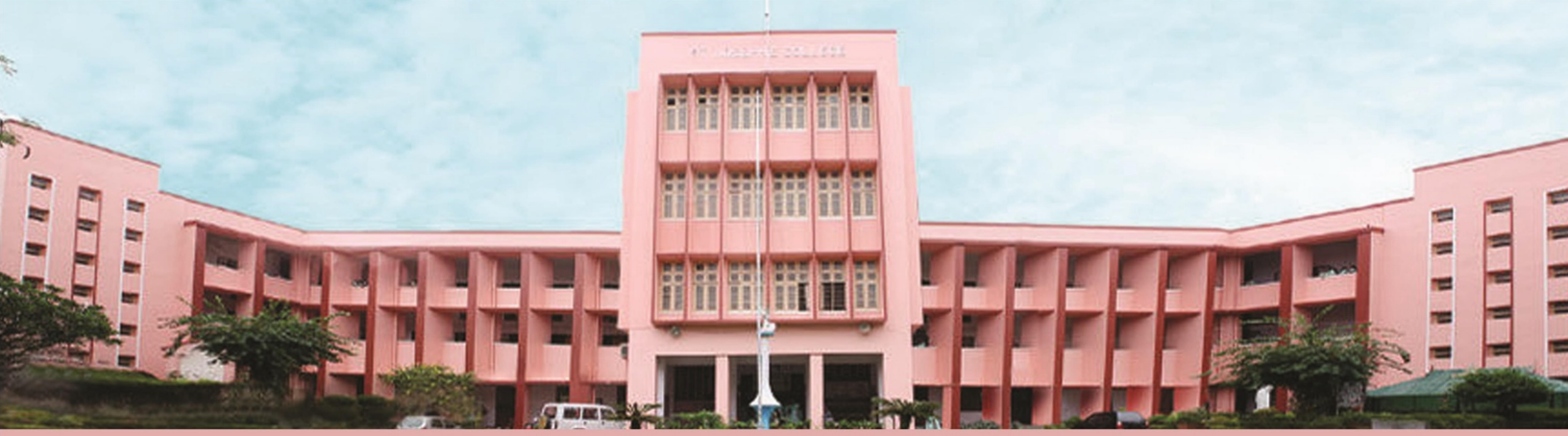

ST. JOSEPH'S COLLEGE (AUTONOMOUS)

IRINJALAKUDA

CURRICULA AND SYLLABI FOR

Under Graduate Programme in Botany

Under Choice Based Credit & Semester System

2020 Admissions

St. Joseph's College (Autonomous), Irinjalakuda

Department of Botany

Board of Studies in 2019-20

Name, designation and address of BOS members

Sl. No.	Name	Designation	Address
1	Dr. Roselin Alex **(Chairperson)**	Associate Professor	Department of Botany, St. Joseph's College (Autonomous), Irinjalakuda.
2	Dr. Meena Thomas Irimpan	Head & Associate Professor	Department of Botany, St. Joseph's College (Autonomous), Irinjalakuda.
3	Dr. Binu T. V.	Assistant Professor	Department of Botany, St. Joseph's College (Autonomous), Irinjalakuda.
4	Dr. Alfred Joe	Assistant Professor	Department of Botany, St. Joseph's College (Autonomous), Irinjalakuda.
5	Dr. Asma V. M. **(University Nominee)**	Associate Professor	Department of Botany, MES Asmabi College, Vemballur, Kodungallur.
6	Dr. Joseph Job	Associate Professor	Department of Botany, S. B. College, Changanachery
7	Dr. Suma Arun Dev	Scientist	Forest Genetics & Biotechnology Division, KFRI, Peechi, Thrissur
8	Dr Siril E. A.	Associate Professor	Department of Botany, University of Kerala, Kariavattom, Thiruvanthapuram
9	Dr Sreedevi	Doctor	Sri Bhagavathy Madom Ayurveda Nikethanam ,Ayyanthole, Thrissur – 03.
10	Ms . Shimi K. S.	Assistant Professor (On contract)	Department of Botany, St. Joseph's College (Autonomous), Irinjalakuda.
11	Ms. Saranya V. S.	Assistant Professor (On contract)	Department of Botany, St. Joseph's College (Autonomous), Irinjalakuda.
12	Ms. Reshma K.	Assistant Professor (On contract)	Department of Botany, St. Joseph's College (Autonomous), Irinjalakuda.

Contributors towards Curriculum and Syllabus

Sl. No.	Name	Designation	Address
1.	Dr. Asma V. M.	Associate Professor	Department of Botany, MES Asmabi College, Vemballur, Kodungallur.
2.	Dr. Joseph Job	Associate Professor	Department of Botany, S. B. College, Changanachery
3.	Dr. Suma Arun Dev	Scientist	Forest Genetics & Biotechnology Division, KFRI, Peechi, Thrissur
4.	Dr. Jose T. Puthur.	Reader	Department of Botany, University of Calicut.
5.	Dr. Sreekumar V. B.	Scientist	KFRI, Peechi, Thrissur.
6.	Dr. Anilkumar M	Assistant Professor	Department of Botany, U.C. College Aluva.
7.	Dr Sreedevi	Doctor	Sri Bhagavathy Madom Ayurveda Nikethanam ,Ayyanthole, Thrissur – 03.
8.	Dr. Siril E. A.	Associate Professor	Department of Botany, University of Kerala, Kariavattom, Thiruvanthapuram
9.	Mr. R. Sankaran Pillai	Assistant Director	MPEDA, Regional Division, Kochi 25

FOREWORD

Higher Education scenario in Kerala has been going through turbulent transformations in recent times with the grant of autonomy to colleges by the State Government. There is no doubt about the qualitative worth of the institutions handpicked for autonomy. However, there are apprehensions about the absorption and implementation of the package of autonomy. St. Joseph's College was given autonomy in the year 2016, and has since then been endeavouring to reinvent itself.

Academic autonomy has given us the freedom to recreate our own curriculam and syllabus keeping in mind the challenges and changing needs of the society, the nation, the industry and the world. Hence, a structured feedback on the requirements of the new millennium was sought from all the relevant stakeholders of the institution- students, faculty, alumnae, parents, industry experts, employers etc.

The suggestions of the stakeholders were incorporated into the curricula and syllabi, and presented in the respective Boards of Studies for discussion. The changes pointed out were duly considered and the restructured syllabi are then presented to, and ratified by, the Academic Council.

The role of the IQAC of the college in the above exercise is laudatory. The Cell spearheads all the quality enhancement endeavours, including that of curriculum and syllabus redesigning. By organizing workshops, seminars and hands on training sessions, the cell has facilitated a smooth conduct of the restructuring process. At the end of the year, an evaluation of the syllabi followed is also undertaken, with suggestions noted down for future changes.

As an institution that wishes seriously to provide enhanced quality education to young women students in order to empower them to be fit for the changing world, St. Joseph's College is bravely facing the challenges even as it is happily handling the possibilities, that autonomy has brought to it. Academic enriching programmes, skill – based micro credentials, ICT up gradations, promotional activities for a culture of research, etc. are a few of the multifarious responsibilities invested with the college in its restructuring of curriculum and redesigning of syllabus.

I specially thank the IQAC, the Heads of various departments, the faculty, and staff, directly in charge of updating the syllabus, for their sincere and dedicated efforts.

Principal

ACKNOWLEDGEMENT

As the Chairperson of the Board of Studies of B. Sc. Programme in Botany of St. Joseph's College (Autonomous), Irinjalakuda, I express my sincere thanks to all the well-wishers and stakeholders who have rendered significant suggestions and comments in the preparation of the curriculum and syllabus. My heartfelt gratitude to Dr Asma V. M., Associate Professor, Dept. of Botany, MES Asmabi College, Vemballur, Kodungallur, for her sincere effort and contributions in the preparation of this syllabus.

I place on record my sincere thanks to the subject experts, Dr. Sreedevi, Sri Bhagavathy Madom Ayurveda Nikethanam, Ayyanthole, for her guidance and remarkable suggestions to restructure various courses of the programme. Thanks to Dr. Suma Arun Dev, Scientist, Forest Genetics & Biotechnology Division, KFRI, Peechi, Thrissur, for her invaluable suggestions.

Department of Botany, St. Joseph's College, gratefully acknowledges the role played by Dr. Naijil George, Assistant Professor and IQAC Coordinator, Department of Biotechnology and other members of the syllabus committee for the guidance and help given to shape the overall frame work and structure of the curriculum and syllabus.

I extend my deep sense of gratitude to our Principal Dr. Sr. Isabel for her valuable suggestions and support during the various stages of syllabus revision. My deep sense of appreciation to Dr. Meena Thomas Irimpan, Dr. Binu T.V., Dr. Alfred Joe, Ms. Shimi K.S., Ms. Saranya V.S., Ms. Reshma K., the members of Board of Studies and faculty of Department of Botany, St. Joseph's College, Irinjalakuda, for their sincere cooperation and hard work in compiling the curriculum and syllabus.

Dr. Roselin Alex, Chairperson,

Board of Studies.

CONTENT

ST. JOSEPH'S COLLEGE, (AUTONOMOUS), Irinjalakuda

DEPARTMENT OF BOTANY

2020 ADMISSION

Preface

As an autonomous college under Calicut University, St. Joseph's College has taken conscientious efforts to strengthen the curriculum by retaining all the fundamental stipulations of the University/Higher Education Council, to ensure a well-balanced Curriculum. Within the constraints of a prescribed syllabus, we have resolved to take a collective effort to create an inspiring academic culture in the institution, essential for teachers and students to access deeper knowledge and participate in its expansion and transmission. It is also to re-articulate the almost lost or forgotten fact that production and transmission of Quality Knowledge, essential for the development of students in particular and society in general, are the primary functions of any Educational Institution.

The Syllabus restructuring of 2020 aims to provide the students many opportunities to engage with authentic, real world learning. This has been evident through the significant number of new Programmes introduced at the wake of autonomy in 2016. Efforts are taken to develop Programme with course outcomes that focus on cognitive and intellectual skills of the learners.

STUDENT ATTRIBUTES

The motto of the institution is "Light, Life, Love"
Light for the illumination of the heart and mind
Life for the fullness of growth – physical, mental, intellectual and spiritual
Love for fellowship with the Supreme & with one another

The motto enshrines the vision of the Founders for the students and constitutes the foundation for the acquisition of the following student attributes envisioned by the institution.

- Empowerment
- Life Long Learning
- Holistic Development
- Value Orientation
- Social Responsibility
- Nation Building Capacity
- Green Thinking
- Creativity & Innovation
- Acquiring Life Skills
    - Discipline
    - Leadership / Team skills
    - Problem solving skills
    - Communicability

The above Student Attributes will be attained in the span of their student life at St. Joseph's College through various activities such as

- Curricular, Co-curricular & extra-curricular
- Sports, games, fine arts and cultural
- Enrichment / certificate courses
- Extension / outreach programmes
- Healthy / Best practices

PROGRAMME OUTCOMES

At the end of a UG programme, a student would have:

1. Acquired adequate knowledge of the subject
2. Crafted a foundation for higher learning
3. Been initiated into the basics of research
4. Imbibed sound moral and ethical values
5. Become conscious of environmental and societal responsibilities
6. Attained skills for communication and career
7. Learned to tolerate diverse ideas and different points of view
8. Become empowered to face the challenges of the changing universe

PROGRAMME SPECIFIC OUTCOMES

	Program Specific Outcomes
PSO1	**Scope and importance of Botany:** Understand scope and importance of Botany
PSO2	**Environmental concern:** Create awareness on natural resources and their importance in sustainable development, analyze the importance of biodiversity conservation, estimate biodiversity loss and develop conservation strategies.
PSO3	**Scientific temper:** Develop scientific temper and undertake scientific projects.
PSO4	**Practical applications:** Identify and classify plants according to the principles of plant systematics, apply techniques like plant propagation methods, organic farming, mushroom cultivation, preparation of biofertilizers, biopesticides etc.
PSO5	**Awareness on life processes:** Understand plant life processes, biomolecules, and basic hereditary principles.

AIMS AND OBJECTIVES

First Semester

- Demonstrate the ability to differentiate plant organs by observing anatomical features.
- Understand the non-living inclusions of plants and their significance.
- Differentiate tissues and their functions.
- Illustrate primary and secondary (normal and anomalous) structures of plant organs.
- Explain various developmental details of angiosperms.
- Realize the significance and applications of palynology.

