of spores and other reproductive parts.

MODULE 8: IMPORTANCE OF BRYOPHYTES 3hrs

Significance of bryophytes, Economic importance of Bryophytes –beneficial- biological, ecological and medicinal and harmful, Ecological significance- pedogenesis.

Practicals: 2hrs/week

1. Conduct a field visit to any one of the ecosystems rich in Algae to experience algal diversity. Submit a report with photographs.
2. Make micropreparations of vegetative and reproductive structures of *Volvox*, *Zygnema*, *Oedogonium*, *Chara*, *Sargassum*, and *Polysiphonia*.
3. Familiarizing the technique of algal collection preservation and culture of algae
4. Conduct a field visit to any one of the ecosystems to study bryophytes and submit a report with photographs.
5. Study the habit, anatomy of thallus and reproductive structures of *Riccia*, *Anthoceros*, *Marchantia*.
6. Familiarizing the technique of bryophyte collection and preservation

References

1. Andersen R A, 2005. *Algal Culturing Techniques*, Elsevier .
2. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B., 2008. *Biology*, Pearson Benjamin Cummings, USA. 8th edition
3. Charrier, B., Wichard, T., and C R K Reddy, 2018. *Protocols for Macroalgae Research*, CRC Press, Taylor and Francis.
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5. Goffinet, B. and Shaw, A.J. 2009. *Bryophyte Biology*, 2nd ed. Cambridge University Press, Cambridge:
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7. Lee, R.E., 2008. *Phycology*, Cambridge University Press, Cambridge. 4th edition
8. Sahoo, D., 2000. *Farming the ocean: seaweeds cultivation and utilization*. Araval International, New Delhi.
9. Sambamurthy A V S S, 2005. *A Text book Of Algae*, Mittal Books India.
10. Sharma, O P, 2017, *Algae*,
11. Vanderpoorten, A. and Goffinet, B. 2009. *Introduction to Bryophytes*. Cambridge University Press, Cambridge

**WEIGHTAGE OF QUESTION PAPER: 3B03BOT/PLS: PLANT DIVERSITY 1-
ALGAE AND BRYOPHYTES**

Unit	Marks
Module 1	6
Module 2	26
Module 3	6
Module 4	4
Module 5	6
Module 6	14
Module 7	4
Module 8	4

Difficulty level	Easy	Average	Difficult
Weightage of Marks	20	40	10
Creation level and related verbs	<u>Knowledge</u> Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	<u>Understanding</u> Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	<u>Application and higher levels</u> Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY THIRD SEMESTER BSc DEGREE EXAMINATION

3B03BOT/PLS: PLANT DIVERSITY 1- ALGAE AND BRYOPHYTES

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME
AS IN 1B01BOT/PLS and 2B02BOT/PLS

CORE COURSE- 4- PLANT DIVERSITY II – PTERIDOPHYTES AND GYMNOSPERMS

Semester	Course Code	Hours per week	Credit	Exam Hours
4	4B04BOT/PLS	3+ 2	3	3

Course Outcomes

1. A comparative knowledge of lower vascular plants and lower group of flowering plants.
2. Skill development for the proper description, identification and classification through morphological, anatomical and life cycle studies.
3. Awareness on the morphological, anatomical and reproductive features of primitive and advanced plants with an evolutionary link between them.
4. Skill development in collection preservation and studies in diversity studies of pteridophytes and gymnosperms.

Module 1- Introduction to Pteridology

10 Hrs

Pteridophytes- Salient features and Classification (Reimer's)- Salient features for the identification and classification. Origin and evolution of pteridophytes- relationships of pteridophytes with bryophytes and gymnosperms- brief account of the development of pteridology in India.

General methods in collection, preservation, staining techniques for spores and reproductive parts.

Ecological and economic importance of pteridophytes

Module 2-Study of selected taxa of pteridophytes

25 Hrs

Study of the habitat, distribution, habit, anatomy, reproduction and life cycle of *Psilotum*, *Selaginella*, *Equisetum*, *Pteris* and *Marsilea*. (Developmental details are not required). Stellar evolution in pteridophytes, heterospory and seed habit. Polyploidy in pteridophytes

Module 3-Introduction to gymnosperms

7 Hrs

Introduction - Salient features and Classification (Sporne's) .Distribution of gymnosperms in India. Relationship with pteridophytes and angiosperms- Indian contribution on gymnosperm study.

Ecological and Economic importance- Food, timber, industrial uses and medicines

General methods in collection, preservation and staining techniques for the vegetative and reproductive parts.

Module 4-Study of selected taxa of Gymnosperms

12 hrs

Study of the habitat, distribution, habit, anatomy, reproduction and life cycle of *Cycas*, *Pinus* and *Gnetum* (Developmental details not required). Origin and evolution of gymnosperms-

Practicals 2hrs/week

1. *Psilotum* : external features, stem T.S., synangium T.S
2. *Selaginella*: habit, rhizophore T.S, stem T.S, axis with strobilus, Megasporophyll and Microsporophyll
3. *Equisetum* – Habit, rhizome T.S, stem T.S., strobilus V.S.
4. *Pteris*- Habit, petiole T.S., sporophyll T.S., prothallus
5. *Marsilea*- Habit, rhizome and petiole T.S, Sporocarp T.S, V.S & R.L.S
6. *Cycas*- seedling, coralloid root-entire and T.S., leaflet T.S, petiole T.S., male cone L.S., microsporophyll, micro sporophyll T.S., megasporophyll, ovule entire and L.S.
7. *Pinus* – Branch of indefinite growth, spur shoot, T.S of old stem, needle T.S., male cone, male cone V.S., female cone, female cone V.S.
8. *Gnetum*- Habit, stem T.S(young and mature), leaf T.S, male strobilus, female strobilus, V.S of male cone, V.S. of female cone, V.S of ovule, seed entire.
9. Familiarisation of Pteridophyte and Gymnosperm collection and Preservation and Staining.

Reference

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WEIGHTAGE OF QUESTION PAPER:
4B04BOT/PLS: PLANT DIVERSITY 2- PTERIDOPHYTES AND GYMNOSPERMS

Unit	Marks
Module 1	10
Module 2	35
Module 3	7
Module 4	18

Difficulty level	Easy	Average	Difficult
Weightage of Marks	20	40	10
Creation level and related verbs	Knowledge Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	Understanding Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	Application and higher levels Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY FOURTH SEMESTER BSc DEGREE EXAMINATION

4B04BOT/PLS: PLANT DIVERSITY 2- PTERIDOPHYTES AND GYMNOSPERMS

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN
 1B01BOT/PLS and 2B02BOT/PLS

CORE COURSE-05-CORE PRACTICAL~1

Semester	Course Code	Hours per week	Credit	Exam Hours
4	4B05BOT/PLS	2	4	3

Course Outcomes

1. Learning the fundamental techniques used in a botany lab.
2. Understands the working of science by first-hand experience.
3. By comparing different plants and their vegetative and reproductive structures a generalisation in evolutionary concept is attained.
4. Internalisation of practical skills for further application in free, independent, individual needs and helps in designing scientific experimentation.

PRACTICAL WORK DONE DURING 1B01BOT/PLS, 2B02BOT/PLS, 3B03BOT/PLS and 4B04BOT/PLS IS THE BASIS OF THIS PRACTICAL COURSE,

MODEL QUESTION PAPER- CORE PRACTICAL I

Time-3Hrs

Max.marks-70

1. Take sections of various plant parts and identify the given plant 'A' as dicot or monocot with morphological and anatomical reasons
 Identification-1, Sectioning -2 Reasons-3, (6 marks)
2. Take a transverse section of material B, stain, mount and identify the type of secondary thickening, Draw a neat labeled cellular diagram and leave the preparation for valuation.
 Identification-1 Preparation-4 labeled diagram-3 (8 marks)
3. Take transverse sections of materials C and ,D, Identify with a neat labeled diagram.
 Identification-1, Preparation -3 labelled diagram -3 (2x7=14 marks)
4. Dissect out the embryo from flower E, identify the stage and leave the preparation for valuation
 Identification-1 preparation-3 (4 marks)
5. Prepare an acetocarmine squash of material F identify two clear stages of mitotic division with reasons and report for valuation
 Identification-2 preparation-4 (6 marks)
6. Note the features of the inflorescence/flowers/fruits G given, compare and classify them with reasons
 Comparison 3 marks Contrastin 3 marks Identification -1 mark Classification 1 mark (8 Marks)
7. From the algal mixture given H, identify any two algal filaments with reasons.
 (Identification-0.5 Reasons 1.5 Preparation-2) x 2 (8 marks)
8. Spot at sight, identify the specimen with short notes , I,J,K,L,M, N, O, P,
 (identification 1, reason/notes-1) x 8 (8x2=16 marks)

KEY TO THE SPECIMENS

- 1). Any Dicot/Monocot plant twig without much complicated structure.
- 2). Any material studied for Secondary thickening- anomalous/normal/ Primary stem with Bicolateral vascular bundle.
- 3). Any studied Fungi/Bryophyte/Pteridophyte/Gymnosperm material. C-Fungi/Bryo; D-Pterido/Gymno
- 4). Dicot Flower-
- 5). Onion Root tip
- 6). Any 3 inflorescence/ flowers/Fruits studied
- 7). Mixture of 4-5 filamentous algae studied.
- 8). Anatomy /reproductive structures of Algae / Bryophyte/ Pteridophyte / Gymnosperms / Flowers or inflorescence/ placentations or fruits/embryos or anther and pollinia.

CORE COURSE~6-ANGIOSPERM SYSTEMATICS AND ETHNOBOTANY

Semester	Course Code	Hours per week	Credit	Exam Hours
5	5B06BOT/PLS	3 + 4	3	3

Course Outcomes

1. Understanding the main features in Angiosperm evolution.
2. Skill development in identification and classification of flowering plants.
3. Ability to identify, classify and describe a plant in scientific terms, thereby.
4. Identification of plants using dichotomous keys.
5. Recognition of locally available angiosperm families and plants.
6. Recognition of economically important plants.
7. Appreciation of human activities in conservation of useful plants from the past to the present.