Second Semester

- Understand basics of microbial life and their economic importance.
- Develop general awareness on the diversity of microorganisms, fungi and lichens.
- Analyze the ecological role played by bacteria, fungi and lichens
- Identify plant diseases and find out control measures.
- Realize the significance of plant diseases as far as crop production is concerned.

Third Semester

- Appreciate the diversity and evolutionary significance of lower plant groups.
- Classify algae, bryophytes and pteridophytes.
- Understand the economic and ecological importance of lower plant groups.

Fourth Semester

- Develop scientific temper and problem solving skills.
- Undertake scientific projects and prepare project reports
- Summarize, organize and display quantitative data and derive conclusions
- Prepare permanent slides, applying the histochemical techniques

Fifth Semester

- Understand the role of gymnosperms as a connecting link between pteridophytes and angiosperms
- Appreciate the process of organic evolution.
- Realize the importance of fossil study.
- Understand the climatic conditions of the past and realize the changes happened
- Recognize the phytoeographic zones of India.
- Appreciate the diverse morphology of angiosperms.
- Identify and classify plants based on taxonomic principles.
- Make scientific illustrations of vegetative and reproductive structures of plants.
- Develop the skill of scientific imaging of plants.
- Realize the importance of field study.
- Change their attitude towards over exploitation of rare/endemic plants.
- Critically evaluate the advantages of tissue culture and horticulture over conventional methods of propagation.
- Apply various horticultural practices in the field.
- Experiment on the subject and try to become entrepreneurs.
- Identify the economically important plants.
- Appreciate the ultra-structure of a plant cell.
- Enumerate the functions of each cell organelle.
- Draw and explain the structure of biomolecules.

Sixth Semester

- Appreciate the facts behind heredity and variations.
- Understand the basic principles of inheritance.
- Solve problems related to classical genetics.
- Predict the pattern of inheritance.
- Understand various plant breeding techniques.
- Realize the role of plant breeding in increasing crop productivity.
- Analyze the role of biotechnology in daily life.

- Understand the basic aspects of bioinformatics.
- Explain the concepts in molecular biology.
- Identify the physiological responses of plants.
- Analyze the role of external factors in controlling the physiology of plants.
- Explain the metabolic processes taking place in each cell.
- Appreciate the energy fixing and energy releasing processes taking place in cells
- Realize the importance of ecological studies.
- Develop environmental concern in all their actions and practise Reduce, Reuse and Recycle.
- Try to reduce pollution and environmental hazards and change their attitude towards throwing away plastic wastes.
- Spread awareness of the need of conservation of biodiversity and natural resources.
- Analyze the reasons for climate change and find out ways to combat it.
- Understand various techniques employed for increasing crop productivity.
- Identify diseases affecting crop plants.
- Attain general awareness on various crop research stations of the country.

COURSE DESIGN

The UG BOTANY programme includes

i. Common Courses
ii. Core courses
iii. Complementary courses
iv. Open Course
v. Audit courses

The number of Courses for the UG Botany programme contains 15 compulsory core courses and one elective course from the frontier area of the core courses, one open course and a project; 4 complementary courses, from the relevant subjects for complementing the core of study. There are 10 common courses which include the English and second language of study. Project Work and/or Viva-voce are mandatory for UG programme and these shall be done in the end of sixth semester. The student shall select any Choice based course offered by the department which offers the core courses, depending on the availability of teachers and infrastructure facilities, in the institution. Open course shall be offered in any subject and the student shall have the option to do courses offered by other departments.

Duration of the programme

The minimum duration for completion of a four semester UG Programme is 3 years. The duration of each semester will be 90 working days, inclusive of examinations, spread over five months. The odd semesters (1, 3, 5) shall be from June to October and the even semesters (2, 4, 6) shall be from November to March subject to the academic calendar of St. Joseph's College (Autonomous) Irinjalakuda.

Programme structure

A student is required to acquire a minimum of 140 credits for the completion of the UG programme, of which 120 credits are to be acquired from class room study and shall only be counted for SGPA and CGPA. Out of the 120 credits, 38 (22 for common (English) courses + 16 for common languages other than English) credits shall be from common courses, 2 credits for

project/corresponding paper and 3 credits for the open course. (In the case of LRP Programmes 14 credits for common courses (English), 8 credits for additional language courses and 16 credits for General courses). The maximum credits for a course shall not exceed 5. Audit courses shall have 4 credits per course and a total of 16 credits in the entire programme. The maximum credit acquired under extra credit shall be 4. If more Extra credit activities are done by a student, that may be mentioned in the Grade card. The credits of audited courses or extra credits are not counted for SGPA or CGPA.

Course	**Credit**	**Number**	**Total credits**
Common Courses	4 3	8 2	38
Core courses	5 4 3	2 1 13	53
Complementary courses	4 2	2 8	24
Open Course	3	1	3
Audit courses	4	4	16
Project	2	1	2
Extra Credit	4	1	4
Total			140

Common Courses

UG student should undergo 10 common courses (total 38 credits) for completing the programme:

A01. Common English Course 1 A02. Common English Course II A03. Common English Course III A04. Common English Course IV A05. Common English Course V A06. Common English Course VI	English courses A01-A06 applicable to BA/BSC Regular pattern English courses A01-A04 applicable to Language Reduced Pattern (LRP) Programmes B.com, BBA, BBA (T), BBM, B.Sc. (LRP), BCA etc.

A07. Additional Language Course I A08. Additional Language Course II A09.Additional Language Course III A10.Additional Language Course IV	Addl. Language courses A07-A10 applicable to BA/B.Sc Regular Pattern Addl. Language courses A07-A08 applicable to Language Reduced Pattern (LRP) Programmes
A11. General Course I A12. General Course II A13. General Course III A14. General Course IV	Applicable to Language Reduced Pattern (LRP) Programmes

Common courses A01-A06 shall be taught by the department of English and A07-A10 by teachers of additional languages respectively. General courses A11-A14 shall be offered by teachers of departments offering core courses concerned.

General courses I, II, III and IV shall be designed by the group of boards concerned.

The subjects under Language Reduced Pattern (LRP) (Alternative Pattern) are grouped into five and General Courses I, II, III & IV shall be the same for each group.

1. BBA, B.Com.
2. Industrial Chemistry, Polymer Chemistry
3. Computer Science, Computer Application.
4. Biotechnology
5. B.A Multimedia

Common Courses in various programmes

No.	Programme	Semester I	Semester II	Semester III	Semester IV
1	B.A. & B.Sc.	A01, A02, A07	A03, A04, A08	A05, A09	A06, A10
2	LRP	A01, A02, A07*	A03, A04, A08*	A11, A12	A13, A14

Core courses

Core courses are the courses in the major (core) subject of the UG Botany programme chosen by the student.

CORE & OPEN COURSES

Total credits 58 (Core courses: 55 + Open course 3)

COURSE STRUCTURE, WORK LOAD AND CREDIT DISTRIBUTION OF CORE COURSES: (Semesters 1 -4)

Semester	Course Code	Title of Course	Hours/ Semester		Hours/ Week		Credit
S- I	SJBOT1B01	CORE COURSE 1. **Angiosperm Anatomy, Reproductive Botany & Palynology**	36	72	2	4	3
	-	Core Course -1 Practical	36		2		*
S -II	SJBOT2B02	CORE COURSE 2. **Microbiology, Mycology, Lichenology & Plant Pathology**	36	72	2	4	3
	-	Core Course -2 Practical	36		2		*
S-III	SJBOT3B03	CORE COURSE 3. **Phycology, Bryology & Pteridology**	54	90	3	5	3
	-	Core Course -3 Practical	36		2		*
S-IV	SJBOT4B04	CORE COURSE 4 **Methodology and perspectives in Plant Science**	54	90	3	5	3
	-	Core Course -4 Practical	36		2		*
	SJBOT4B05	CORE COURSE 5: Practical Paper - I **Angiosperm Anatomy, Reproductive Botany, Palynology, Microbiology, Mycology, Lichenology, Plant Pathology, Phycology, Bryology & Pteridology, Methodology and perspectives in Plant Science**					4
		TOTAL				**18**	**16**
*Credits of practical (total given against Practical paper SJ BOT4B05)							

COURSE STRUCTURE, WORK LOAD AND CREDIT DISTRIBUTION OF CORE COURSES AND OPEN COURSES (Semester 5)

Course Code	Title of Course	Hours/ Semester		Hours/ Week		Credit
SJBOT5B06	CORE COURSE 6 **Gymnosperms, Palaeobotany, Phytogeography & Evolution**	54	90	3	5	3
-	Core Course –6 Practical	36		2		*
SJBOT5B07	CORE COURSE 7 **Angiosperm Morphology & Systematics**	54	90	3	5	3
-	Core Course-7. Practical	36		2		*
SJBOT5B08	CORE COURSE 8 **Tissue culture, Horticulture, Economic Botany & Ethnobotany**	54	90	3	5	3
-	Core Course 8. Practical	36		2		*
SJBOT5B09	CORE COURSE. - 9 **Cell Biology & Biochemistry**	54	90	3	5	3
-	Core Course-9. Practical	36		2		*
SJBOT5D01	OPEN COURSE - CHOICE I **General Botany**	54	54	3	3	3
SJBOT5D02	OPEN COURSE - CHOICE II **Applied Botany**	54	54	3	3	3
SJBOT5D03	OPEN COURSE - CHOICE III **Basic Tissue Culture**	54	54	3	3	3
SJBOT5D04	OPEN COURSE - CHOICE III **Horticulture and Herbal Cosmetology**	54	54	3	3	3
SJBOT6B17	PROJECT WORK / RESEARCH METHODOLOGY	36	36	2	2	**
TOTAL					**25**	**15**
* Credits of practical (already given)						
** Credits of project work/ Research methodology (already given)						

COURSE STRUCTURE, WORK LOAD AND CREDIT DISTRIBUTION OF CORE COURSES: (Semester 6)

Course Code	Title of Course	Hours/ Semester		Hours/ Week		Credit
SJBOT6B10	CORE COURSE 10 **Genetics & Plant Breeding**	54	90	3	5	3
-	Core Course 10. Practical	36		2		*
SJBOT6B11	CORE COURSE – 11 **Biotechnology, Molecular biology & Bioinformatics**	54	90	3	5	3
-	Core Course- 11. Practical	36		2		*
SJBOT6B12	CORE COURSE -12 **Plant Physiology & Metabolism**	54	90	3	5	3
-	Core Course- 12. Practical	36		2		*
SJBOT6B13	CORE COURSE – 13 **Environmental Science**	54	90	3	5	3
-	Core Course– 13. Practical	36		2		*
SJBOT6B14 (1)	CORE COURSE 14 Elective- Choice - I **Genetic Engineering**	54	90	3	5	3
-	Elective Choice – I. Practical	36		2		*
SJBOT6B14 (2)	CORE COURSE 14 Elective- Choice - II **Genetics and Crop Improvement**	54	90	3	5	3
-	Elective Choice – II. Practical	36		2		*
SJBOT6B14 (3)	CORE COURSE 14 Elective- Choice - III **Advanced Angiosperm Systematics**	54	90	3	5	3
-	Elective Choice – III. Practical	36		2		*
SJBOT6B15	CORE COURSE 15: Practical Paper- II: **Gymnosperms, Palaeobotany, Phytogeography, Angiosperm Morphology, Systematics, Tissue culture, Horticulture, Econ. Botany, Ethnobot. Cell Biol. & Biochemistry**					5
SJBOT6B16	CORE COURSE 16: Practical Paper- II: **Genetics, Pl. Breeding, Biotechnology, Molecular Biology, Plant Physiology & Environmental Science**					5
SJBOT6B17	CORE COURSE 17: PROJECT WORK / RESEARCH METHODOLOGY	**	**	**	**	2
TOTAL					**25**	**27**
* Credits of practical (total given against Practical paper SJBOT6B16)						
** Workload eligible is already shown						

INSTRUCTIONAL HOURS, MARK DISTRIBUTION AND SCHEME OF EXAMINATION OF CORE COURSES & OPEN COURSES

Course Code	Instructional Hours		Duration of Exams (hrs)	Marks				Total marks
	Theory	Practical		Theory		Practical		
				External	Internal	External	Internal	
SJBOT1B01	36	36	2	60	15	--	--	**75**
SJBOT2B02	36	36	2	60	15	--	--	**75**
SJBOT3B03	54	36	2	60	15	--	--	**75**
SJBOT4B04	54	36	2	60	15	--	--	**75**
SJBOT4B05	--	--	3	--	--	80	20	**100**
(Practical) Record	--	--		--	--	15	--	**15**
Submission	--	--		--	--	5	--	**5**
SJBOT5B06	54	36	2	60	15	--	--	**75**
SJBOT5B07	54	36	2	60	15	--	--	**75**
BOT5B08	54	36	2	60	15	--	--	**75**
SJBOT5B09	54	36	2	60	15	--	--	**75**
SJBOT5D01/02/03	54	---	2	60	15	--	--	**75**
SJBOT6B10	54	36	2	60	15	--	--	**75**
SJBOT6B11	54	36	2	60	15	--	--	**75**
SJBOT6B12	54	36	2	60	15	--	--	**75**
SJBOT6B13	54	36	2	60	15	--	--	**75**
SJBOT6B14 (1/2/3)	54	36	2	60	15	--	--	**75**
SJBOT6B15	--	--	4	--	--	80	20	**100**
(Practical) Record	--	--		--	--	15	--	**15**
Submission	--	--		--	--	10	--	**10**
Study tour	--	--		--	--	5	--	**5**
SJBOT6B16	--	--	4	--	--	80	20	**100**
(Practical) Record	--	--		--	--	10	--	**10**
Submission	--	--		--	--	5	--	**5**
Record of Elective	--	--	--	--	--	10	--	**10**
SJBOT6B17 (Project)		36		--	--	60	15	**75**
SJBOT6B17 (Theory)	36*		2*	60*	15*	--	--	
TOTAL				**840**	**210**	**375**	**75**	**1500**

*Applicable only if the Centre is opting for research methodology paper instead of project work

Elective courses shall be spread over either in the Fifth & sixth Semesters combined or in any one of these Semesters (V / VI). Study Tour / Field visit / Industrial visit / Trip for specimen collection may be conducted as a part of the Programme.

Complementary courses

Complementary courses cover one or two disciplines that are related to the core subject and are distributed in the first four semesters.

COURSE STRUCTURE, WORK LOAD AND CREDIT DISTRIBUTION

Semester	Paper Code	Title of Paper	Hours/ Semester	Hours allotted / Week	Credit
S I	SJBOT1C01	COMPLEMENTARY COURSE 1. **Angiosperm Anatomy & Micro technique**	36 hrs	2	2
	-	Complementary Course -1 Practical	36 hrs	2	*
S II	SJBOT2C02	COMPLEMENTARYCOURSE 2. **Cryptogams, Gymnosperms & Plant Pathology**	36 hrs	2	2
	-	Complementary Course –2 Practical	36 hrs	2	*
S III	SJBOT3C03	COMPLEMENTARY COURSE - 3 **Morphology, Systematic Botany, Eco. Botany, Plant Breeding & Horticulture**	54 hrs	3	2
	-	Complementary Course-3 Practical	36 hrs	2	*
S IV	SJBOT4C04	COMPLEMENTARY COURSE - 4 **Plant Physiology, Ecology & Genetics**	54 hrs	3	2
	-	Complementary Course -4 Practical	36 hrs	2	*
	SJBOT4C05	COMPLEMENTARY COURSE- 5 Practical Paper 1 **Angiosperm Anatomy, Microtechnique, Cryptogams, Gymnosperms, Plant Pathology, Morphology, Systematic Botany, Plant Physiology, Ecology, Genetics, Eco. Botany, Plant Breeding & Horticulture**			4
TOTAL					**12**
• Credits of practical paper (total credits provided against Practical paper SJBOT4C05 P)					

Table 13. COURSE STRUCTURE, MARK DISTRIBUTION, SCHEME OF EXAMINATION

Course code & Title of course	Total Hours		Duration of Exams	Marks				Total Marks
				Theory		Practical		
	Theory	Practical		External	Internal	External	Internal	
Semester –1 : SJBOT1C01 **Anatomy & Microtechnique**	36	36	2 hrs	60	15	--	--	75
Semester-2 : SJBOT2C02 **Cryptogams, Gymnosperms & Plant Pathology**	36	36	2 hrs	60	15	--	--	75
Semester-3: SJBOT3C03 **Morphology, Syst. Botany, Economic Botany, Plant Breeding & Horticulture**	54	36	2 hrs	60	15	--	--	75
Semester- 4: SJBOT4C04 **Plant Physiology, Ecology & Genetics**	54	36	2 hrs	60	15	--	--	75
Semester- 4: SJBOT4C05 **Comple. Course Practical** External Practical Exam Record Submission	--	--	3 hrs	--	--	60 15 10	15	100
Total	180	144		240	60	85	15	**400**

Open courses

There shall be one open course in core subjects in the fifth semester. The open course shall be open to all the students in the institution except the students in the parent department. The students can opt that course from any other department in the institution. Each department can decide the open course from a pool of three courses. Credit allotted for open course is 3 and the hours allotted is 3.

Ability Enhancement courses/Audit courses

These are courses which are mandatory for a programme but not counted for the calculation of SGPA or CGPA. There will be one Audit course each in the first four semesters. These courses are not meant for class room study. The students can attain only pass (Grade P) for these courses. At the end of each semester there will be examination conducted by the college from a pool of questions (Question Bank) set by the College. The students can also attain these credits through online courses like SWAYAM, MOOC etc. (optional). The list of courses in each semester with credits are given below.

Course with credit	Credit	Semester
Environment Studies	4	1
Disaster Management	4	2
Human Rights/Intellectual Property Rights/ Consumer Protection	4	3
Gender Studies/Gerontology-	4	4

Extra credit Activities

Extra credits are mandatory for the programme. Extra credits will be awarded to students who participate in activities like NCC, NSS and Swatch Bharath. Those students who could not join in any of the above activities have to undergo Social Service Programme offered by the College. Extra credits are not counted for SGPA or CGPA.

Attendance

A student shall be permitted to appear for the semester examination, only if she secures not less than 75% attendance in each semester. Attendance will be maintained by the Department concerned. Condonation of shortage of attendance to a maximum of 10% in the case of single condonation and 20% in the case of double condonation in a semester shall be granted by College remitting the required fee. Benefits of attendance may be granted to students who attend the approved activities of the college with the prior concurrence of the Head of the institution. Participation in such activities may be treated as presence in lieu of their absence on production of participation/attendance certificate (within two weeks) in curricular/extracurricular activities

(maximum 9 days in a semester). Students can avail of condonation of shortage of attendance in a maximum of four semesters during the entire programme (Either four single condonations or one double condonation and two single condonations during the entire programme). Less than 50% attendance requires Readmission. Readmission is permitted only once during the entire programme.

Grace Marks

Grace Marks may be awarded to a student for meritorious achievements in co-curricular activities (in Sports/Arts/NSS/NCC/Student Entrepreneurship) carried out besides the regular hours. Such a benefit is applicable and limited to a maximum of 8 courses in an academic year spreading over two semesters. In addition, maximum of 6 marks per semester can be awarded to the students of UG Programmes, for participating in the College Fitness Education Programme (COFE).

Project

Every student of a UG programme shall have to work on a project of 2 credits under the supervision of a faculty member or shall write a theory course based on Research Methodology as per the curriculum. (Project work is a group activity with not more than 5 members)

COURSE CODE FORMAT

The following are the common guidelines for coding various courses in order to get a uniform identification. It is advisable to assign a nine Digit Code (combination of Alpha Numerical) for various courses as detailed below:

i. Common Courses (Code A)
ii. Core courses (Code B)
iii. Complementary courses (Code C)
iv. Open Course (Code D)
v. Audit courses (Code E).

1. **First two digits** indicate the code of college SJ
2. **Next three digits** indicate the Programme/discipline code (ENG for English, MCM for M.Com, CHE for chemistry, PHY for physics, MLM for Malayalam, SKT for Sanskrit, HTY for History etc.)
3. **Sixth digit** is the Semester indicator which can be given as 1, 2, 3 & 4 respectively for I, II, III & IV Semester (MCM1, CHE2 Etc).
4. **Seventh digit** will be the Course Category indicator as detailed below :
5. **Last two digits** indicate the serial number of the respective courses. If there is one digit it should be prefixed by '0'(Zero). (01, 02, etc)
6. If the number of courses in one category is only one (eg : Viva, Project etc.), assign the course serial number as 01.
7. Examples :

Sl. No	Code	Details
1	SJMCM 1C01	M.Com I Sem Core Course No1
2	SJCHE 2 A 02	Chemistry II Sem Audit Course No.2
3	SJENG 4 V01	English IV Sem Viva No. 1
4	SJMLM 3 E02	Malayalam III Sem Elective No. 2
5	SJPHY 4 P 01	Physics IV Sem Project Work No. 1
6	SJ BGY 2 L 02	Biology II Sem Practical No. 2
7	SJPSY 3 C 02	Psychology III Sem Core Coure No. 2
8	SJHTR 2 E 01	History II Sem Elective Course No. 1

EVALUATION AND GRADING

The evaluation scheme for each course will contain two parts; (a) Internal/Continuous Assessment (CA) and (b) External / End Semester Evaluation (ESE). Of the total, 20% weightage will be given to Internal evaluation/Continuous assessment and the remaining 80% to External/ESE and the ratio and weightage between Internal and External is 1:4.

a) Internal/Continuous Assessment (CA) : 15 marks

b) External / End Semester Evaluation (ESE) : 65 marks

Total : 80 marks

Internal Assessment

20% of the total marks in each course are for internal examinations. The internal assessment shall be based on a predetermined transparent system involving written tests, Class room performance based on attendance in respect of theory courses and lab involvement/records attendance in respect of Practical Courses. Internal assessment of the project will be based on its content, method of presentation, final conclusion and orientation to research aptitude.

The criteria and percentage of mark assigned to various components for internal evaluation are as follows:

(a) Theory:			
Sl. No	**Component**	**Percentage**	**Mark**
1	Examination /Test	40%	6
2	Seminars / Presentation	20%	3
3	Assignment	20%	3
4	Class room performance/Attendance	20%	3
(b) Practical:			
1	Lab Involvement	40%	6
2	Records/viva	60%	9

Attendance mark can be distributed as follows

Attendance	Internal weightage	Marks
Above 90%	1	3
85–89%	0.8	2.5
80–84%	0.6	2
76–79%	0.4	1.5
75%	0.2	1

To ensure transparency of the evaluation process, the internal assessment marks awarded to the students in each course in a semester shall be notified on the notice board at least one week before the commencement of external examination. There shall not be any chance for improvement for internal marks. The course teacher(s) shall maintain the academic record of each student registered for the course.

Examination /Test: For each course there shall be class test/s during a semester. Grades should be displayed on the notice board. Valued answer scripts shall be made available to the students for perusal.

Seminars / Presentation: Every student should deliver Seminar/Presentation as an internal built – in component of the curriculum transaction for every course and must be evaluated by the respective course teacher in terms of structure, content, presentation and interaction. The soft and hard copies of the seminar report are to be submitted to the course teacher.

Assignment: Each student will be required to do assignment/s as an internal built – in component of the curriculum transaction for each course. Assignments after valuation must be returned to the students. The teacher shall define the expected quality of the above in terms of structure, content, presentation etc. and inform the same to the students. Punctuality in submission is to be considered.

Lab Skill: Students in the science stream are required to combine their classroom methods with hands on practical sessions in the laboratories. The teacher shall assess the skills of the student and the quality of application of theoretical knowledge.

Records/viva: Records are submitted by science students for documenting the textual and classroom knowledge along with their practical lab skills. Neatness, accuracy and precision are also evaluated here. Viva voce is conducted to assess the grasp of knowledge gained by the student and to test their communication skills in the translation of the knowledge.

Practical Test: It is conducted for students in the science stream to assess their scientific temper and application of theoretical knowledge. The sense of precision and accuracy is also taken into account.

External Evaluation

External evaluation carries 80% of marks. The external question papers may be of uniform pattern with 80/60 marks. The courses with 2/3 credits will have an external examination of 2 hours duration with 60 marks and courses with 4/5 credits will have an external examination of 2.5 hours duration with 80 marks. The external examination in theory courses is to be conducted by the college with question papers set by external experts. The evaluation of the answer scripts will be done by examiners based on a well-defined scheme of valuation and answer keys will be provided by the College. The external examination in practical courses shall be conducted by two examiners – one internal and an external. The project evaluation with viva can be conducted either internal or external. After the external evaluation only, marks are to be entered in the answer scripts. All other calculations including grading are done by the College.