ANGIOSPERM SYSTEMATICS AND ETHNOBOTANY

Module-1 Systematics:

5Hrs

History, objectives and relevance of Systematics, Systems of classification: Artificial, Natural and Phylogenetic; brief account of Linnaeus', Engler and Prantl's system and APG system(2003). A detailed study of Bentham & Hooker's system-Merits and demerits.

Module-2 Nomenclature:

9Hrs

Botanical Nomenclature, ICN, Latest code –brief account, Brief account of Ranks of taxa, Type concept, Rule of priority, Author citation. Plant identification: Taxonomic literatures- Floras, Monograph. Herbaria-Technique of Herbarium Preparation. Importance of Herbaria, Important Herbaria, Botanical gardens-roles, important botanical gardens. Taxonomic keys-dichotomous (brief account only).

Plant descriptions – Common Terminologies used for description of vegetative and reproductive parts.

Module-3 Study of the diagnostic features and economic importance of Angiosperm families

30 Hrs

Annonaceae, Nymphaeaceae, Malvaceae, Rutaceae, Anacardiaceae, Fabaceae with sub families, Combretaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Sapotaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Acanthaceae, Verbenaceae, Lamiaceae, Euphorbiaceae, Amaranthaceae, Orchidaceae, Zingiberaceae, Liliaceae, Arecaceae and Poaceae.

Module 4 Ethnobotany

10hrs

Major Tribes of North Malabar- Paniya, Adiyar, Kurichya, Karimpalar, Koragar, Kurumar and Maratti. Indigenous knowledge on plants-Major plants used by the tribes- food, fodder, medicine and other livelihood activities.

Scientific validation of Traditional Knowledge. Benefit sharing case study-*Trichopus zeylanicus*. Traditional knowledge and Scientific Knowledge.

Practicals: 4hrs/week

1. Work out atleast one genus of each family mentioned in the syllabus and make suitable diagrams, describe them in technical terms and identify up to species using the flora.
2. Field visit- Local area/ Botanical garden/ tribal settlements.
3. Preparation of 20 properly identified herbarium specimens.
4. Survey of ethnobotanical uses of plants.
5. Identify plants/plant products of economic importance belonging to the families mentioned in the syllabus;with binomial, family and morphology of useful parts. *Annona*, Cotton, Mango, Red gram, Green gram, Horse gram, Black gram, Bengal gram, Red gram, Indigo, Tamarind, Bitter gourd, *Luffa*, Asfoetida, Cumin, Coriander, Coffee, *Catharanthus*, *Rauwolfia*, Brinjal, Tomato, Chilly, *Justicia adhatoda*, *Vitex nigundo*, *Leucas aspera*, *Hevea*, Tapioca, *Ricinus*, Ginger Turmeric, Coir, Arecanut, Rice, Wheat, Ragi, Sugar cane

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**WEIGHTAGE OF QUESTION PAPER:
5B06BOT/PLS: ANGIOSPERM SYSTEMATICS AND ETHNOBOTANY**

Unit	Hours	Marks
Module 1	5	7
Module 2	9	12
Module 3	30	38
Module 4	10	13

Difficulty level	Easy	Average	Difficult
Weightage of Marks	20	40	10
Creation level and related verbs	Knowledge Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	Understanding Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	Application and higher levels Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

**KANNUR UNIVERSITY FIFTH SEMESTER BSc DEGREE EXAMINATION
5B06BOT/PLS: ANGIOSPERM SYSTEMATICS AND ETHNOBOTANY**

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN
1B01BOT/PLS and 2B02BOT/PLS

CORE COURSE-7- PLANT PHYSIOLOGY AND METABOLISM

Semester	Course Code	Hours per week	Credit	Exam Hours
5	5B07BOT/PLS	4+ 1	4	3

Course Outcomes

1. Preliminary understanding of the basic functions in a plant body.
2. Awareness on the interdisciplinary nature of botany, chemistry and physics by studying the principles of plant life, growth and reproduction.
3. Recognising the wonderful mechanism of transport and the Interrelationships existing between metabolic pathways thereby gaining an idea about the importance of plants in the dynamicity of nature.
4. Enhance research interest among students by introducing the historical aspects of physiological research.

PLANT PHYSIOLOGY AND METABOLISM

Module 1: Plant -Water relations

12 Hrs.

Importance of water in plant physiology, Diffusion, DPD, Plasmolysis, Osmosis, Osmotic Pressure, Concept of water potential, Osmotic potential, Turgor pressure, Imbibition.

Mechanism of water absorption -Active and Passive absorption, Pathway of water movement - apoplastic, symplastic and transmembrane pathways, Factors affecting absorption of water.

Transpiration: Types, Mechanism of stomatal transpiration, Significance of transpiration, Antitranspirants,

Ascent of sap: Mechanism and Theories of ascent of sap-Cohesion Tension Theory.

Module 2: Nutrition and Metabolism

20 Hrs.

Mineral Nutrition: Essential elements – Macro and Micro nutrients – Specific roles and deficiency symptoms, Hydroponics.

Mineral salt absorption: Mechanism of mineral salt absorption, Passive and Active absorption.

Photosynthesis: Historical summary of photosynthesis research, Photosynthetic pigments, Absorption of light, Fluorescence and Phosphorescence, Photo systems, Quantasomes, Action and Absorption spectra, Red drop and Emerson and Enhancement effect, Mechanism of photosynthesis – Photosynthetic electron transport, Photophosphorylation, Photosynthetic carbon reduction cycle – C₃, C₄, CAM pathways, Photorespiration, RUBISCO. Laws of limiting factor, Factors influencing photosynthesis.

Respiration: Mechanism of respiration, Glycolysis, Fermentation, Citric acid cycle, Terminal oxidation, overall balance sheet, Amphibolic nature of citric acid cycle.

Fatty Acid metabolism- beta Oxidation

Nitrogen Metabolism transamination and deamination

Module 3: Plant Growth and Movements

12 Hrs.

Phytohormones: Auxin, Gibberellins, Cytokinin, Abscisic acid and Ethylene – Physiological role, Photoperiodism and Vernalisation, Phytochrome - chemistry and physiological effects (Brief Account only).

Plant movements: Movements of locomotion, Curvature and Hygroscopic movements, Tropic and nastic movements.

Module 4: Bioenergetics

8 Hrs.

Laws of Thermodynamics, High energy compounds and high energy nucleotides- ATP, NADPH, FADH and FMN with emphasis to the structure and function of ATP.

Enzymes: Classification, Mechanism of action, Enzyme inhibition, Factors affecting enzyme activity. Endo and Exoenzymes, Constitutive and inductive enzymes, Coenzymes, Isozymes, Ribozymes, Zymogens, multienzyme system, Allosteric enzymes, Enzyme kinetics.

Module 5: Biomolecules

20 Hrs.

Carbohydrates: Structure and Classification– Monosaccharides-Triose-glyceraldehyde, Pentose- ribose deoxyribose; Hexose-Glucose and Fructose; Disaccharides-Lactose, Maltose, Sucrose; Pentoses Starch, Glycogen.

Lipids: Classification – Simple lipids, Complex lipids, Storage and Structural lipids, Membrane Lipids, Biological functions of lipids.

Aminoacids and Proteins: Classification of aminoacids based on polarity, Properties of aminoacids, Proteinogenic and Non-proteinogenic aminoacids.

Classification of protein based on function and structure, Physical configuration of protein – primary, secondary, tertiary and quaternary structures, Denaturation and Renaturation.

Secondary metabolites: Classification and Physiological roles.

References

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13. Verma V, 2007. Textbook of Plant Physiology. Ane Books India, New Delhi.

Practicals:1 hr /week

1. Determination of water potential by tissue weight change method.
2. Rate of plasmolysis determination using *Rhoeo* leaf epidermal peelings

3. Relation between water absorption and transpiration.
4. Extraction and separation of leaf pigments by paper chromatography.
5. Effects of light intensity on photosynthesis by Wilmott's bubbler.
6. Photo morphogenesis in seedlings grown under normal light and darkness.
7. Demonstration of gravitropism using Klinostat.
8. Determination of the rate of transpiration using Ganong's potometer.
9. Kuhne's fermentation experiment.
10. Respirometer experiment.
11. Any two experiments with Wilmott's Bubbler, Potometer, Paper chromatography, Plasmolysis/water balance/respirometer/Klinostat etc using different plants/leaves under different conditions.
Report can be submitted along with the record or separately during the practical examination.
12. Qualitative tests:
 - a. Molisch's test for all carbohydrates.
 - b. Benedict's test for reducing sugars.
 - c. Barfoed's test for monosaccharides.
 - d. Seliwanoff's test for ketoses.
 - e. Iodine test for starch.
 - f. Biuret test and xanthoproteic test for amino acids and protein.

**WEIGHTAGE OF QUESTION PAPER:
5B07BOT/PLS: PLANT PHYSIOLOGY AND METABOLOISM**

Unit	Marks
Module 1	12
Module 2	19
Module 3	12
Module 4	8
Module 5	19

Difficulty level	Easy	Average	Difficult
Weightage of Marks	20	40	10
Creation level and related verbs	Knowledge Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	Understanding Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	Application and higher levels Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY FIFTH SEMESTER BSc DEGREE EXAMINATION

5B07BOT/PLS: PLANT PHYSIOLOGY AND METABOLOISM

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN
1B01BOT/PLS and 2B02BOT/PLS

**CORE COURSE-8-- MICROBIOLOGY, MYCOLOGY, LICHENOLOGY AND
PHYTOPATHOLOGY**

Semester	Course Code	Hours per week	Credit	Exam Hours
5	5B08BOT/PLS	4+ 2	4	3

Course Outcomes

1. Understanding and appreciating the unity and diversity of microbes and fungi,
2. Understanding the significance of microbes in nature's dynamicity.
3. Develop skill in studying the fungal diversity through the study of representative taxon and methodology.
4. Understanding the inter-relationship between plants and microbes both beneficial and harmful.
5. Skill development to diagnose plant disease and to apply general control measures.

Module 1. Microbiology

20 Hrs

Microbiology Definition, Scope and Significance

Diversity of microorganisms.

Distribution, Structure, reproduction and genetic recombination in Bacteria and allied microbes- Bacteria,, Actinomycetes, Mycoplasma, Spirochaetes, Cyanobacteria and Rickettsia.

General structure and classification of Viruses-HIV, TMV, Bacteriophage. Lytic and Lysogenic life cycles

Distribution of microorganisms in nature-Soil, water and air.

Economic importance and Ecological significance of microbes.

Module 2. Mycology

20 Hrs

General characters and classification of fungi (Alexopoulos et.al.1996).Characteristic features of Fungal groups –Zygomycetes, Ascomycetes and Basidiomycetes; Allied groups Oomycetes and mitosporic fungi .

General Structure, Reproduction and Life cycles of the Genera - *Pythium*, *Rhizopus*, *Saccharomyces*, *Penicillium*, *Peziza*, *Puccinia*, *Agaricus* and *Cercospora*.

Economic importance and Ecological significance of Fungi

Module 3. Lichenology

3 Hrs

General characters of lichens. Classification of Lichens- Crustose, Foliose and Fruticose. Structure, Reproduction and Life cycle of *Usnea*. Economic importance and Ecological significance of Lichens

Module 4. Plant-microbe Interactions

2 Hrs

Plant-microbe interactions-Positive interactions-Rhizosphere and Phyllosphere. Plant growth promoting rhizobacteria. Legume-*Rhizobium* association. *Frankia*. *Azospirillum*. Mycorrhiza. Ectotrophic and Arbuscular mycorrhizal associations. Commercial products - Biofertilizers, Bio-control agents.

Module 5. Phytopathology

20 Hrs

Phytopathology-Concepts-disease, pathogens and other causative agents, symptoms. Classification of plant diseases on the basis of causal agents and symptoms. Host-parasite interactions, transmission and dissemination, disease cycle, simple and compound interest

diseases, epidemiology and control measures-cultural, biological, host resistance and chemicals.

Case studies consisting of symptoms, etiology and control measures of the diseases viz. Citrus canker (*Xanthomonas citri*), Mahali disease of Arecanut (*Phytophthora arecae*), Grey leaf spot of coconut (*Pestalotia palmarum*), Mosaic disease of tapioca, Bunchy top of Banana, Quick wilt of pepper (*Phytophthora tropicalis*), Soft rot of ginger (*Pythium myriotylum*), Abnormal leaf fall of Rubber (*Phytophthora palmivora*), Root (wilt) disease (Phytoplasma) of coconut, Root knot (*Meloidogyne incognita*) disease of vegetables and mistletoe (*Dendrophthoe falcata*) of mango.

Module 6. Laboratory and Field Protocols. 7hrs

General method of sample collection for Bacteria, Fungi and Phytopathology specimen. Serial dilution Technique, Gram Staining and other staining techniques of bacteria, and fungi . Laboratory bio-safety. Laboratory culture media for bacteria, Fungal culture media Culture incubation methods. Quantification of bacteria and Fungi in natural samples.

Practicals: 2hrs/week

Mycology

1.Collection, preservation and methods of making micropreparations (Sections and whole mounts) of fungi.

2.Gross and micromorphology of the types (Note:*Pythium* may be collected from soil by baiting. Infected male inflorescence of jack fruit may be observed for *Rhizopus*, Commercial formulation may be used for observing *Saccharomyces*, Infected fruits may be observed for *Penicillium*, *Peziza* may be collected from decomposing organic manure, Infected bhindi leaves may be used for observing *Cercospora*).

3. Gross morphology of bracket fungi/shelf fungi, puff balls, earth stars and birds nest fungi for field identification.

Microbiology

1. Collection, preservation and isolation of bacteria of soil and infected plant parts

2.Enumeration of bacteria in soil by soil dilution method

3. Purification of bacteria by streak plate method

4. Simple staining of bacteria by crystal violet/congo red

5. Gram's staining

6. Gross morphology and anatomy of root nodules.

7. Observation of AM fungi in roots by staining with writing ink.

Phytopathology

1. Symptomatic diagnosis of given plant diseases.
2. Isolation of Pathogen from infected sample, eg. male inflorescence of jack fruit, infected vegetables
3. Establishment of Koch's postulates (Demonstration and reporting)
4. Preparation of Bordeaux mixture
5. Gross and micromorphology of *Trichoderma*
6. Application of *Pseudomonas fluorescence* by seed biopriming and soil treatment

Reference

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WEIGHTAGE OF QUESTION PAPER:
5B08BOT/PLS: MICROBIOLOGY, MYCOLOGY, LICHENOLOGY &
PHYTOPATHOLOGY

Unit	Marks
Module 1	20
Module 2	20
Module 3	3
Module 4	2
Module 5	20
Module 6	5

Difficulty level	Easy	Average	Difficult
Weightage of Marks	20	40	10
Creation level and related verbs	<u>Knowledge</u> Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	<u>Understanding</u> Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	<u>Application and higher levels</u> Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY FIFTH SEMESTER BSc DEGREE EXAMINATION

5B08BOT/PLS: MICROBIOLOGY, MYCOLOGY, LICHENOLOGY &
PHYTOPATHOLOGY

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN
 1B01BOT/PLS and 2B02BOT/PLS

**CORE COURSE-9- RESEARCH METHODOLOGY, INSTRUMENTATION AND
BIostatISTICS**

Semester	Course Code	Hrs/ week	Credit	Exam hours
V	5B09BOT/PLS	4+1	3	3

Course Outcomes

1. Learning of the fundamental characteristics of science as a human enterprise, product and intellectual process
2. Understanding the working of science for further application in free, independent, individual needs and in designing scientific experimentation.
3. Appreciation of several scientific works and assessment of its influence on society.
4. Acquire knowledge on the principles, components and applications of various scientific equipments in biology.
5. Foundation knowledge in the basic concepts, components and functions of informatics.
6. Appreciate the importance of statistical principles in biological research.

Module -1. Introduction to Science Research Methodology 20 Hrs

What is Science? Science and Non Science, Pseudoscience. History of Science, Types of knowledge- scientific knowledge, The salient features of knowledge, concepts and laws in science - Information. Hypotheses, theories and laws in science, Areas of science-pure and applied science.

Experimentation in Science-Selecting a problem, observation, data collection, Presentation of Data, and interpretation; formation of hypothesis; Experimental designs- variables- correlation and causality, sampling, control in experiments, experimental bias and errors. Types of Experiments -to test a hypothesis-to measure a variable - to gather data. Making observations -direct and indirect; controlled and uncontrolled; human and machine observations. Documentation of experiments. Discussion and analysis.

Publications in Science- Types of Publication Journals, Important Journals in Botany, Impact Factor; Monographs; Floras. Importance of Peer Review. Patents and copyrights

Ethics in Science- Research /Experimentation /Publication – Agriculture, Patent, Bitotechnology, animal Experimentation, Variety Production

Module 2 – Instrumentation 25 Hrs

Microscopy- Types and Principles

Parts of compound microscope- the instrument. magnification, resolution. - objective lenses- ocular lens- aberration of lenses-visibility. Phase contrast microscopy, Fluorescence microscopy- Electron microscopes-SEM, TEM.

Accessory techniques: Camera lucida drawing, Micrometry, video microscopy and image processing- photomicrography. Hand Sectioning and Microtome Sectioning, Staining – Common stains. Mounting and Mounting media.

Methods in Molecular biology and Biochemistry.

Separation techniques- Types, Principles, and Applications of Centrifuge,

Chromatography and Electrophoresis.

Sterilization methods - Autoclave, Laminar air flow, UV irradiation, Chemical sterilization,

Spectrophotometry– Principles, instrumentation and Applications of Colorimeter and Spectrophotometer.

Buffers- their principle and functions in biological systems, Preparation and uses of buffers in biological research,

pH meter- Principles, and Applications.

Laboratory Safety Measures by UNESCO; Biosafety Concept

Module 3: Computer for Research

8 Hrs

Features of the modern personal computer and peripherals, computer networks and Internet, wireless technology, cellular wireless networks. Overview of Operating Systems & major application softwares that can be used in biological research.

Module 4 – Biostatistics

19 Hrs

Biostatistics– Measures of Central tendency- Arithmetic Mean, Median, Mode; Measures of Dispersion – Range, Standard Deviation, Standard Error; Correlation and Regression, Test of Significance: Chi-square analysis, Application of Biostatistics. Major statistical softwares used in biology.

Practicals -1 hr/ week

1. Parts of Compound microscope.
2. Micrometry
3. Demonstration of Microtome sectioning
4. Separation of Plant pigments by paper chromatography
5. Preparation of buffers (Phosphate buffer) and determination of pH
6. Demonstration of Autoclave, Spectrophotometer, Laminar Air Flow cabinet, Centrifuge and Electrophoresis.
7. Graph and Table preparation using computers
8. Familiarisation of Computer hardwares- photographs and diagrams
9. Work out problems on measures of central tendencies, measures of dispersion . chisqre analysis, both manually and using computer softwares.
10. Whole mount preparation

References:

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2. Alexis & Mathews Leon, *Fundamentals of Information Technology*, Leon Vikas
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WEIGHTAGE OF QUESTION PAPER
**5B09BOT/PLS: PLANT RESEARCH METHODOLOGY, INSTRUMENTATION
AND BIostatISTICS**

Unit	Hours	Marks
Module 1	20	20
Module 2	25	25
Module 3	8	7
Module 4	19	18

Difficulty level	Easy	Average	Difficult
Weightage of Marks	20	40	10
Creation level and related verbs	Knowledge Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	Understanding Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	Application and higher levels Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY FIFTH SEMESTER BSc DEGREE EXAMINATION

**5B09BOT/PLS: PLANT RESEARCH METHODOLOGY, INSTRUMENTATION
AND BIostatISTICS**

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN
1B01BOT/PLS and 2B02BOT/PLS

CORE COURSE -10- ENVIRONMENTAL SCIENCE AND PHYTOGEOGRAPHY

Semester	Course Code	Hours per week	Credit	Exam Hours
6	6B10BOT/PLS	4+ 2	4	3

Course Outcomes

1. Understanding the fundamental concepts in ecology, environmental science and phytogeography.
2. Concept development in conservation, global ecological crisis, Sustainable development and pros and cons of human intervention.
3. Enable the student to appreciate bio diversity and the importance of various conservation strategies, laws and regulatory authorities.
4. Recognition of the need for more research to create a baseline data for sustainable exploitation- Think globally and Act locally
5. Analyse the interrelationship between the geography and pattern of distribution of plants.
6. Appreciate key concepts from economic, political, and social analysis as pertained to the design and evaluation of environmental policies and institutions.
7. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
8. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

ENVIRONMENTAL SCIENCE AND PHYTOGEOGRAPHY

Module-1 Introduction

2 Hrs

Definition, scope and importance of environmental science. Difference between ecology, environmental science and environmental studies, branches of ecology- autecology, synecology,

Module -2: Structure and function of an ecosystem

15 Hrs

Structure of freshwater, marine and forest ecosystem. Producers, Consumers and Decomposers. Factors affecting ecosystem- biotic and abiotic factors Trophic organization. Food chains- grazing, parasitic, microbial loop, food webs and types of ecological pyramids., Energy flow in the ecosystem- 10% law and flow diagram. Productivity of ecosystem- Primary and Secondary Productivity. NPP and GPP Biogeochemical cycles-complete, incomplete, Water, Gaseous- Nitrogen, Carbon, Sulphur, Phosphorus.