Pattern of Questions for External/ESE:

Questions will be set to assess the knowledge acquired, standard, and application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. Due weightage will be given to each module based on content/teaching hours allotted to each module. Different types of questions shall be given different weightages to quantify their range given in the following model:

Sl. No.	Type of Questions	Individual mark	Total mark	Ceiling (Marks)
1	Short Answer type questions	2	2 × 12 = 24	20
2	Short essay/ problem solving type	5	5 × 7 = 35	30
3	Long Essay type questions	2	2 × 10 = 20	10 (Answer any one)
Total				**60**

End Semester Evaluation in Practical Courses will be conducted and evaluated by both Internal and External Examiners.

EXTERNAL VIVA-VOCE

External viva voce if any shall be conducted along with the practical examination/project evaluation.

The model of question papers may be prepared by the concerned Board of Studies. Each question should aim at (1) assessment of the knowledge acquired (2) standard application of knowledge

(3) application of knowledge in new situations.

Different types of questions shall possess different marks to quantify their range.

- **PROJECT EVALUATION**

Project evaluation shall be conducted at the end of sixth semester. 20% of marks are awarded through internal assessment. Internal assessment of the project will be based on its content, method of presentation, final conclusion and orientation to research aptitude.

Internal Assessment will be completed two weeks before the last working day of sixth Semester. Internal Assessment marks will be published in the Department. In the case of Courses with practical examination, project evaluation shall be done along with practical examinations.

Submission of the Project Report and presence of the student for viva are compulsory for internal evaluation. No marks shall be awarded to a candidate if she fails to submit the Project Report for external evaluation. The student should get a minimum P Grade in aggregate of External and Internal. There shall be no improvement chance for the Marks obtained in the Project Report. In the extent of student failing to obtain a minimum of Pass Grade, the project work may be re-done and a new internal mark may be submitted by the Parent Department. External examination may be conducted along with the subsequent batch.

Evaluation of Audit Courses:

The examination and evaluation will be conducted by the college in MCQ model from the Question Bank and other guidelines provided by the University/BoS. The Question paper will be for minimum 100 mark and a minimum of 3-hour duration for the examination. The marks of audit courses one and two will be forwarded to Controller of Examinations of St. Joseph's College (Autonomous) Irinjalakuda in time of respective semesters. The result will be intimated / uploaded to the University during the Third Semester.

Revaluation

The prevailing rules of revaluation are applicable to CBCSS UG- 2020. Students can apply for photocopies of answer scripts of external examinations. Applications for photocopies/scrutiny/revaluation should be submitted within 10 days of publication of results. The fee for this shall be as decided by the College.

INDIRECT GRADING SYSTEM

Indirect grading System based on a 10-point scale is used to evaluate the performance of

students. Each course is evaluated by assigning marks with a letter grade (O, A+, A, B+, B, C, P, F or Ab) to that course by the method of indirect grading. Evaluation (both internal and external) is carried out using Mark system. The Grade on the basis of total internal and external marks will be indicated for each course, for each semester and for the entire programme. Indirect Grading System in 10 -point scale is as below:

Ten Point Indirect Grading System

Percentage of Marks (Both Internal &External put together)	Grade	Interpretation	Grade point Average (G)	Range of grade points	Class
95 and above	O	Outstanding	10	9.5 -10	First Class with Distinction
85 to below 95	A+	Excellent	9	8.5 -9.49	
75 to below 85	A	Very good	8	7.5 -8.49	
65 to below 75	B+	Good	7	6.5 -7.49	First Class
55 to below 65	B	Satisfactory	6	5.5 -6.49	
45 to below 55	C	Average	5	4.5 -5.49	Second Class
35 to below 45	P	Pass	4	3.5 -4.49	Third Class
Below 35	F	Failure	0	0	Fail
Absent	Ab	Absent	0	0	Fail
Incomplete	I	Incomplete	0	0	Fail

An aggregate of P grade (after external and internal put together) is required in each course for a pass and also for awarding a degree. No separate grade/mark for internal and external will be displayed in the grade card; only an aggregate. Also the aggregate mark of

internal and external are not displayed in the grade card. A student who fails to secure a minimum grade for a pass in a course is permitted to write the examination along with the next batch. After the successful completion of a semester, Semester Grade Point Average (SGPA) of a student in that semester is calculated using the formula given below. For the successful completion of a semester, a student should pass all courses. However, a student is permitted to move to the next semester irrespective of SGPA obtained.

SGPA of the student in that semester is calculated using the formula

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

` The Cumulative Grade Point Average (CGPA) of the student is calculated at the end of a programme. The CGPA of a student determines the overall academic level of the student in a programme and is the criterion for ranking the students. CGPA can be calculated by the following formula.

$$\text{CGPA} = \frac{\textit{Total credit points obtained in six semesters}}{\textit{Total credits acquired (120)}}$$

SGPA and CGPA shall be rounded off to three decimal places. CGPA determines the broad academic level of the student in a programme and is the index for ranking students (in terms of grade points). An overall letter grade (cumulative grade) for the entire programme shall be awarded to a student depending on her CGPA.

CORE COURSES

SYLLABI FOR CORE COURSES

Course Code: SJBOT1B01

Name of the Course: ANGIOSPERM ANATOMY, REPRODUCTIVE BOTANY AND PALYNOLOGY

	Course Outcome	PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Demonstrate the ability to differentiate plant organs by observing anatomical features.	3	A	C	6	6
CO2	Understand the non-living inclusions of plants and their significance.	4	U	C	6	6
CO3	Differentiate tissues and their functions.	5	A	C	6	6
CO4	Illustrate primary and secondary (normal and anomalous) structures of plant organs.	4	U	C	6	6
CO5	Explain various developmental details of angiosperms.	5	U	C	6	6
CO6	Realize the significance and applications of palynology.	3	R	C	6	6

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Angiosperm Anatomy	22	27	49
2	Reproductive Botany & Palynology	14	9	23
Total		**36**	**36**	**72**

QUESTION PAPER QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Anatomy	Reprod. Bot. & Palynology	Total
2 marks (total 12) quesions)	8	4	Ceiling 20
5 marks (total 7)	4	3	Ceiling 30
10 marks (total 2)	1	1	1x10 = 10
TOTAL			**60**

ANGIOSPERM ANATOMY

Module - I. (5 hrs)

1. Cell Wall - Structure and development; Growth of Cell wall; cell wall materials (**2** hrs)
2. Non-living inclusions (**3** hrs)

a. Reserve food materials: carbohydrates, proteins, fats & oils. Carbohydrates: sugars & starch; Starch grains- structure, types with examples; Proteins- Aleurone grains with examples; Fats & oils examples.

b.Secretory materials

c. Waste materials - Nitrogenous – alkaloids, Non-nitrogenous- gums, resins, tannins, organic acids, essential oils; Mineral crystals - Calcium oxalate, Druses, Raphides, Calcium carbonate –cystoliths with examples

Module-II (5 hrs)

1. Tissues: Definition –Types

a. Meristematic tissues - classification. (**2** hrs)

i. Theories on apical organization - Apical cell theory, Histogen theory, Tunica Corpus theory

ii. Organization of shoot apex and differentiation of tissues (protodern, procambium and ground meristem).

iii. Organization of root apex in dicots- common types with three sets of initials- in monocots: Maize type with four sets of initials

b. Mature tissues: definition classification- simple complex and secretory (**3** hrs)

i. Simple tissues: structure occurrence and function.

ii. Complex tissues: Xylem & Phloem -structure, origin, phylogeny and function

iii. Secretory tissues: glands, glandular hairs, nectaries, hydathodes, schizogenous and

lysigenous ducts, resin ducts, laticifers –articulated and non-articulated

Module – III (4 hrs)

1. Vascular bundles - Origin and types - conjoint, collateral, bi-collateral, open closed, radial, concentric - amphicribral and amphivasal. (**2** hrs)
2. Primary structure of root, stem & leaf (brief account only) (**2** hrs)

Module- IV (8 hrs)

1. Normal secondary growth in Dicot stem and Dicot root. Formation of vascular cambial ring - structure and activity of cambium – storied and non-storied, fusiform and ray initials; Formation of secondary wood, secondary phloem, vascular rays, growth ring, heart wood, sapwood. (**3** hrs)
2. Extra stelar Secondary thickening in stem and root - Periderm formation. Structure - phellogen, phellem, phelloderm, bark, lenticels - structure & function. (**2** hrs)
3. Anomalous secondary growth - general account with special reference to the anomaly in Dicot stem – *Boerhaavia*, *Bignonia* and Monocot stem- *Dracaena* (**3** hrs)

PRACTICAL (ANGIOSPERM ANATOMY)

1. Identification at sight the different types of tissues and vascular bundles.
2. Primary structure of stem, root and leaf of Dicots and Monocots
   a. Dicot stem : normal –*Eupatorium*; bi-collateral – *Cephalandra*
   b. Dicot root – Pea
   c. Monocot stem - Bamboo
   d. Monocot root – *Musa*
   e. Dicot leaf – *Ixora*
   f. Monocot leaf – Grass
3. Secondary structures: Dicot stem– *Vernonia,* Dicot root– *Tinospora*
4. Anomalous secondary thickening in *Boerhaavia*, *Bignonia* and *Dracaena*

REFERENCES (ANGIOSPERM ANATOMY)

1. Cuttler, EG. (1969). Plant Anatomy - Part I. Cells & Tissue. Edward Arnold Ltd., London.
2. Cuttler, E.G. (1971). Plant Anatomy, Part III Organs Edward Arnold Ltd., London.
3. Eames, A. J. & L H Mac Daniels (1987) An Introduction to Plant Anatomy. Tata McGrew Hill Publishing Company Ltd. New Delhi.
4. Esau K. (1985) Plant Anatomy (2nd ed.) Wiley Eastern Ltd. New Delhi.
5. Fahn A (2000) Plant Anatomy. Permagon Press.
6. Pandey B.P. (2001) Plant Anatomy, S. Chand & Co. Delhi.
7. Tayal M.S (2012) Plant Anatomy. Rastogi Publishers, Meerut.
8. Vasishta P.C. (1974) Plant Anatomy, Pradeep Publication, Meerut, UP.

REPRODUCTIVE BOTANY & PALYNOLOGY

1. Introduction to angiosperm embryology with special reference to Indian embryologists (**1** hr)
2. Microsporogenesis: structure and function of wall layers, development of male gametophyte, dehiscence of anther (**3** hrs)
3. Megasporogenesis: development of female gametophyte, embryosac- development and types- monosporic: *Polygonum* type, bisporic: *Allium* type, tetrasporic: *Adoxa* type. (**3** hrs)
4. Pollination, fertilization, barriers of fertilization, germination of pollen grains, double fertilization. (**2** hrs)
5. Structure of embryo dicot (*Cypsella*), monocot (*Sagittaria*) and endosperm types (**2** hrs)
6. Palynology: pollen morphology, structure of pollen wall, shape of pollen grains, apertural morphoforms, exine ornamentation; pollen allergy, economic and taxonomic importance

(**3** hrs)

PRACTICAL (REPRODUCTIVE BOTANY & PALYNOLOGY)

1. *Datura* anther T.S. (mature).
2. Types of ovules: Orthotropous, Anatropous and Campylotropous (Slides only, drawing not required)
3. Dicot and monocot embryo of Angiosperms (Slides only, drawing not required)
4. Pollen morphology of *Hibiscus*, and pollinia of *Cryptostegia* / *Calotropis* by acetolytic method
5. Viability test for pollen.
   a. *In vitro* germination using sugar solution. (cavity slide method)
   b. Tetrazolium test
   c. Acetocarmine test (Acetocarmine & Glycerine 1:1)

REFERENCES (REPRODUCTIVE BOTANY & PALYNOLOGY)

1. Agarwal S.B. (1984) Embryology of Angiosperms- a fundamental approach, Sahithya Bhavan, Hospital Road, Agra.
2. Bhojwani S S & Bhatnagar S.P. Dantu PK (2015) The Embryology of Angiosperms. 6th edition, Vikas Publishing House (P) Ltd.
3. Davis C.L. (1965) Systematic Embryology of Angiosperms. John Wiley, New York.
4. Eames M.S (1960) Morphology of Angiosperms McGraw Hill New York.
5. Erdtman G (1952) Pollen Morphology and Plant Taxonomy Part I. Almquist & Wiksell Stockholm
6. Erdtman G (1969) Hand Book of Palynology. National Botanical Gardens Publication, Lucknow.
7. Johri BD (1984) (ed.) Embryology of Angiosperms Springer-Verlag, Berlin.
8. Maheswari P. 1985. Introduction to Embryology of Angiosperms - McGraw Hill, New York.
9. Nair PKK (1970). Pollen Morphology of Angiosperms Vikas Publishing House, Delhi.