Module -3: Community structure and Dynamics

15 Hrs

Concept of habitat and ecological niche, Ecotone and Edge Effect. Concepts in ecospecies- Ecads and Ecotypes. Techniques used in Plant community studies- Quadrat and transect methods-species area curve- density, frequency, abundance and dominance of populations- importance value index- construction of phytographs. Ecological succession: Introduction, types, characteristic features, structure of each substages in Xeracrh, Hydrarch and Mesarch.

Module 4: Plant adaptations and interactions**5 Hrs**

Adaptations -morphological, anatomical and physiological in Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites.

Plant- Animal Interactions -Introduction, General categories with examples. Commensal interactions, Antagonistic interactions-Herbivory, Mutualisms- Pollination and seed dispersal. Co-evolution of plants and insects, Role of Plant-Animal interactions in sustainability of ecosystem. Brief account on myrmecophily, chiropterophily.

Module -5: Environmental Pollution**8 Hrs**

Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Electromagnetic pollution and Light Pollution. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents. Pollution Control Board and its role.

Pollution case studies- Ganga River, Chernobyl, London and Delhi Smog, Endosulfan, Tajmahal

Module 6: Biodiversity**5 Hrs**

Introduction – Definition: genetic, species and ecosystem diversity. Importance of biodiversity at global, National and local levels. India as a mega-diversity nation . Concept of Hot-spots of biodiversity and hotspots in India. Threats to biodiversity: habitat loss, poaching of wildlife, Endangered and endemic species of India

Module 7-Phytogeography**4 hrs**

Phytogeography- Definition, concepts --Descriptive and dynamic -Continental drift, age and area theory, Endemism, centre of origin, Plant migration and barrier. Topographic factors- Altitude and latitude. GPS. Remote sensing. Vegetation types of India

Module -8: Man and Biosphere**18 hrs**

Man in conflict with other resources during Infrastructure development, Urbanisation and Industrialisation, Consumerism and Tourism. Depletion of Natural resources, Man-wildlife conflict.

Man's efforts for the restoration of Natural resources:

Environment Protection Acts- major clauses, provisions and impacts of Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Biodiversity conservation Act, Gadgil Committee Report,

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity – National Parks, Sanctuaries and Biosphere Reserves, Sacred groves and Botanic Gardens. Biodiversity related agencies and activities-PBR, BMC, etc.

Disaster Management: Floods, earthquake, cyclone, forest fire and landslides

Solid and liquid waste Management: Causes, effects and control measures of urban and industrial waste including e-waste, Biomanuring and composting, Phytoremediation.

Energy Management: Use of Renewable Energy Resources and alternate energy resources

Afforestation and Reforestation: Natural and Artificial regeneration-Forest Nurseries-Plantation techniques- Social forestry, Agroforestry and Silviculture.

Restoration of Aquifers: Rain water harvesting methods, Watershed management.

Movements, Agitations and Awareness Programmes : Earth Summits and World protocols Chipko movement, Silent Valley Movement, Important days- World Environment day, Forest Day, Wetland Day, etc.

Sustainable Development and changes in lifestyle: Conservation of Indigenous knowledge and Community participation. Utilization of GPS, Remote sensing and GIS to address environmental problems

Practicals 2 Hrs/week

1. Visit a local polluted site and documentation of major pollutants/Reserve forest.
2. Study of plant community by quadrat method.
3. Study of ecological and anatomical modifications of xerophyte, hydrophyte, halophyte, parasite and epiphyte.
4. Estimation of DO and BOD and calculate the primary productivity of pond water.
5. Estimation of dissolved carbon dioxide in water
6. Knowledge of ecological instruments- hygrometer, rain gauge, anemometer, altimeter, luxmeter, wet and dry bulb thermometer, salinometer, water sampler, GPS (with the help of equipment/diagram or photograph)

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**WEIGHTAGE OF QUESTION PAPER:
6B10BOT/PLS: ENVIRONMENTAL SCIENCE AND PHYTOGEOGRAPHY**

Unit	Marks
Module 1	2
Module 2	15
Module 3	15
Module 4	4
Module 5	8
Module 6	4
Module 7	2
Module 8	20

Difficulty level	Easy	Average	Difficult
Weightage of Marks	20	40	10
Creation level and related verbs	Knowledge Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	Understanding Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	Application and higher levels Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY SIXTH SEMESTER BSc DEGREE EXAMINATION

6B10BOT/PLS: ENVIRONMENTAL SCIENCE AND PHYTOGEOGRAPHY

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN
1B01BOT/PLS and 2B02BOT/PLS

CORE COURSE -11-GENETICS, MOLECULAR BIOLOGY AND PLANT BREEDING

Semester	Course Code	Hours per week	Credit	Exam Hours
6	6B11BOT/PLS	5+ 3	4	3

Course Outcomes

1. Identify the basic principles and current trends in classical genetics.
2. Recognise the historical process of the evolution of molecular genetics from classical genetics.
3. Review the relevance of the application of genetic principles in agriculture, medicine, research and industry.
4. Outlining the use of genetic principles for conservation, defining and better understanding of nature.
5. Develop theoretical background on molecular genetics to provide a strong support for the student for future research and employability.
6. Appreciate the way scientists work in understanding biological processes and the organization of cell.
7. Cite examples for scientific interventions to human and plant life through brief exposure to plant breeding principles.
8. Modify the concept on gender, human diseases and their management based on the study of genetic principles of human beings.

GENETICS, MOLECULAR BIOLOGY AND PLANT BREEDING

Module 1: Introduction to Genetics

3 Hrs

Definition, Branches and Scope of Genetics. Early concepts on reproduction and genetics, Division of Genetics. Technical advancements and emergence of molecular genetics

Important terms in genetics – factors, genes, chromosomes, alleles, homozygous and heterozygous, hemizygous, traits, phenotypes, genotypes, locus, linkage, mutation; population, offspring, clone, Test cross, back cross, reciprocal cross.

Genes Vs Environment. Genetics and society- Eugenics and Euphenics

Module 2: Mendelian Genetics

4 Hrs

Brief account of Mendel's life history: Mendelian experiments: Monohybrid cross and dihybrid cross, Mendelian ratios, Laws of inheritance. Reasons for Mendel's success. Mendelian Genetics and sexual cycle in plants.

Module 3- Gene interactions and modified Mendelian ratios

10 Hrs

a. Allelic interactions: dominant – recessive, Incomplete dominance – flower color in *Mirabilis*; Co-dominance – Coat colour in cattle, Lethal genes – Sickle cell anemia in Human beings.

b. Interaction of genes: Non epistatic - Comb pattern inheritance in poultry 9:3:3:1. Epistasis: dominant - Fruit colour in summer squashes 12:3:1; recessive - Coat color in mice 9:3:4; Complementary gene interaction- flower color in *Lathyrus* 9:7. Inhibitory genes – Leaf

Colour in paddy 13:3; Duplicate gene interaction- Shepherd's Purse 15:1, Duplicate genes with cumulative effect-9:6:1. Pleiotropic genes.

c. *Quantitative inheritance*- Polygenes-General Characters-. Ear size in corn. Transgressive variation-Heritability Phenotypic expression- Penetrance and expressivity

Module 4- Chromosomes

10 Hrs

Introduction – Role of chromosomes in inheritance and its significance. Chromosome Morphology, Chromosomal nomenclature- Chromatid, Centromere, Telomere, Secondary constriction, Satellite and Nucleolar Organizing Regions. Chromosomal classification based on position of Centromere. Heterochromatin and Euchromatin, Karyotype and Idiogram. Chromatin reticulum-Structure, Chemical organization of Chromosomes; DNA and Histones. Packaging the DNA into Chromosomes, Polytene chromosomes, Lamp brush chromosomes and B chromosomes. **Chromosomal mutation - Structural aberration.** - Deletion, Duplication, Inversion and Translocation and its genetic consequences. **Numerical aberration** - Aneuploidy and Euploidy.

Module 5- Sexuality and Genetics

6 Hrs

Determination of sex- different theories- Chromosome theory (Grasshopper, Man, *Drosophila*); Dosage compensation; Lyon Hypothesis; Genic balance theory. Sex determination in plants (*Melandrine*, *Dioscorea*, *Sphaerocarpus*). Sex linked Inheritance-X linked inheritance-eye color in *Drosophila*. Y-Linked inheritance-Sex limited and sex influenced traits. Extra chromosomal inheritance- Variegation in Four o' clock plant; Poky in *Neurospora*

Module 6- Chromosome mapping

5 Hrs

Linkage: Definition; types – complete (*Drosophila*) and incomplete (Maize); explanations for linkage- Linkage Vs Independent assortment. Crossing over -Mechanism of crossing over cytological demonstration. Chromosome Mapping-Definition- determining the gene sequence - importance of Two point and three point test crosses in chromosome mapping-Interference and coincidence

Module 7- Overview of molecular biology

12 Hrs

Introduction: DNA- The genetic material, Evidences for DNA as genetic material, (Griffith, Avery, McLeod, McCarthy Experiments) Chargaff's rules. Watson and Crick model of DNA. Different forms of DNA- A, B and Z.

DNA replication- Enzymology of DNA replication, Mechanism and types of Replication

Concept of gene - Cistron, Recon, Muton. One gene-One enzyme hypothesis, One gene-One polypeptide hypothesis. Introns and Exons. Mobile genetic elements (general account)

Genetic code – Discovery (Brief account), features of genetic code, Codon and Anticodon.

Module 8 Gene Expression

12 hrs

Central dogma-

Transcription-Mechanism-.initiation, elongation and termination of RNA synthesis. Types of RNA-Structure, Composition and Significances of tRNA, mRNA and rRNA. Post transcriptional modification in eukaryotic mRNA.

Translation-Protein synthesis- Mechanism -Activation of aminoacids, initiation, elongation, termination. Post translational processing (Brief account).

Gene regulation in prokaryotes - Operon concept- *lac*, *trp* operons.

Gene regulation in Eukaryotes - Transcriptionally active and inactive form of chromatin, and role of promoters in Eukaryotic gene regulation.

Module 9 Gene Mutation

6 hrs

Types of mutation-Transition, Transversion and Frameshift mutation, Molecular basis of mutation, Mutagens; Chemical and Physical agents, tautomeric shift, alkylating agents, base analogues. DNA Repairing Mechanisms

Module 10 Human Genetics

5 Hrs

Mendelian principles and human genetics. Blood group in human beings; Quantitative inheritance in human beings-skin colour, IQ and other traits Haemophilia in man. Syndromes- Down, Turner, Klienfelter, Criducat. Human Genome Project and significance.

Oncogenes and cancer –Carcinogenesis, Characters of Cancer cells, Cellular oncogenes and Tumour suppressor genes

Module 11 Statistics and Genetics

2 Hrs

Statistical Probability and Mendelian genetics-Hypothesis testing-Chi-square test. Pedigree analysis- Symbols of Pedigree- Pedigrees of Sex-linked & Autosomal (dominant & recessive)

Module 12 Plant breeding

15 Hrs

History and objectives of Plant Breeding. Genetic resources-Centres of diversity, Origin of crop plants, Domestication, Conservation, Plant introduction and acclimatization. Plant quarantine measures.

Methods of Breeding- Hybridization-Heterosis and Selection, (Pedigree, Mass, Pureline and Clonal). Haploidy, Polyploidy breeding and Mutation breeding. Achievements in Rice, Wheat, Cotton, Sugarcane, Potato and Tomato.

Major plant breeding Institutes in India and its contributions.

Plant variety protection, Farmer's right and plant breeders rights.

Biotechnology and Crop improvement: Pest Resistance, Herbicide Resistance, Drought resistance, Enrichment of storage protein and Improvement of the nutritional quality.

Issues related to crop improvement

Practicals 3 hrs/week

1. Dihybrid inheritance
2. Allelic and Non allelic Gene interactions.
3. Chromosome mapping (two-point and three point crosses),
4. Chi square analysis
5. Probability factor in Genetics
6. Plant total DNA extraction.
7. Agarose gel electrophoresis of DNA samples
8. Breeding Methods-Budding, Layering and Grafting

References

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WEIGHTAGE OF QUESTION PAPER:
6B11BOT/PLS: GENETICS, MOLECULAR BIOLOGY AND PLANT BREEDING

Unit	Marks
Module 1 and 2	5
Module 3	8
Module 4	8
Module 5	5
Module 6	4
Module 7	9
Module 8	9
Module 9	5
Module 10 and 11	5
Module 12	12

Difficulty level	Easy	Average	Difficult
Weightage of Marks	20	40	10
Creation level and related verbs	<u>Knowledge</u> Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	<u>Understanding</u> Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	<u>Application and higher levels</u> Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY SIXTH SEMESTER BSc DEGREE EXAMINATION

6B11BOT: GENETICS, MOLECULAR BIOLOGY & PLANT BREEDING

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN
 1B01BOT/PLS and 2B02BOT/PLS

CORE COURSE-12-BIOTECHNOLOGY AND BIOINFORMATICS

Semester	Course Code	Hours per week	Credit	Exam Hours
6	6B12BOT/PLS	5+ 2	4	3

Course Outcomes

1. Develop knowledge of the fundamental techniques of biotechnology and the history of its development.
2. Recognise theoretical knowledge on the equipments used in biotechnology which will give a support during future prospects.
3. Connect the genetic engineering principles in agriculture, medicine, research and industry for a better world.
4. Identify the significance of nanobiotechnology results for updated knowledge in that field.
5. Appreciate and criticise the information technology aided advancements in biology.
6. Develop awareness on the economic, social and environmental problems of gene manipulation.

BIOTECHNOLOGY

Module 1: Introduction to biotechnology

3 Hrs

History and Emergence of Biotechnology; Old and New Biotechnology; Introduction to various sub disciplines of biotechnology with special emphasis to Microbial, Plant, Animal and Environmental biotechnology; Scope of Biotechnology in Agriculture, Industry, Environment and Biodiversity conservation.

Module 2: Fundamentals of Plant tissue culture

12 hrs

Brief History, Principles–Totipotency, differentiation, dedifferentiation, redifferentiation; requirements for plant tissue culture – laboratory, culture media-MS media, sterilization techniques. Types of explants used in tissue culture, their sterilisation and inoculation and general methodology of *in vitro* callus culture; Types of plant tissue culture- Meristem culture, Organ culture, Callus culture, Cell suspension culture, Protoplast culture, anther, embryo and endosperm culture and their significance-

Module 3: Applications of plant tissue culture

10 Hrs

Micropropagation; Brief account on production of haploids, somatic hybridization, somatic embryogenesis, synthetic seeds, somaclonal variant production, Hairy root technique, Secondary metabolite production in Bioreactors.

Module 4: Recombinant DNA Technology

10 Hrs

Introduction and brief history; Principles of rDNA technology, Vectors- cloning, expression and shuttle vectors; Concept of ideal vectors- pBR 322, pUC, cosmids, phagemids, BAC and YAC. Enzymes- Restriction Endonucleases, Ligases and DNA modifying Enzymes. Introduction of DNA into cells- Physical, Chemical and Biological; Selection of recombinants– screening, selection markers and methods- GFP, Replica plating, Blue-white colony selection. Genomic library and cDNA library construction and its significance.

Module 5. Techniques and tools of biotechnology**10 Hrs**

Electrophoresis – Agarose gel electrophoresis and Polyacrylamide gel electrophoresis and their uses. Blotting techniques: Northern, Southern and Western Blotting and their uses. Polymerase Chain Reaction, RT-PCR and qRT-PCR and their uses. DNA Fingerprinting; Molecular DNA markers - RAPD, RFLP, and SSR. DNA sequencing -Maxam –Gilbert method, Sanger's Sequencing.

Module 6. Plant biotechnology**8 Hrs**

Introduction to *Agrobacterium* biology and its role in plant biotechnology, Ti and Ri plasmids and application in crop improvement and Industry. T-DNA mutagenesis, T-DNA Tagging. GMPs Production- methodology, recombinant genes and the type of tools used in Bt Cotton, Golden Rice, Terminator Seeds, Flavr Savr Tomato, Banana with vaccines.

Module 7. Nanobiotechnology**10 Hrs**

History ; scope and significance of nanotechnology. Property changes for a material from bulk to nanoscaled particle. Description of nanoparticles in nature with examples. Application of nanotechnology in life sciences- Biosensors, Disease diagnosis, Drug delivery, Crop protection, Tissue engineering. Next Gen- sequencing, Gene editing tools, CRISPR-Cas9.etc.

Module8 .Biotechnology and Bioethics**5 Hrs**

Brief description of the public and ethical concerns on GMPs, GM foods, vaccines and drugs, Gene therapy and DNA fingerprinting. Pros and cons in patenting of life forms.

Overview of Biotechnology in India – Regulatory authorities (Patent, Ethics, EIA), Departments (DBT and DST), Institutes (CSIR, ICAR, NBPGR, RGCB, CCMB) and Achievements.

BIOINFORMATICS**Module 09: Introduction to Bioinformatics****2 Hrs**

Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics. Proteomics, Genomics, Metabolomics. General applications of Bioinformatics.

Module 10: Databases in Bioinformatics**10 Hrs**

Biological Databases-Diversity Databases, Nucleotide Database, Protein Database, Gene Expression Database, Metabolite databases. Major Databases in Bioinformatics- National Center for Biotechnology Information (NCBI), EMBL Nucleotide Sequence Database (EMBL): DNA Data Bank of Japan (DDBJ), Genbank, Protein Information Resource (PIR), PDB, Swiss-Prot. Methods of Search and data retrieval from databases- Entrez and SRS.

Module 11: Molecular phylogeny and its application**10 Hrs**

Concept of Sequence Alignment and Tools – Pairwise- Basic local alignment search tool (BLAST); Multiple Sequence Alignment – CLUSTALW/X. Methods and softwares for phylogeny analysis- PHYLIP
Brief overview of Homology Modelling and Structure Prediction. Applications in Drug Discovery, Overview of Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement and Molecular visualisation.