10. Raghavan,V. (2000). Developmental Biology of Flowering plants, Springer, Netherlands.
11. Saxena M.R. (1993). Palynology –A treatise, Oxford, I.B.H. New Delhi
12. Shivanna KR & Johri.BM (1985) The Angiosperm Pollen, Structure and Function. John Wiley & Sons Pte Ltd.
13. Shivanna KR & Johri.BM (1985) Pollen Biology: A Laboratory Manual, Springer Verlag, New Yrok.
14. Shivanna, K.R. &. Rangaswami, N.S (1993) Pollen Biology Narosa Publishing House, Delhi.
15. Singh V., P.C. Pande & D.K. Jain (2001) Embryology of Angiosperms- Rastogi Publications, Gangothri, Sivaji road, Meerut.

MODEL QUESTION PAPER

FIRST SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
CORE COURSE 1
SJBOT1B01: ANGIOSPERM ANATOMY, REPRODUCTIVE BOTANY & PALYNOLOGY

TIME: 2 Hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Describe the structure of hydathodes
2. What is tapetum? Add a note on its types and functions.
3. What is protoderm?
4. Give an account of lysigenous ducts in plants.
5. Discuss how the study of pollen grains becomes important in taxonomy.
6. What is a casparian strip? What is its role?
7. What is an embryosac?
8. Where can you find raphides? How is it formed?
9. What is the reason for fragrance of flowers?
10. Write short note on aleurone grains.
11. Explain Histogen theory.
12. What is meant by double fertilization?

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Discuss the specialties of meristematic cells.
14. Give an account of cell wall materials.
15. Explain exine ornamentation in angiosperms.
16. Give an account of organisation of root apex in dicots.
17. Describe the structure of a dicot embryo.

18. Describe the structure of collenchyma. Where do you find it in a plant body? Add a note on its functions.
19. Give an account of barriers of fertilization.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Give a detailed account of complex tissues in angiosperms. Discuss the phylogenetic significance of complex tissues. .
21. Give a detailed account of Microsporogenesis with illustrations.

Course Code: SJBOT2B02

Name of the Course: MICROBIOLOGY, MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY

	Course Outcome	PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand basics of microbial life and their economic importance.	1	U	C	8	8
CO2	Develop general awareness on the diversity of microorganisms, fungi and lichens.	5	R	F	7	7
CO3	Analyze the ecological role played by bacteria, fungi and lichens	2	Z	F	7	7
CO4	Identify plant diseases and find out control measures.	4	A	P	7	7
CO5	Realize the significance of plant diseases as far as crop production is concerned.	4	R	C	7	7

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Microbiology	12	9	21
2	Mycology	12	14	26
3	Lichenology	4	4	8
4	Plant Pathology	8	9	17
Total		**36**	**36**	**72**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Microbiology	Mycology	Lichenology	Pathology	Total
2 marks (total 12)	3	4	2	3	Ceiling 20
5 marks (total 7)	3	2	1	1	Ceiling 30
10 marks (total 2)	2				1x10 = 10
TOTAL					**60**

MICROBIOLOGY

1. Introduction to Microbiology (**1**hr)
2. Bacteria –Classification based on morphology and staining, ultra structure of bacteria; Bacterial growth, Nutrition, Reproduction. (**5** hrs)
3. Viruses – Classification, architecture and multiplication; Bacteriophages, TMV, Retroviruses-HIV, Viriods, Prions. (**3** hrs)
4. Microbial ecology – Rhizosphere and Phyllosphere. (**1** hr)
5. Industrial microbiology –alcohol, acids, milk products single cell proteins (**1** hr)
6. Economic importance of bacteria, Vaccines: importance, mechanism. (**1** hr)

PRACTICAL (MICROBIOLOGY)

1. Simple staining
2. Gram staining – Curd, root-nodules
3. Culture and isolation of bacteria using nutrient agar medium (demonstration only)

REFERENCES (MICROBIOLOGY)

1. Alain Durieux (2009) Applied Microbiology, Springer International Edition.
2. Dubey R.C. & D.K. Maheswari (2000) A Textbook of Microbiology, Chand & Co, New Delhi.
3. Frazier W.C. (1998) Food Microbiology, Prentice Hall of India, Pvt. Ltd.
4. Hans g Schlegel. (2012) General Microbiology-Cambridge University Press. Low Priced Indian Edition, Replica Press Pvt. Ltd.
5. Kumar H.D. & S. Kumar. (1998) Modern Concepts of Microbiology, Tata McGraw Hill. Delhi.
6. Pelzar M.J., E.C.S. Chan & N.R. Kreig. (1986) Microbiology McGraw Hill, New York.

7. Prescott, L.M., Harley J.P., Klein D. A. (2005) Microbiology, McGraw Hill, India. 6th edition.
8. Rangaswami, R & C.K.J. Paniker. (1998) Textbook of Microbiology, Orient Longman.
9. Ross, F.C. (1983) Introductory Microbiology. Charles E. Merill Publishing Company.
10. Schlegel (2008). General Microbiology. Cambridge University press India Pvt Ltd
11. Sharma P.D. (2004). Microbiology and Plant Pathology Rastogi Publication.
12. Tortora, G.J., Funke, B.R., Case. C.L. (2007). Microbiology. Pearson Benjamin Cummings, San Francisco, U.S.A. 9th edition.

MYCOLOGY

1. General characters and phylogeny of the kingdom Fungi, the concept of anamorph and teleomorph. (**2** hrs)
2. General characters, distribution, and biology of the following groups of fungi (**8** hrs)
   a) Mastigomycotina. Type: *Pythium*
   b) Zygomycotina. Type: *Rhizopus*
   c) Ascomycotina. Type:, *Xylaria, Aspergillus*
   d) Basidiomycotina. Types: *Agaricus, Puccinia*
3. Economic importance of fungi: medicinal, industrial, agricultural. Fungi as model organisms for research. (**1** hr)
4. Ecological importance of fungi: different modes of nutrition (pathogenic/parasitic, saprobic, symbiotic) (**1** hr)

PRACTICAL (MYCOLOGY)

1. Micropreparation – Lactophenol cotton blue – Slides of the above mentioned types.

REFERENCE (MYCOLOGY)

1. Alexopoulos C.J., Mims, C.W. and Blackwell, M. (1996) Introductory Mycology, 4th Edn. John Wiley and Sons, New York.
2. Alexopoulos, C.J. and Mims C.W. (1979) Introductory Mycology, 3rd Edition, John Wiley and Sons, New York.
3. Jim Deacon (2007) Fungal Biology, 4th edition, Blackwell publishing, Ane Books Pvt Ltd
4. Mehrotra R.S. and Aneja K.R. (1990) An Introduction to Mycology, Wiley, Eastern Limited, New Delhi.
5. Sethi, I.K. and Walia, S.K. (2011) Text book of Fungi and their Allies, Macmillan Publishers India Ltd.

LICHENOLOGY

1. Introduction: Type of Interaction between the components symbiosis – mutualism. (**1** hr)
2. Classification, growth forms, structure, reproduction, economic importance. Type: *Usnea* (**2** hrs)
3. Toxicology, Lichens as food, Bioremediation, Ecological indicators, Pollution indicators, Lichen in Soil formation and pioneers of Xerosere. (**1** hr)

PRACTICAL (LICHENOLOGY)

1. Identification of different forms of Lichens.
2. *Usnea* : structure of thallus, fruiting body

REFERENCES (LICHENOLOGY)

1. Gilbert, O. (2004) Lichen Hunters. The Book Guild Ltd. England
2. Kershaw, K.A. (1985) Physiological Ecology of Lichen Cambridge University Press.
3. Mamatha Rao, (2009) Microbes and Non-flowering plants. Impact and applications. Ane Books, New Delhi.
4. Sanders, W.B. (2001) Lichen interface between mycology and plant morphology. Bioscience, 51: 1025-1035.

http://www.lichen.com
http://www.newscientistspace.com

PLANT PATHOLOGY

1. Introduction – Concepts of plant disease, pathogen, causative agents, symptoms (**1** hr)
2. Symptoms of diseases: spots, blights, wilts, rots, galls, canker, gummosis, necrosis, chlorosis, smut, rust, damping off. (**1** hr)
3. Control measures: Chemical, biological and genetic methods, quarantine measures. (**1** hr)
4. Brief study of Plant diseases in South India (Name of disease, pathogen, symptom and control measures need to be studied) (**5** hrs)
    1. Citrus Canker
    2. Mahali disease of arecanut
    3. Blast of paddy
    4. Quick wilt of pepper
    5. Mosaic disease of tapioca
    6. Bunchy top of banana
    7. Grey leaf spot of coconut

PRACTICAL (PLANT PATHOLOGY)

Identification of the disease, pathogen, symptoms and control measures of the following: (drawing not required)

a. Citrus canker
b. Mahali disease
c. Tapioca mosaic disease
d. Blast of Paddy
e. Quick wilt of pepper
f. Bunchy top of banana
g. Grey leaf spot of coconut

SUBMISSION (PLANT PATHOLOGY)

Students are expected to submit five properly identified Pathology specimens – electronic documents during the practical examination of Paper-I held at the end of 4th semester. Diseases mentioned in the syllabus or any locally available common diseases of crop plants can be selected for submission.

REFERENCES (PLANT PATHOLOGY)

1. Agros, G.N. (1997) Plant Pathology (4th ed) Academic Press.
2. Bilgrami K.H. & H.C. Dube. (1976) A textbook of Modern Plant Pathology. International Book Distributing Co. Lucknow.
3. Mehrotra, R.S. (1980) Plant Pathology – TMH, New Delhi.
4. Pandey, B.P. (1999) Plant Pathology. Pathogen and Plant diseases. Chand & Co., New Delhi.
5. Rangaswami, G. (1999) Disease of Crop plants of India Prentice Hall of India Pvt. Ltd.
6. Sharma P.D. (2004) Plant Pathology Rastogi Publishers.

MODEL QUESTION PAPER

SECOND SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE- 2

SJBOT2B02: MICROBIOLOGY, MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY

TIME: 2 Hrs **Max. Marks 60**

SECTION A

(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Differentiate between isidium and soredium.
2. Define facultative saprophyte. Give an example.
3. What are plasmids?
4. Describe Prions.
5. Write a short note on symbiotic associations between algae and fungi with one example.
6. What is dikaryotization?
7. What are heterocious fungi?
8. Give an account of viral capsid.
9. Differentiate between rust and smut.
10. Describe apothecium in *Peziza*
11. Define systemic fungicide, with an example.
12. Give an account of quarantine measures adopted for disease control

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Write a brief account of the salient features of Ascomycetes.
14. Explain living and non-living characters of virus.
15. Enumerate the economic importance of Fungi.
16. Briefly explain reproduction in lichens.
17. Describe the gene transfer methods in bacteria.
18. Give an account of application of microbes in industry.
19. Explain the symptoms and control measures of citrus canker disease.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Briefly explain the life cycle of the pathogen of damping off disease, with suitable diagrams.
21. Describe the structure and reproduction of Bacteriophages.