Practicals 2 hrs/week

1. *In vitro* culture of plant tissues – Demonstration of sterilization techniques, Media preparation, Selection, surface sterilization and Inoculation of explants.
2. Isolation of DNA from plant tissues
3. Demonstration of Agarose gel electrophoresis
4. Polymerase chain reaction (Demonstration)
5. Visit report to a biotechnology lab
6. Vectors-pBR322, pUC, Ti plasmid vectors. (Diagrams)
7. Website visits to databases –NCBI, EMBL,DDBJ,PIR,PDB, Swiss Prot
8. Demonstration of Sequence retrieval from databases and Sequence alignment-
9. Construction of phylogenetic tree using PHYLIP
- 10.Sequence alignment using BLAST
11. Molecular visualisation tools- Swiss-Prot

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WEIGHTAGE OF QUESTION PAPER- 6B12BOT/PLS: BIOTECHNOLOGY & BIOINFORMATICS

Unit	Marks
Module 1	2
Module 2	9
Module 3	8
Module 4	8
Module 5	8
Module 6	6
Module 7	8
Module 8 and 9	5
Module 10	8
Module 11	8

Difficulty level	Easy	Average	Difficult
Weightage of Marks	15	35	10
Creation level and related verbs	<u>Knowledge</u> Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	<u>Understanding</u> Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	<u>Application and higher levels</u> Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY SIXTH SEMESTER BSc DEGREE EXAMINATION
6B12BOT/PLS: BIOTECHNOLOGY & BIOINFORMATICS

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN
1B01BOT/PLS and 2B02BOT/PLS

CORE COURSE-13-EVOLUTION AND PALAEOBOTANY

Semester	Course Code	Hours per week	Credit	Exam Hours
6	6B13BOT/PLS	3+ 1	3	3

Course Outcomes

1. Understand the basic principles and current trends in classical evolution.
2. Develop awareness on the historical process of plants and animals with an emphasis on human beings.
3. Relate the evolutionary principles with agriculture, medicine, research and industry.
4. Apply the principles of genetics and evolution in conservation, defining and better understanding of nature.

EVOLUTION AND PALAEOBOTANY

Module 1- Evolutionary concepts

5 Hrs

Evolution: Definition- classical and modern concepts- Macro and Microevolution, Convergent and Divergent Evolution, Retrogressive and Progressive Evolution. Evidences of evolution: fossils, atavism, experimental, embryological and anatomical, life history, cell structure, etc.

Species concept- different definitions taxonomic, biological, evolutionary and ecological: Speciation- types, reasons behind speciation.

Module 2 Theories of evolution:

10 Hrs

Origin of life on earth- biomolecules and its evolution. Oparin's bubble hypothesis. The origin of Prokaryotes and Eukaryotes ; the earliest cells LUCA.

Endosymbiotic theory by L. Margulis; Use and Disuse theory by Lamark; Germplasm theory by Weisman and De Vries.

HMS Beagle and its voyages- Natural Selection theory Darwin and Wallace- examples of plants cited by Wallace and Darwin.

Neo-Darwinism and other modern concepts of evolution. Molecular evidences for Darwinism

Module 3: Evolution and Genes

9 Hrs

Mutation and Evolution- Polygenic inheritance –heritability and selection- Polyploidy and Evolution, Hybridization and Evolution, Population Genetics- Gene Frequencies in population, Gene pool and Gene frequencies; Equilibrium of Gene frequencies and Hardy-Weinberg law. Changes in Gene Frequencies-Mutation, selection, migration, genetic drift, non- random mating.

Module 4: Evolution and phylogeny

8 Hrs

Geological time scale with special emphasis to flora and fauna of each era. The main lines of plant evolution– from algae to angiosperms. Systematics and phylogeny: Monophyly, Polyphyly and Paraphyly.

Reconstructing and Using Phylogenies, Phylogenetic trees based on biomolecules- amino acid sequences, Quantitative DNA measurements, Repetitive DNA sequences, restriction enzyme sites and nucleotide sequences. The modern methods in phylogeny- cladogram

WEIGHTAGE OF QUESTION PAPER: 6B13BOT/PLS: EVOLUTION AND PALAEOBOTANY

Unit	Marks
Module 1	6
Module 2	13
Module 3	11
Module 4	10
Module 5	10
Module 6	4
Module 7	13

Difficulty level	Easy	Average	Difficult
Weightage of Marks	15	35	10
Creation level and related verbs	<u>Knowledge</u> Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	<u>Understanding</u> Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	<u>Application and higher levels</u> Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY SIXTH SEMESTER BSc DEGREE EXAMINATION

6B13BOT/PLS: EVOLUTION AND PALAEOBOTANY

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN
1B01BOT/PLS and 2B02BOT/PLS

CORE COURSE- 14- CORE PRACTICAL II

Semester	Course Code	Hours per week	Credit	Exam Hours
6	6B14BOT/PLS		4	3

Course Outcomes

1. Learning the fundamental techniques used in a botany lab related to Mycology, Microbiology, Angiosperms systematics
2. Understands the working of science by first-hand experience.
3. Comparison skill is attained by comparing different plants and their vegetative and reproductive structures.
4. Incubation of practical skills for further application in free, independent, individual needs and helps in designing scientific experimentation.

PRACTICAL WORK DONE DURING FIFTH SEMESTER-5B06BOT/PLS,
5B07BOT/PLS and 5B08BOT/PLS IS THE BASIS OF THIS PRACTICAL COURSE,

MODEL QUESTION PAPER- 6B14BOT-CORE PRACTICAL II

Time-3Hrs

Max.marks-70

1. Take down the salient features of the Dicot plant twig A with flower and describe the plant.
Vegetative 3 and Reproductive 5, (8 marks)
2. Examine the given Specimen B and identify the family with reasons and systematic position.
Identification-1 Reasons-3 Systematic position- 2 (6marks)
3. Take a transverse section of the flower C, and draw the Flower LS and Floral formula .
LS -2 labeled diagram-3 Floral formula-2 (7 marks)
4. Qualitative Estimation of the solution 'D' with 3 tests
Identification-1, - Result-6 Procedure -2 (9 marks)
5. Staining of specimen 'E' and write down the procedure .
Identification-1 procedure -2 result 3 (6 marks)
6. Set up physiology experiment F (Viva-3 setting up -3) (6 marks)
7. Take the section of the material G with neat labeled diagram.
Identification-1, Preparation -3 labelled diagram -3 (7 marks }
8. Spot at sight, identify the specimen with short notes H, I, J, K,L,M,
(identification 1, reason/notes-1)x 6 (12 marks)
9. Identify the plants in Herbaria N, O
(Botanical name- 1 Family -0.5)x 2 (3 marks)
10. Identify the economically important plants P and Q
(BN -1 Family- 0.5, Morphology of the useful part -0.5 and uses -1)x 2 (6marks)

KEY TO THE SPECIMENS

- 1). A flowered twig from dicot family
- 2) A plant twig with flowers from a studied angiosperm family
- 3) A large Flower from studied angiosperm family
- 4) Carbohydrate/Lipid/Protein solution
- 5) Lactobacillus/Soil fungus
- 6) Plant Physiology Experiment
- 7)Fungus Studied- *Puccinia*, *Agaricus*, *Cercospora*, etc, studied
- 8) Mycology-2, Microbiology-1, Plant Pathology-1, Plant physiology-2
- 9) Herbarium sheets of the student
- 10) Economic botany plants studied

CORE COURSE 16- PROJECT/FIELD STUDY/VIVA VOCE

Semester	Course Code	Hours per week	Credit	Exam Hours
6	6B16BOT/PLS		3	3

Course Outcomes

1. Learning the fundamental techniques used in a research
2. First-hand experience in doing science.
3. Development of the skill to communicate science.
4. Internalisation of skills for further application in designing scientific experimentation.

PROJECT

Every student of a UG Programme shall have to work on a project under the supervision of a faculty member as per the curriculum. Project can be started from the beginning of the fourth semester. BoS suggests a team project, but individual projects can be promoted. A log book should be maintained by each student during the work and should be submitted along with the project report for valuation. The submission of the projects should be in the last week of February in sixth semester.

The internal evaluation should be done by the supervising faculty member and should be completed by the end of February in sixth semester.

The project report should have all the parts of a scientific report with an emphasis to objectives, materials and methods, data analysis and conclusion. References used for the work and report preparation should be cited properly. Project evaluation will be done by the end of sixth semester by the external examiners appointed by the University.

FIELD STUDY

Every student of BSc Botany/Plant Science should complete a minimum five day field study during the programme. Field study report(s) should be submitted along with the project report in the sixth semester.

VIVA VOCE

Viva voce is having four components 1. Project work 2. Field study 3. General assignment done by the student and 4. General knowledge on the subject developed during this three year programme.

General guidelines for the work and also for evaluation is given in the pages 7-9 of this syllabus.

B. Sc PLANT SCIENCE PROGRAMME- GENERAL AWARENESS COURSES

Semester	Course Code	Title	Marks			Credit	Theory	Practical	TOTAL
			Internal	External	Total		hrs/wk		
3	3A11PLS	PLANTATION SCIENCE	10	40	50	3	3	2	5
3	3A12PLS	HORTICULTURE	10	40	50	3	3	2	5
4	4A13PLS	PLANTATION MANAGEMENT	10	40	50	3	3	2	5
4	4A14PLS	HERBAL SCIENCE	10	40	50	3	3	2	5
4	4A15PLS	GENERAL PRACTICAL	5	65	100	4	nil		
		Record + Lab Experiment Study +Field Study+ Viva	15	15					
		Total	60	240	300	16	6	4	20

GENERAL AWARENESS COURSE IN PLANT SCIENCE- 1-

PLANTATION SCIENCE

Semester	Course Code	Hours per week	Credit	Exam Hours
3	3A11PLS	3+2	3	3

Course Outcomes

5. Learning the fundamental techniques used in plantation science.
6. Awareness on the history of agriculture.
7. Internalisation of practical skills related to agriculture.

PLANTATION SCIENCE

Module I. Introduction 4 hours

History and evolution of Agriculture in India. Importance of plantation crops and spices on the economy of India. Present status of plantation crops and spices in Kerala.

Module II. Botany of Crops 15 hours

Study of the plantation crops and spices mentioned below in relation to the following aspects- importance, origin, distribution, morphology, taxonomy, floral biology and morphology of useful parts - tea, coffee, rubber, coconut, areca nut, cashew, pepper and cardamom.

Module III. Propagation of crops 4 hours

Specific protocol for the propagation of plantation crops- seeds, cuttings, bulbils, Budding, grafting, and layering in tea, coffee, rubber, coconut, areca nut, cashew, pepper and cardamom with special emphasis to the recent popular nursery and commercial practices for the production of planting materials.