Course Code: SJBOT3B03

Name of the Course: PHYCOLOGY, BRYOLOGY AND PTERIDOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Appreciate the diversity and evolutionary significance of lower plant groups.	1	U	C	30	30
CO2	Classify algae, bryophytes and pteridophytes.	1	R	C	12	6
CO3	Understand the economic and ecological importance of lower plant groups.	4	U	C	12	-

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Phycology	23	9	32
2	Bryology	9	9	18
3	Pteridology	22	18	40
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Phycology	Bryology	Pteridology	Total
2 marks (total 12)	5	3	4	Ceiling 20
5 marks (total 7)	2	2	3	Ceiling 30
10 marks (total 2)	2			1x10 = 10
TOTAL				**60**

PHYCOLOGY

1. Introduction, Range of thallus structure, pigments, reproduction (**1** hr)
2. Life cycle, Classification of Algae proposed by FE Fritsch (1935). (**3** hrs)
3. General Features: Occurrence, thallus structure, reproduction, and life cycle of the types given below: (**18** hrs)
   a. Cyanophyceae : *Nostoc*
   b. Chlorophyceae: *Chlorella*, *Volvox*, *Oedogonium*, *Chara*.
   c. Xanthophyceae: *Vaucheria*.
   d. Bacillariophyceae: *Pinnularia*.
   e. Phaeophyceae: *Sargassum*.
   f. Rhodophyceae: *Polysiphonia*.
4. Economic Importance: Algae as food, fodder, green manure, bio-fuels, pollution indicators, research tools, medicinal uses of algae, Commercial Products – carrageenin, agar-agar, alginates, diatomaceous earth. Harmful effects – water bloom, eutrophication, neurotoxins, parasitic algae. (**2** hrs)

PRACTICAL (PHYCOLOGY)

1. Identification of the vegetative and reproductive structures of the types studied.

REFERENCES (PHYCOLOGY)

1. Anand, N. (1989) Culturing and cultivation of BGA. Handbook of Blue Green Algae. Bishen Sing Mahendra Pal Sing, Dehradun, Uttarakhand.
2. Fritsch, F.E. (1935) The structure and reproduction of the algae. Vol. 1 and II, Cambridge University Press.
3. Kanika Sharma (2007) Manual of Microbiology. Tools and Techniques 2nd Edition. Ane Books India.
4. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi
5. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition
6. Mamatha Rao. (2009) Microbes and Non flowering plants: impact and application. Ane Books Pvt. Ltd., New Delhi.
7. Morris, I. (1967) An Introduction to the algae. Hutchinson and Co. London.
8. Papenfuss, G.F. (1955) Classification of Algae.
9. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, McGraw Hill, India. 6th edition.
10. Rober Edward Lee (2008) Phycology. Cambridge University Press India Pvt. Ltd. Ansari Road, New Delhi
11. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
12. Van Den Hoek, D.G. Mann and H.M. JaHns (2009) Cambridge University Press India Pvt. Ltd. Ansari Road, New Delhi.

BRYOLOGY

1. Introduction, general characters and classification by Stotler & Stotler (2008) (**2** hrs)
2. Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details not required) (**6** hrs)
   a. *Riccia* (Marchantiophyta)
   b. *Anthoceros* (Anthocerotophyta)
   c. *Funaria* (Bryophyta)
3. Economic importance of Bryophytes (½ hr)
4. Fossil Bryophytes (½ hr)

PRACTICAL (BRYOLOGY)

1. *Riccia* – Habit, Anatomy of thallus, V.S. of thallus through antheridium, archegonium and sporophyte.
2. *Anthoceros*- Habit, Anatomy of thallus. V.S. of thallus through antheridium, archegonium and sporophyte.
3. *Bryum* (due to non-availability of *Funaria* at lower altitudes) - Habit, structure of antheridial cluster, archegonial cluster, L.S. of sporophyte.

REFERENCES (BRYOLOGY)

1. Campbell H.D. (1940) The Evolution of land plants (Embryophyta), Univ. Press, Stanford.
2. Chopra R.N. and P.K. Kumar, (1988) Biology of Bryophytes. Wiley Eastern Ltd. New Delhi.
3. Crandall-Stotler, B. and R. E. Stotler. (2008) In A. J. Shaw and B. Goffinet, Bryophyte Biology, Cambridge University Press (Revised edition).
4. Gangulee Das and Dutta. (2007) College Botany Vol.1, Central Book Dept. Kolkatta.
5. Gangulee, H.C. and Kar A.K. College Botany Vol. II, New Central Book Agency.
6. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
7. Shaw. J.A. and Goffinet B. (2000) Bryophyte Biology, Cambridge University Press.
8. Smith G.M. (1938) Crytogramic Botany Vol.II. Bryophytes and pteridophytes. McGraw Hill Book Company, London.
9. Sporne K.R. (1967) The Morphology of Bryophytes. Hutchinson University Library, London.
10. Vander-Poorteri (2009) Introduction to Bryophytes. COP.
11. Vasishta B.R. Bryophyta. Revised edition. (2011). S. Chand and Co. New Delhi.
12. Watson E.V. (1971) The structure and life of Bryophytes. Hutchinson University Library, London.

PTERIDOLOGY

1. Introduction, general characters and classification (Smith *et al*., 2008 – brief outline only). (**2** hrs)
2. Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required) (**12** hrs)
   a. *Psilotum* (Psilotopsida)
   b. *Selaginella* (Lycopsida).
   c. *Equisetum* (Equisetopsida)
   d. *Pteris* (Polypodiopsida)
3. Apogamy and apospory in Pteridophytes; Stelar evolution in Pteridophytes; Heterospory and seed habit; Affinities of Pteridophytes; Economic importance of Pteridophytes. (**8** hrs)

PRACTICAL (PTERIDOLOGY)

1. *Psilotum*- habit, T.S. of stem, C.S. of synangium (slides only)
2. *Selaginella* – habit, T.S. of stem, T.S. of rhizophore, L.S. of strobilus
3. *Equisetum* - habit, T.S. of stem, L.S. of strobilus
4. *Pteris* - habit, T.S. of stem, C.S. of sporophyll

REFERENCES (PTERIDOLOGY)

1. Bower, F.O. (1935) Primitive Land Plants – Cambridge, London.
2. Chandra S. & Srivastava M. (2003) Pteridology in New Millenium, Khuwer Academic Publishers.
3. Eames, A.J. (1979) Morphology of Vascular Plants, Lower Group. Wiley International edition, New Delhi.
4. Parihar, N.S. (1977) Biology and Morphology of Pteridophytes, Central Book Depot, Allhabad.
5. Rashid, A. (1976) An Introduction to Pteridopyta, Vikas publ. Co. New Delhi.
6. Ranker, T.A. & Haufler, C.H. (eds.) (2008) Biology and Evolution of Ferns and Lycophytes. Cambridege University Press.
7. Mehltreter, K., Walker, L.R. & Sharpe, J.M. (eds.) (2010) Fern Ecology. Cambridge University Press.
8. Smith, A.R., Pryer, K.M., Schuttpelz, E. Korall, P., Schnelder, H. and Wolf, P.G. (2006) A Classification for extant ferns. Taxon 53: 705-731.
9. Smith, A.R., Pryer, K.M., Schuettpelz, E. (2008) Fern classification. *In*: T.A. Ranker and C.H. Haufler (eds.). Biology and Evolution of Ferns and Lycophytes. Cambridge University press, U.K.
10. Smith G.M. (1938) Cryptogamic Botany Vol. II. Bryophytes and Pteridophytes. McGraw Hill Book Company, London.
11. Sporne, K.R. (1967) Morphology of Pteridophytes – Hutchinson University Library, London.
12. Vasishta B.R. (1993) Pteridophyta – S. Chand and Co., New Delhi.

MODEL QUESTION PAPER

THIRD SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE – 3

SJBOT3B03: PHYCOLOGY, BRYOLOGY AND PTERIDOLOGY

TIME: 2 hrs **Max. Marks 60**

SECTION A

Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. What is circinate vernaion? Give an example of a peridophye showing this.
2. Differentiate between conceptacles and receptacles in *Sargassum*.
3. Write notes on Apogamy in pteridophyes.
4. Comment on the role of *Nostoc* in agriculture. Which part of the thallus helps perform the role?
5. Describe the structure of cystocarp in *Polysiphonia*.
6. Critically evaluate the sporophyte of *Riccia*.
7. Explain the cell structure of *Pinnularia*.
8. Give a brief account of the morphology and affinities of Bryophytes.
9. Write noes on the evolutionary importance of Bryophytes.
10. Critically evaluate the synangium in *Psilotum*.
11. Describe the reproduction in *Voucheria*.
12. What are trabeculae? How are they formed?

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Comment on the sporophyte of *Funaria*.
14. Give an account of the algal classification proposed by FE Fritsch.
15. Describe the anatomical features of *Equisetum*.
16. Explain the structure of sporophyte in *Anthoceros*.
17. Critically evaluate the attempt of seed formation observed in *Selaginella*.
18. Describe the economic importance of algae.
19. Describe the structure of strobilus in *Equisetum*.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Critically anlyse the thallus variation and types of reproduction seen in Chlorophyceae.
21. Give a detailed account of the stelar evolution in Pteridophytes with diagrams.

Course Code: SJBOT4B04

Name of the Course: METHODOLOGY AND PERSPECTIVES IN PLANT SCIENCE

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Develop scientific temper and problem solving skills.	3	U	C	9	8
CO2	Undertake scientific projects and prepare project reports	3	A	C	15	10
CO3	Summarize, organize and display quantitative data and derive conclusions	3	A	C	15	8
CO4	Prepare permanent slides, applying the histochemical techniques	3 & 4	Z	C	15	10

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Scientific Methods	9	9	18
2	Biostatistics	15	9	24
3	Biophysics	15	9	24
4	Microtechnique	15	9	24
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Methodology	Biostatistics	Biophysics	Microtech.	Total
2 marks (total 12)	2	3	4	3	Ceiling 20
5 marks (total 7)	1	2	2	2	Ceiling 30
10 marks (total 2)	2				
TOTAL					**60**

SCIENTIFIC METHODS

Module – I

1. Steps in scientific methods (**2** hrs)
2. Structure of Research report, Style of citation, Biological Journals, Impact Factor, Sources of reference: Google Scholar, Shodhganga, NCBI, Inflibnet, e-pathshala (**5** hrs)
3. Latest methods of presentation. (**2** hrs)

PRACTICALS (SCIENTIFIC METHODS)

1. Bibliography searches using online tools
2. Familiarizing latest methods of ICT based presentations

REFERENCES (SCIENTIFIC METHODS)

1. P.G. Hewitt, J.A. Suchocki ISBN-10 0805 390385, Conceptual integrated science ISBN-139780805390384.
2. R.G. Newton (1997) The truth of Science Physical theories and reality. Viva Books, New Delhi, II Edition.

BIOSTATISTICS

Module – I (7 hrs)

1. Introduction to Biostatistics: Importance and limitations of Biostatistics (**1** hr)
2. Observations: direct and indirect observations, controlled and uncontrolled observations, human and machine observations. (**1** hr)
3. Data collection: Introduction; Sampling; random and non-random. (**1** hr)
4. Representation of data; Tables, Bar diagram, Pie diagram, Histogram, Frequency polygon, Ogive, Frequency curve [both manual and using computer]. (**3** hrs)
5. Interpretation and deduction of data, significance of statistical tools in data interpretation, errors and inaccuracies. (**1** hr)

Module II: **(8 hrs)**

1. Measures of central tendency: mean, median and mode (**2** hrs)
2. Measures of dispersion: Range, Mean Deviation, Variance, Standard Deviation, Coefficient of variation. (**2** hrs)
3. Correlation and regression (brief account). (**2** hrs)
4. Test of hypothesis: Null hypothesis, Alternate hypothesis Chi-square test. (**2** hrs)

PRACTICAL (BIOSTATISTICS)

1. Work out problems under all types mentioned in the syllabus. One example each from all categories should be recorded.
2. Familiarize the technique of data representation (bar diagram, histogram, pie-diagram and frequency curve (both manual and using computer).

REFERENCES (BIOSTATISTICS)

1. Jasra. P.K. and Raj Gurdeep (2000). Biostatistics. Krishna Prakashan Media Pvt Ltd.
2. Khan, I.A. and Khayum. Fundamentals of Biostatistics. Wraaz Publ. Hyderabad.
3. Prasad, S. (2003) Elements of Biostatistics. Rastogi Publ.
4. Ramakrishnan, P. Biostatistics, Saras Publishers.
5. Rastogi, V.B. Fundamentals of Biostatistics Ane Book India.
6. Norman T.J. Bailey (2007) Statistical Methods in Biology- Low Priced Edition, Cambridge University Press, Replica Press Private Ltd
7. Zar, J.H. (2012) Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition

BIOPHYSICS

Module 1

1. Solutions: representing concentrations: Molarity, Normality, Percentage and ppm. (**2** hrs)
2. Acids and bases, buffers and pH, measurement of pH. Preparation and use of buffers in biological studies. (**3** hrs)
3. Photometry: Colorimetry and Spectrophotometry, principle, working and uses. (**3** hrs)
4. Centrifugation: Principle, types of centrifuges and their applications (**2** hrs)
5. Chromatography - Principle and types: Adsorption chromatography, Partition chromatography, Ion exchange chromatography, Molecular sieving. (**5** hrs)

PRACTICAL (BIOPHYSICS)

1. Preparation of solutions of known concentrations using pure samples and stock solutions
2. Preparation of buffers
3. Measurement of pH using pH meter.
4. Demonstration of the working of different kinds of centrifuges

REFERENCES (BIOPHYSICS)

1. Keith Wilson and John Walker (2008). Principles and techniques of Biochemistry and Molecular Biology 6th edition. Cambridge University Press.
2. Hoppe, W., Lohmann W., Markl H. and H. Ziegler. (1983) Biophysics. Springer Verlag.
3. Rogers, A.W. (1969) Techniques of Autoradiography. Elsevier Publishing Company.
4. Roy, R.N.(1996) AText book of Biophysics.New Central Book Agency Pvt. Ltd., Calcutta.
5. Sasidharan, A. (1984) Selected Topics of Biophysics. Frontier Area Publishers.
6. Slayter. E.M. (1970) Optical methods in Biology. Wiley Intersciences.
7. Wong. C.H. (1965) Radiation Tracer Methodology in Biophysical Sciences. Prentice Hall.