Module IV. Agronomic practices 10 hours

Specific protocol for the farm management and agronomic practices of the crops mentioned with special reference to - Soil and climate, land preparation and planting techniques, organic manure and fertilizers, growth regulators, Irrigation and fertigation, Inter cropping and mixed cropping

Popular varieties of these plantation crops and their morphometric, immunological and nutritional qualities.

Module V. Diseases

10 hours

Study of the symptoms, etiology, crop loss and management of the major fungal diseases of crops. Tea- Camellia Blister blight, red rot; Coffee- Leaf rot, Black Rot, Rubber- Powdery mildew, Pink disease; Coconut-Leaf rot and Thanjavur wilt; Cashew- Dieback disease; Arecanut- Bud rot and root rot; Pepper- Anthracnose; Cardamom- Capsule rot and Rhizome rot. Major plant protectants- fungicides, bactericides, pesticides, and herbicides. Biological control of pests and diseases. Integrated pest and disease management.

Module VI. Harvesting and post- harvest management 11 hours

Study of the harvesting, storage, processing, value addition and marketing of the economically important products of the crops mentioned earlier. By-product and their utilization. Grading of the products of above crops.

PRACTICALS 36 hours

1. Field identification of crops mentioned in the syllabus.
2. Visit to a major estate, plantation or factory to study harvesting and processing techniques
3. Visit to major R & D centres and quality control laboratories of the above crops
4. Field identification of the common diseases of the crop plants mentioned in the syllabus.
5. Familiarization with agronomic practices of any 2 crops mentioned earlier.
6. Collection of different grades of marketed products of crops mentioned in the syllabus.
7. Seed viability Test by TTC

REFERENCES

1. Bavappa, K.V.A, Nair, M. K and Kumar, T. P. 1982. The Arecanut Palm, CPCRI
2. Child, R. 1974. Coconuts. Longman
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7. Paulose, T.T. 1972. Arecanut and Spices, a grower handbook. Directorate of Arecanut & Spices
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WEIGHTAGE OF QUESTION PAPER: 3A11PLS: PLANTATION SCIENCE

Unit	Marks
Module 1	5
Module 2	20
Module 3	5
Module 4	13
Module 5	13
Module 6	14

Difficulty level	Easy	Average	Difficult
Weightage of Marks	15	35	10
Creation level and related verbs	<u>Knowledge</u> Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	<u>Understanding</u> Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	<u>Application and higher levels</u> Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY THIRD SEMESTER BSc DEGREE EXAMINATION

3A11PLS: PLANTATION SCIENCE

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN 1B01BOT/PLS and 2B02BOT /PLS

GENERAL AWARENESS COURSE IN PLANT SCIENCE -2-

HORTICULTURE

Semester	Course Code	Hours per week	Credit	Exam Hours
4	3A12PLS	3+2	3	3

Course Outcomes

1. Learning the fundamental techniques used in horticulture.
2. First-hand experience in cultivation of plants.
3. Internalisation of practical skills in agriculture practices.

HORTICULTURE

MODULE -1 Introduction to Cultivation of Plants:

12 Hours

History, Scope and Types of Plant Cultivation:- Horticulture, Floriculture, Olericulture, Plantations. Major garden tools and implements- Methods of vegetative propagation- natural- specialized stem and roots-bulbs, corms, tubers, rhizomes and pseudobulbs and artificial-cutting, budding, layering and grafting. Media for propagation- soil, sand, peat, sphagnum moss, vermiculite. Methods of soil laying. Soil mixture and nursery beds. Sowing/raising of seeds and seedlings - Transplanting of seedlings Manures: Organic and inorganic- Types of manuring. Irrigation methods. Management of pests and diseases and harvesting.

MODULE-2- Gardening

12 Hours

Types of gardens-Home Gardens- Indoor garden, Kitchen garden; and public garden. Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens. Garden Components- Garden wall, Fencing, Steps, Hedge, Edging. Lawn, glass house, rockery, water garden and topiary. Nursery- Significance of Nursery. Hardening of plants – green house - mist chamber, shed root, shade house, polyhouse and glass house. Landscaping- Principles of landscaping designs, components of landscape designs, lawn grass varieties, Role of trees in landscaping. Making of Lawn and Bonsai. Computers in landscaping.

MODULE-3- Vegetable and Fruit Cultivation**12 Hours**

Olericulture- Definition- Importance of vegetables- Production technology- Cultivation of vegetables- Bhindi, Brinjal, Bitter gourd, Pumpkin, *Colocasia*, Tapioca and Tomato. Pomology- Definition and Importance-Cultivation of fruits- Banana, Pineapple and mango. Storage and marketing procedures of the studied vegetables and fruits Growth regulators in horticulture. Major varieties of each vegetable and fruit with their characters.

MODULE-4- Floriculture**10 Hours**

Floriculture- Definition and Importance. Cultivation, Harvesting, Storage and marketing procedures of flowers- Jasmine, Rose, *Gladiolus*, *Aster*, *Chrysanthemum*, Orchids and *Anthurium*. Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life.

MODULE-5- Plant protection measures**8 Hours**

Major Diseases and Pests of Ornamental Plants- Jasmine, Rose, *Gladiolus*, *Aster*, *Chrysanthemum*, Orchids and *Anthurium*; Vegetables- Bhindi, Brinjal, Bitter gourd, Pumpkin, *Colocasia*, Tapioca and Tomato; and Fruits- Banana, Pineapple and mango.

PRACTICALS**36 Hours**

1. Demonstration of vegetative methods of propagation- all types of Budding, Layering and Grafting.
2. Preparation of potting mixture with known composition
3. Physical Properties-porosity, texture, water holding capacity and density of soil
4. Chemical Analysis of soil and potting mixture- pH, Salinity, Temperature, Conductivity, Nitrite, Nitrate, Phosphate and Potassium
5. Visit to well established nursery.
6. 3 Major diseases of each plants mentioned in the syllabus, with causative organism/agent and control measures
7. Study of 3 morphometric varieties of Horticultural plants/vegetables and fruits
8. Floral morphology of each genus mentioned in the syllabus

REFERENCES

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2. Bose, T. K, J. Kabir, P. Das and P.P. Joy. 2001. Tropical Horticulture. Naya Prakash

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3. Capon, B., 2010. Botany for Gardeners. 3rd Edition. Timber Press, Portland, Oregon.
4. Chaha, K.L. 2001. Handbook of horticulture. ICAR, New Delhi.
5. Desh Beer Singh and Poonam Wazir. 2002. Bonsai- an Art. Scientific Publishers, Jodhpur.
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7. Industrial Research Board, Delhi.
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10. Kumar, N. 1999. An introduction to horticulture. Rajalakshmi Publication, Nagarcoil.
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WEIGHTAGE OF QUESTION PAPER: 3A12PLS: HORTICULTURE

Unit	Marks
Module 1	15
Module 2	16
Module 3	16
Module 4	13
Module 5	10

Difficulty level	Easy	Average	Difficult
Weightage of Marks	15	35	10
Creation level and related verbs	<u>Knowledge</u> Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	<u>Understanding</u> Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	<u>Application and higher levels</u> Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY THIRD SEMESTER BSc DEGREE EXAMINATION

3A12PLS: HORTICULTURE

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN 1B01BOT/PLS and 2B02BOT /PLS

GENERAL AWARENESS COURSE IN PLANT SCIENCE-3

PLANTATION MANAGEMENT

Semester	Course Code	Hours per week	Credit	Exam Hours
4	4A13PLS	3+2	3	3

Course Outcomes

1. Awareness on the fundamental techniques used in plantation management.
2. Understands the importance of Human Resource Management in Agriculture and Plantations. .
3. Awareness on the legal and economic aspects of farming and agriculture. ..

PLANTATION MANAGEMENT

MODULE – I FARM MANAGEMENT 15Hrs

Principles of farm management – Planning and Budgeting in the cultivation of following crops: Tea, Coffee, Rubber, Cardamom, Coconut, Areca nut, Cashew, Black Pepper. Study of the following farm machineries and equipments in relation to plantation crops-garden tiller, weed cutter, sprayers (rocker, knap sack, power), dusters (traction, wet, rotary), rubber roller, de huskers for coconut and areca nut, palm climber.

MODULE- II. HUMAN RESOURCE MANAGEMENT 15Hrs

Management process: Basic concepts, Leadership-qualities of a good leader-leadership styles. Motivation, morale and productivity (brief account only). Communication- definition, formal and informal communication. **Introduction to Human Resource Management:** HRM - definition - HRM and personnel management - HR function - role of HR manager - HR planning -recruitment, selection and placement. **Training and Development:** Orientation and training - need for training - training techniques - quality of life and quality of work life - performance appraisal - Career development. **Labour Relations and Employee Security:** Trade unions and their role in organizations - collective bargaining - labour participation in management - labour disputes - grievance settlement procedure, layoff, lockout and retrenchment - management of conflict.

MODULE- III ECONOMICS OF PLANTATION CROPS 12Hrs

The Role of Agriculture in a Growing Economy: Interdependence between agriculture and industry- Role of plantation Crops in a growing economy (Tea, Coffee, Rubber, Cashew and Cardamom). **The Economics of Plantation Crops in the New Economic Environment-** Factors Affecting Growth of Plantations (Tea, Coffee, Rubber, Cashew and Cardamom) - production and productivity - - Problems of plantation cultivation – suggestions to improve plantation farming. **Plantation cultivation in Kerala Economy** ∴ Social and environmental impacts of plantation farming-- Need for technological advancements in Plantation sector.

MODULE –IV LEGAL ASPECTS OF PLANTATION MANAGEMENT 12Hrs

The Plantation Labour Act, 1951: Definitions - Registration of Plantations - Inspecting staff - Provisions as to health - welfare - Hours and limitation of employment - Leave with wages - Accidents - Penalties and procedure.

Minimum Wages Act, 1948: Interpretation - Minimum rates of wages - Advisory committee - Advisory boards - Payment of minimum wages.

Employees State Insurance Act, 1948: Administration of insurance corporation - Standing committee - Medical benefit council - Employees state insurance fund - Contribution - Benefit - Sickness benefit - Maternity - Disablement benefit - Dependents benefit. Medical benefit - Liability of the employer.

Practicals:

36Hrs

1. Visit to one plantation farming sector to study the management of crops.
2. Identify the farm equipments mentioned in the syllabus and familiarize the working.
3. Organize a leadership development programme.
4. Visit to a labour welfare office to acquaint with labour issues.

References:

1. Agarwal, R.D., Organisation and Management
2. Ashwathappa, K., Human Resource Management
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4. Chabbra, T.N., Human Resource Management
5. Chawla, R.C., and K. C. Garg, Mercantile Law
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WEIGHTAGE OF QUESTION PAPER: 4A13PLS: PLANTATION MANAGEMENT

Unit	Marks
Module 1	19
Module 2	19
Module 3	16
Module 4	16

Difficulty level	Easy	Average	Difficult
Weightage of Marks	15	35	10
Creation level and related verbs	<u>Knowledge</u> Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	<u>Understanding</u> Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	<u>Application and higher levels</u> Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY FOURTH SEMESTER BSc DEGREE EXAMINATION

4A13PLS: PLANTATION MANAGEMENT

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN 1B01BOT/PLS and 2B02BOT /PLS

GENERAL AWARENESS COURSE IN PLANT SCIENCE-4

HERBAL SCIENCE

Semester	Course Code	Hours per week	Credit	Exam Hours
4	4A14PLS	3+2	3	3

Course Outcomes

1. Understanding the fundamental methods used in herbal science.
2. Knowledge on the interaction between human beings and nature with an emphasis on medicinal plants.
3. Internalisation of practical skills in culturing and processing of medicinal plants for drug preparation,

HERBAL SCIENCE

MODULE-1: Introduction to Herbal Science 9hrs

Historical background, present status, scope of Medicinal botany – Indigenous medical system bioprospecting, indigenous knowledge systems, Ayurveda, Siddha, Unani, Homeopathy, Tibetan, Folklore medicines, Systems of medicine. Need to preserve knowledge systems.

MODULE -2: Selected Herbal medicines of India 12 hrs

Cultivation of medicinal plants: Vegetative propagation, Seed propagation and cultivation of medicinal plants – Amla (*Phyllanthus emblica*), Glory lily (*Gloriosa superba*), Sadavari (*Asparagus racemosus*), periwinkle (*Catharanthus roseus*), Sarpagandha (*Rauwolfia serpentina*), Aloe (*Aloe vera*). Medicinal plants in wasteland management. Medicinal plants types suitable for cultivation in public gardens.

MODULE -3: Herbal Preparations 6 hrs

Introduction and scope -Herbal preparations- General methods of phyto chemical & biological screening– extraction– Maceration, digestion, decoction, extracts and tinctures. Purification and isolation of Plant constituents – Alkaloids – Glycosides – Volatile oils

MODULE -4: Commercial Aspects in Herbal Science: 12 hrs

Study of some herbal formulation as drug and cosmetics. Antioxidants and human health benefits. Drugs from leaves, flower, seed, barks and roots. Bioactivities of drug constituents: glycosides, saponins, enzymes, alkaloids, tannins, volatile oils, resins, gums, proteins and fixed oils. Biological testing of herbal drugs- Phytochemical screening tests for secondary metabolites- alkaloids, flavanoids, steroids, triterpenoids, phenolic compounds.

MODULE -5: Ethnomedicine 10 hrs

Introduction-definition-scope. Role of AYUSH, NMPB, CIMAP and CDRI. Plants in primary health care: Common medicinal plants – chittamruthu (*Tinospora cordifolia*), tulasi (*Ocimum sanctum*), thippali (*Piper longum*), Kadukka (*Terminalia chebula*), kattarvazha (*Aloe vera*), Turmeric (*Curcuma longa*). Traditional medicine vs Modern medicine: Study of select plant examples used in traditional medicine as resource of modern medicine: Amukkaram (*Withania somnifera*), Sarpagandhi (*Rauvolfia serpentina*), keezharnelli (*Phyllanthus amarus*), nelli (*Phyllanthus emblica*) and Brahmi (*Bacopa monnieri*). Medicinal plant conservation. Role of ethnic groups in conservation of plant genetic resources.

MODULE -6: Intellectual Property Rights 5 hrs

Patent, Plant variety protection bill, geographical indications, trade secrets, trade mark, copy right, patent applications notification, sanctioning, Indian patent act, TRIPS, farmers right, biopiracy, status of WTO.

PRACTICAL

36 Hours

1. Identification and description of medicinal plants
2. Breaking of dormancy by scarification, acid treatment
3. Study of viability of different seeds-germination test-tetrazolium test
4. Cultivation of medicinal plants.

REFERENCE

1. Arber, A., 1999. Herbal plants and Drugs. Mangal Deep Publications.
2. Atal, C.K. - Cultivation and Utilization of Medicinal Plants. R.R.L. Jammu.
3. Chada, K.L., Ravindran, P.N., and Leela Shajiram, 2000. Biotechnology in horticultural and plantation crops. Malhotra Publishing House, New Delhi.
4. Chopra, R.N., S.L.Nayar and I.C.Chopra, 1956. Glossary of Indian medicinal plants, C.S.I.R, New Delhi.
5. Joshi, S. G. 2000. Medicinal Plants. Oxford and IBH, New Delhi.31
6. Kanny, Lall, Dey and Raj Bahadur, 1984. The indigenous drugs of India International Book Distributors.
7. Kapoor L.D, 2005 Hand book of Ayurvedic medicinal plants, CRC Press NewDelhi
8. Kokate, C. K, et al., 1999. Pharmacognasy- Nirali Prakashan, NewDelhi
9. Kokate, C.K, A.S Gokhale and S.B Gokhale . cultivation of medicinal plants ,2004 Nirali prakashan, Pune.
10. Rastogi, R. R. and B. N. Mehrotra. 1993. Compendium of Indian Medicinal Plants. Vol. I & Vol.II
11. Sambamurthy AVSS. and N.S Subramanyam, 1989 Text book of Economic botany. Wiley Eastern Ltd.
12. Sivarajan V.V., and Balachandran, I .,1994.Ayurvedic drugs and their plant sources. Oxford IBH Publishing Co.

WEIGHTAGE OF QUESTION PAPER: 4A14PLS: HERBAL SCIENCE

Unit	Marks
Module 1	11
Module 2	16
Module 3	8
Module 4	16
Module 5	13
Module 6	6

Difficulty level	Easy	Average	Difficult
Weightage of Marks	15	35	10
Creation level and related verbs	<u>Knowledge</u> Define, Describe, Explain, Illustrate, Enumerate, List, Label, Select, etc	<u>Understanding</u> Summarise, Classify, Compare, Contrast, Infer, Relate, Discuss, Distinguish, etc	<u>Application and higher levels</u> Solve, Comment, Criticize, Modify, Plan, Design, Revise, Differentiate, Demonstrate, etc

KANNUR UNIVERSITY FOURTH ST SEMESTER BSc DEGREE EXAMINATION

4A14PLS: HERBAL SCIENCE

TIME: 3Hrs

MAXIMUM MARKS : 40

Draw diagrams wherever specified

MODEL QUESTION PAPER WILL BE ADDED LATER; PATTERN IS THE SAME AS IN 1B01BOT/PLS and 2B02BOT /PLS

GENERAL PRACTICAL

Semester	Course Code	Hours per week	Credit	Exam Hours
4	4A15PLS	2	4	3

Course Outcomes

1. Learning the fundamental techniques used in plantation science, herbal science and horticulture.
2. First-hand experience in doing science for the betterment of human life.
3. Internalisation of practical skills for further application in free, independent, individual needs and helps in designing scientific experimentation in the field of plant science..

PRACTICAL WORK DONE DURING THIRD AND FOURTH SEMESTERS IS THE BASIS OF THIS PRACTICAL COURSE,

GENERAL PRACTICAL-MODEL QUESTION PAPER

Time 3 hours

Maximum marks-65

1. Demonstratebudding /.....grafting on specimen **A** and write the procedure.
Procedure 1 marks, conducting 2 marks Viva 2marks (5 marks)
2. Estimate the physical properties of the given soil **B** .
Procedure 2 marks, conducting 2 marks result 1mark (5 marks)
3. Demonstrate..... layering on specimen **C** and write the procedure.
Procedure 1 marks, conducting 2 marks viva 2 marks (5 marks)
4. Identify the disease **D** and **E**, name the pathogen, mention any two important symptoms, and write any two control measures.
Identification of disease 1 mark, pathogen 1 mark, Important symptoms and control measures 2 mark (2× 4 =8 marks)
5. Identify the source plant of **F** and **G**. Write its binomial and family
binomial 1 mark, Family 1 mark (2×2 =4 marks)
6. Describe the floral morphology of **H** and **I**.
Identification 1 Description 4 (2 x 5=10 marks)

7. Write the process of harvesting and processing of **J and K**.

Identification	1	Description	3
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(2x4=8marks)

8. Identify the two varieties of **L** of horticulture crops by describing morphometric variations (identification-1, description-3) (2x 4= 8 marks)

9. Spot at sight. **M, N, O, P, Q,R, S** (Identification/botanical name -1 notes-1) (6x2 = 12 marks)

,KEY TO SPECIMENS

1. Material **A** for budding – T budding/Patch budding/Inverted T Budding or Tongue grafting/Whip Grafting/Crown grafting
2. B- For physicochemical analysis dry soil
3. Material **C** for layering – Air layering/Simple layering/Serpentine Layering
4. Material **D** and **E**- pathology specimens mentioned in the plantation science/horticulture syllabus
5. Material **F** and **G** –raw products from Plantation crops
6. Material **H** and **I**. Flower of any plantation crop/olericulture.horticulture/floriculture mentioned in the syllabus.
7. **J** and **K** Any two marketed products of plantation crops mentioned in the syllabus
8. **L** Any fruit/seed varieties of Horticultural plants studied
9. Any three Horticulture tools- **M, N** and **O**, identify P and Q from Herbal science and R and S from olericulture