MICROTECHNIQUE

Module – 1 (**9** hrs)

1. Principles of microscopy and parts of microscopes (**1** hr)
2. Types of microscopes: Light microscope, Compound microscope, Phase contrast microscope, Fluorescent microscope, Electron microscope: Transmission Electron

Microscopy (TEM) and Scanning Electron Microscopy (SEM) (**6** hrs)

3. Micrometry: Stage micrometer, Ocular micrometer, Calibration and working. (**1** hr)
4. Illustrations using digital camera and Photomicrography. (**1** hr)

Module – II (**6** hrs)

1. General account of Killing and fixing, agents used for killing and fixing. Common fixatives – Formalin – Acetic – Alcohol, Carnoy's fluids I & II, Chromic acid – Acetic acid – Formation (CRAF) (**2** hrs)
2. Dehydration and infiltration – general account of dehydration (Ethanol, Isopropyl alcohol, Acetone, Glycerine). Ethanol – Xylene series and Tertiary Butyl Alcohol Series. (**1** hr)
3. Infiltration: paraffin wax method, embedding. (½ hr)
4. Free hand sectioning; Microtome (Rotary and sledge) serial sectioning and its significance. (**1** hr)
5. Staining – General account, Classification: natural dyes, coaltar dyes. Double staining, Vital staining (**1** hr)
6. Mounting, whole mounting, maceration and smears (½ hr)

PRACTICALS (MICROTECHNIQUE)

1. Parts of microscope and its operation (drawing not required)
2. Free hand sectioning of stem, leaves, Staining and mounting.
3. Measurement of pollen size using micrometer.
4. Demonstration of dehydration, infiltration, embedding and microtoming.

REFERENCES (MICROTECHNIQUE)

1. Johansen, D.A. (1940) Plant Microtehnique. McGraw Hill Book Co., Inc. New York.
2. Kanika, S. (2007) Manual of Microbiology – Tools and Techniques. Ane's student edition.
3. Khasim, S.K. (2002) Botanical Microtechnique; principles and Practice, Capital Publishing Company, New Delhi.
4. Toji, T. (2004) Essentials of Botanical Microtechnique. Apex Infotec Publ.

MODEL QUESTION PAPER

FOURTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
CORE COURSE- 4
SJBOT4B04: METHODOLOGY AND PERSPECTIVES IN PLANT SCIENCE

TIME: 2 Hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Define Shodhganga and elaborate its importance.
2. What does an Impact Factor indicate?
3. Differentiate between Central tendency and Dispersion.
4. How is a Chi-square test used in biological experiments?
5. What are Ogives?
6. Is pH of any solution relevant? Why?
7. What is molecular sieving?
8. What are the different kinds of centrifuges?
9. What is 'ppm', why is it commonly used in preparation of solutions?
10. Differentiate TEM from SEM in their principles.
11. Why are vital stains important?
12. Describe the importance of maceration.

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Elaborate the steps involved in Scientific methods and preparation of scientific reports
14. Describe the various data collection methods
15. Explain the importance of Correlation and Regression
16. Describe the principle and applications of different photometric methods
17. Write a short note on the importance of buffers in biological experiments
18. Explain the principle of phase contrast microscopy
19. Describe the various killing and fixing agents used in preservation of specimens

SECTION C
(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Explain the prospects and limitations of Biostatistics, emphasizing on the different tools used for statistical analysis.
21. Describe the principles and different types of chromatography.

Course Code: SJBOT4B05

Name of the Course: B.Sc. BOTANY CORE PRACTICAL EXAMINATION Paper-I

B.Sc. BOTANY CORE PRACTICAL EXAMINATION Paper-I

SJBOT4B05 (Angiosperm Anatomy, Reproductive Botany, Palynology, Microbiology, Mycology, Lichenology, Plant Pathology, Phycology, Bryology, Pteridology & Methodology and perspectives in Plant Science)

Time: 3 Hours **Max: 80 Marks**

1. Prepare a T.S. of the given specimen **A, B and C,** draw the ground plan and cellular diagram of a portion enlarged and identify the specimen.
   (Preparation-4; Drawing-3; Identification-1; Reasons-2) 10×3 = 30 Marks

2. Identify the given bacteria **D** and submit the micro preparation for valuation.
   (Preparation-3) 3 x1 = 3 Marks

3. Prepare Histogram/Frequency polygon/ using the given data **E**
   OR
   Workout the given problem **E** (Chi square test) 5 x1 = 5 Marks

4. Identify the disease, pathogen and list out the symptoms from the given specimen **F** and **G**
   (Disease identification-1, Pathogen – 1, Symptoms-1) 3×2 = 6 Marks

5. Determine the pollen viability of the sample **H** 6 x1 = 6 Marks

6. Spot at sight **I** to **W** 2×15=30 Marks

Practical examination	**: 80 Marks**
Record	**: 15 Marks**
Submission	**: 5 Marks**
Total	**:100 Marks**

Course Code: SJBOT5B06

Name of the Course: GYMNOSPERMS, PALAEOBOTANY, PHYTOGEOGRAPHY AND EVOLUTION

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand the role of gymnosperms as a connecting link between pteridophytes and angiosperms	5	U	C	18	26
CO2	Appreciate the process of organic evolution.	5	U	F	9	
CO3	Realize the importance of fossil study.	4	R	F	9	5
CO4	Understand the climatic conditions of the past and realize the changes happened	2	U	F	10	
CO5	Recognize the phytogeography zones of India.	2	R	C	8	5

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Gymnosperms	9	18	27
2	Palaeobotany	9	9	18
3	Phytogeography	18	9	27
4	Evolution	18	-	18
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Gymno.	Palaeobot.	Phytogeo.	Evolution	Total
2 marks (total 12)	4	2	3	3	Ceiling 20
5 marks (total 7)	2	1	2	2	Ceiling 30
10 marks (total 2)	2				1x10 = 10
TOTAL					**60**

GYMNOSPERMS

1. Introduction, General characters and classification of Gymnosperms (Sporne, 1965) (**1** hr)
2. Distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details not required): *Cycas, Pinus* and *Gnetum* (**6** hrs)
3. Evolutionary trends in Gymnosperms; Affinities of Gymnosperms with Pteridophytes and Angiosperms (**1** hr)
4. Economic importance of Gymnosperms. (**1** hr)

PRACTICAL (GYMNOSPERMS)

1. *Cycas*- Habit, coralloid root, T.S. of coralloid root, T.S. of leaflet, T.S. of rachis, male cone and L.S. of male cone , microsporophyll, megasporophyll, T.S. of microsporophyll, L.S. of ovule and seed.
2. *Pinus*- branch of unlimited growth, spur shoot, T.S. of stem and needle, male cone and female cone, L.S. of male cone and female cone, seed.
3. *Gnetum*- Habit, stem T.S., leaf T.S., male and female cones, L.S. of ovule, seed.

REFERENCES (GYMNOSPERMS)

1. Chamberlain C.J. (1935) Gymnosperms –Structure and Evolution, Chicago University Press.
2. Coutler J.M. and C.J. Chamberlain, (1958) Morphology of Gymnosperms. Central Book Depot, Allahabd.
3. Sporne K.R. (1967) The Morphology of Gymnosperms, Hutchinson and Co. Ltd. London.
4. Sreevastava H.N. (1980) A Text Book of Gymnosperms. S. Chand and Co. Ltd., New Delhi.
5. Vasishta P.C. (1980) Gymnosperms. S. Chand and Co., Ltd., New Delhi.

PALAEOBOTANY

1. Introduction and objectives (½ hr)
2. Fossil formation and types of fossils (**1** hr)
3. Geological time scale- sequence of plants in geological time (**2** hrs)
4. Fossil Pteridophytes- *Rhynia*, *Lepidodendron* and *Calamites* (**2** hrs)
5. Fossil gymnosperms- *Williamsonia* (**1** hr)
6. Important Indian Paleobotanical Institutes. (**1** hr)
7. Indian Palaeobotanists: Birbal Sahni and Savithri Sahni (**1** hr)
8. Applied aspects of Palaeobotany- exploration of fossil fuels (½ hr)

PRACTICAL (PALAEOBOTANY)

1 Fossil Pteridophytes - *Rhynia* stem, *Lepidodendron* and *Calamites*

2 Fossil gymnosperms- *Williamsonia*

(Drawings may be replaced by photos with critical notes in the record)

REFERENCES (PALAEOBOTANY)

1. Andrews H.N. (1961) Studies in Paleobotany. John Wiley and Sons Inc., New York.
2. Arnold C.A. (1947) Introduction to Paleobotany, Tata McGraw Hill, New Delhi.
3. Shukla, A.C. & S.P. Misra, (1975) Essential of Palaeobotany, Vikas Publishing House, Pvt. Ltd., Delhi.
4. Sreevastava H.N., (1998) Palaeootany, Pradeep Publishing Company, Jalandhan. Sewart,
5. Taylor, T.N. Paleobotany. An Introduction to Fossil Plant Biology. Mc Graw Hill, New York.
6. Steward A.C. (1935) Fossil Plants Vol. I to IV. Watson J. An introduction to study of fossil plants. Adams and Charles Black Ltd. London.

PHYTOGEOGRAPHY

1. Definition, concept, scope and significance of phytogeography. (**2** hrs)
2. Patterns of plant distribution - continuous distribution and discontinuous distribution, vicarism, migration and extinction (**3** hrs)
3. Continental drift -Evidences and impact. (**3** hrs)
4. Glaciation: Causes and consequences. (**2** hrs)
5. Theory of land bridges. (**2** hrs)
6. Endemic distribution, theories on endemism, age and area hypothesis. (**3** hrs)
7. Phytogeographical zones (phytochoria) of India. (**3** hrs)

PRACTICAL (PHYTOGEOGRAPHY)

1 Mark the phytogeographic zones of India.

REFERENCES (PHYTOGEOGRAPHY)

1. Ronald Good, (1947) The Geography of Flowering Plants. Longmans, Green and Co, New York
2. Armen Takhtajan, (1986) Floristic Regions of the World. (translated by T.J. Crovello & A. Cronquist). University of California Press, Berkeley.
3. P. D. Sharma, (2009) Ecology and Environment, Rastogi Publications, Meerut

EVOLUTION

1. Theories on Origin of Universe, Earth and Origin of life. Condensation and Polymerization; Protenoids and Prions – Oparin's concept; Miller's experiment. (**3** hrs)
2. Evolution of prokaryotic and eukaryotic cells, archaebacteria, early fossilized cells. (**2** hrs)
3. Theories on origin and evolution of species: Darwinism; Neo-Darwinism and its objection;

Arguments and support for Darwinism, Modern concept of evolution. (**3** hrs)

4. Evidences of organic evolution from Morphology, Anatomy, Embryology, Palynology, Genetics and Molecular Biology. (**3** hrs)
5. Genetic Constancy and Creation of Variability: Cell divisions and genetic constancy; – Genetic variability by recombination, Chromosomal variations, Gene mutations, Selection and genetic drift. (**4** hrs)
6. Speciation: Isolating mechanism, Modes of speciation: sympatric and allopatric (**3** hrs)

REFERENCES (EVOLUTION)

1. Crick F. (1981) Life itself: Its origin and Nature. Simon and Schuster, New York.
2. Drake J.W. (1970) The molecular basis of mutation. Holden – Day – San Francisco.
3. Dott R.H. R.L. Batten, (1981) Evolution of the earth 3rd edn. McGraw Hill New York.
4. Fox S.W. and Dose, K. (1972) Molecular evolution and the origin of life. W.H. Freeman & Co., San Francisco.
5. Gould S.J. (1977) Ontogeny and Phylogeny. Harvard Univ. Press, Cambridge, Mass.
6. Jardine N., D. Mc Kenzie (1972) Continental drift and the dispersal and evolution of organisms. Nature, 234. 20-24.
7. Miller, S.L. (1953) A production of aminoacids under possible primitive earth conditions. Science, 117: 528-529.
8. Strickberger, (1990) Evolution, Jones and Bastlett Publishers International, England.

MODEL QUESTION PAPER

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE -6

SJBOT5B06: GYMNOSPERMS, PALAEOBOTANY, PHYTOGEOGRAPHY, EVOLUTION

TIME: 2 Hrs **Max. Marks 60**

SECTION A

(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. What is an ovuliferous scale?
2. Describe the features of manoxylic wood. Give an example.
3. Enumerate the angiosperm features of *Gnetum*.
4. Describe the features of the male gametophyte of *Pinus*.
5. Write short note on types of fossils.
6. Describe Geological time scale.
7. What is mean by continental drift? Explain.
8. What are the causes and consequences of glaciation?
9. Give a brief account of phytogeographical zones of India.
10. What is endemism? Explain with an example.
11. What is discontinuous distribution?

12. Describe the Modern concept of evolution.

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Comment on the evolutionary position of gymnosperms.
14. Explain the economic importance of gymnosperms.
15. Enumerate the contributions of Birbal Sahni and Savithri Sahni.
16. Define migration. What is its impact on biodiversity of a particular region? Explain with example.
17. Explain the theory of land bridges.
18. Describe the evolution of prokaryotic cells.
19. Explain speciation.

SECTION C
(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Compare the anatomy of *Cycas* leaflet and *Pinus* needle with suitable diagrams. Add a note on the special types of tissues found in these.
21. Explain the theories on origin and evolution of species.

Course Code: SJBOT5B07

Name of the Course: ANGIOSPERM MORPHOLOGY AND SYSTEMATICS

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Appreciate the diverse morphology of angiosperms.	4	R	C	6	6
CO2	Identify and classify plants based on taxonomic principles.	4	A	C	24	6
CO3	Make scientific illustrations of vegetative and reproductive structures of plants.	3	A	C	6	6
CO4	Develop the skill of scientific imaging of plants.	3	A	C	6	6
CO5	Realize the importance of field study.	2	U	C	6	6
CO6	Change their attitude towards over exploitation of rare/endemic plants.	2	A	C	6	6

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Angiosperm Morphology	14	9	23
2	Systematics	40	27	67
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Angio. Morphology	Systematics	Total
2 marks (total 12)	4	8	Ceiling 20
5 marks (total 7)	2	5	Ceiling 30
10 marks (total 2)	2		1x10 = 10
TOTAL			**60**

ANGIOSPEM MORPHOLOGY

1. Technical description of a flowering plant (brief) (**2** hrs)
2. Inflorescence: racemose, cymose and specialised (cyathium, hypanthodium, coenanthium, verticillaster, thyrsus) (**3** hrs)
3. Flower: Flower as a modified shoot, detailed structure of flowers, floral parts –their arrangement, relative position, cohesion and adhesion - symmetry of flowers. (**4** hrs)
4. Fruits– simple, aggregate and multiple with examples; Seed structure - dicot and monocot - albuminous and exalbuminous, aril, caruncle; Dispersal of fruits and seeds - types and adaptations. (**5** hrs)

PRACTICAL (ANGIOSPEM MORPHOLOGY)

1. Identify the types of inflorescence and fruits mentioned in the syllabus.
2. All the types mentioned under inflorescence and fruits must be represented in the photo album. (All drawings in records are replaced by photo album submission).

REFERENCES (ANGIOSPEM MORPHOLOGY)

1. Gangulee, H.C., J.S. Das & C. Dutta. (1982) College Botany (5th Ed.) New Central Book Agency, Calcutta.
2. George, H.M. Lawrence. (1951) Introduction to Plant Taxonomy. Mac Millan comp. Ltd., New York.
3. Simpson, M. G. (2006) Plant Systematics. Elsevier Academic Press, London
4. Sporne, K.R. (1974) Morphology of Angiosperms. Hutchinson University Press London

SYSTEMATICS

Module-I (**6** hrs)

1. Components of systematics: identification, description nomenclature and classification; objectives and importance of systematics (**2** hrs)
2. Systems of classification: Artificial– Linnaeus; Natural– Bentham and Hooker; Phylogenetic – Hutchinson; Angiosperm Phylogeny Group system (**4** hrs)

Module – II (**14** hrs)

1. Detailed study (systematic position, distribution, common members, diagnostic features, description from habit to fruit and economic importance of the following families.
   Annonaceae, Malvaceae, Meliaceae, Fabaceae with sub families, Myrtaceae, Cucurbitaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Orchidaceae and Poaceae.

Module- III (**8** hrs)

1. Taxonomic structure: Hierarchy; Concepts of taxa; Species: Biological, Phenetic and Phylogenetic; Genus; Family. (**2** hrs)
2. Taxonomic character – concept, primitive and advanced characters, sources, comparative morphology, vegetative, reproductive, macro and micromorphology; modern trends in taxonomy, cytotaxonomy, chemotaxonomy, numerical taxonomy, molecular taxonomy and phylogenetics. (**4** hrs)
3. Contributions of eminent Taxonomists viz Hendrik van Rheede, William Roxburgh, Robert Wight, J. S. Gamble and EK Janaki Ammal. (**2** hrs)

Module – IV (**12** hrs)

1. Plant Nomenclature – Limitations of common name, ICN **-** Principles (introduction only); Typification (holotype, isotype, syntype paratype and lectotype); Priority– merits and demerits; Effective and valid publication; Author citation. (**3** hrs)
2. Plant identification – Keys; indented and bracketed, construction and applications. (**2** hrs)
3. Taxonomic information resources – Herbarium preparation and maintenance, Herbarium types: International- Kew (K); National-Central national herbarium (CAL), MH Coimbatore, Virtual herbarium, Botanic Gardens: RBG, Kew; IGB, Kolkotta; JNTBGRI Thiruvananthapuram and MBGIPS, Kozhikode. (**4** hrs)
4. Taxonomic literature- Floras, e-Flora, Monographs, Revisions, Journals and online resources & Databases. (**3** hrs)

PRACTICAL (SYSEMATICS)

1. Students are expected to work out at least two members of each family mentioned in the syllabus and make suitable diagrams (floral diagram and floral formula not needed). Describe them in technical terms and identify up to species using the Flora. Orchidaceae may be excluded from practical examination scheme.

2. Students shall be able to prepare artificial key to segregate any five given plants. This must be recorded.
3. Familiarization of herbarium techniques (Demonstration only).
4. Mounting of a properly dried and pressed specimen of any common wild plant (rare, endangered or endemic plants should not be collected for the purpose) from any one of the families mentioned in the syllabus, with proper herbarium label (to be submitted in the record book).
5. Every student shall submit original images of plants, at least one from each family mentioned in the syllabus, duly certified by Head of the department, at the time of examination. The images of plants should be properly identified and they should carry details like systematic position, GPS location, date, name and reg. no. of the student etc. Habitat, Habit, Inflorescence and single flower should be represented. Web sourced and outsourced images should not be used. The images can be submitted along with the photo album containing images of inflorescence and fruits mentioned under morphology. Individuality should be strictly maintained while preparing the photo album.
6. It is compulsory that every student has to undertake field study trips of 3-5 days to study vegetation of ecologically different areas, under the guidance of teachers. Visits to standard Herbaria, Organizations/ Institutes involved in exploring plant resources, Botanical museums etc. may be conducted as part of study tour. Local habitats like sacred groves, rice fields, wetlands, forests, grasslands etc. also can be selected for field trips. Avoid visit to tourist places with meager plant diversity and of having only entertainment value. Submit a field visit report countersigned by the Head of the department during the practical examination.
7. If a student fails to undergo the study tour he /she may not be permitted to attend the examination.

REFERENCES (SYSEMATICS)

1. Bharati Bhattacharyya (2009) Systematic Botany, Narosa Publishing House Pvt. Ltd., New Delhi.
2. Burkill, I.H. (1965) Chapters on the History of Botany in India, Delhi.
3. Clive A. Stace (1991) Plant Taxonomy and Biosystematics, Cambridge University Press.
4. Davis, P.H. & V.H. Heywood, (1963) Principles of Angiosperm Taxonomy. Oliver & Boyd Ltd., London.
5. Gurucharan Singh, (2012) Plant Systematics - Theory and Practice. Oxford & IBH, New

Delhi.
6. Jeffrey, C. (1968) An introduction to Plant Taxonomy, London.
7. Mondal A.K. (2009) Advanced Plant Taxonomy, New Central Book agency Pvt. Ltd. Kolkata.
8. Nicholas J. Turland *e al*. (2018) International Code of Nomenclature for algae, fungi, and plants- Shenzhen Code (printed/ electronic version) Koeltz Botanical Books.
9. Pandey, S.N. & S.P. Misra. (2008) Taxonomy of Angiosperms. Ane Books India, New Delhi.
10. Radford, A.E. (1986) Fundamentals of Plant Systematics. Harper & Row Publishers, New York.
11. Sambamurthy A.S.S. (2005) Taxonomy of Angiosperms, I.K. International Pvt. Ltd, New Delh.
12. Sharma, B.D. *et al*. (Eds.) (1996) Flora of India, Vol. I. Botanical Survey of India, Kolkata.
13. Simpson, M.G. (2006) Plant Systematics. Elsevier Academic Press, London
14. Sivarajan, V.V. (1991) Introduction to Principles of Plant Taxonomy. Oxford & IBH, New Delhi.
15. Stuessy, T.F. (1990) Plant Taxonomy –The systematic evaluation of Comparative data. Columbia University Press, New York.

MODEL QUESTION PAPER

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
CORE COURSE-7
SJBOT5B07: ANGIOSPERM MORPHOLOGY& SYSTEMATICS

TIME: 2 hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Describe the structure of a coenanthium.
2. Explain the rule of priority.
3. A flower can be considered as a modified shoot. Justify.
4. Describe the vegetative features of Lamiaceae.
5. Differentiate between definable and non-definable families with examples.
6. Briefly describe the contributions of EK Janaki Ammal to the field of angiosperm taxonomy.
7. What is caruncle? Where can you find? Describe is function.
8. What is meant by virtual herbarium?
9. What is meant by effective publication?

10. What type of structural adaptions can you find in a coconut seed that helps its easy dispersal?
11. What is resupinaion? Where can you find his?
12. Give an account of taxonomic hierarchy.

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Give an account of the various types of racemose inflorescences found in angiosperms with examples.
14. Write noes on typification.
15. Give an account of the APG system of classification. Enumerate is advantages.
16. Describe the concept of species
17. What is numerical taxonomy?
18. Describe the types of flowers based in the relative position of ovary and other floral parts.
19. Give an account of ICN principles.

SECTION C
(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Give an account of various types of fruits produced by angiosperms with special reference to the types of placentations observed in these, citing suitable examples.
21. Critically evaluate the reasons for the successful establishment of Asteraceae.

Course Code: SJBOT5B08

Name of the Course: TISSUE CULTURE, HORTICULTURE, ECONOMIC BOTANY AND ETHNOBOTANY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Critically evaluate the advantages of tissue culture and horticulture over conventional methods of propagation.	3 & 4	E	C	15	10
CO2	Apply various horticultural practices in the field.	4	A	C	15	10
CO3	Experiment on the subject and try to become entrepreneurs.	4	Z	C	15	10
CO4	Identify the economically important plants.	4	A	C	9	6

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Tissue culture	18	12	30
2	Horticulture	18	12	30
3	Economic Botany	9	9	18
4	Ethnobotany	9	3	12
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of	Tissue Cult.	Horticulture	Econ. Bot	Ethnobot.	Total
2 marks	5	5	1	1	Ceiling 20
5 marks	3	2	1	1	Ceiling 30
10 marks	1	1	-	-	1x10 = 10
TOTAL					**60**

TISSUE CULTURE

Module-1 (12 hrs)

1. Plant tissue culture – Principles and techniques; Cellular totipotency; *in vitro* differentiation – de differentiation and re-differentiation. (**2** hrs)
2. Tissue culture medium – Basic components in tissue culture medium – Solid and liquid medium; Murashige and Skoog medium – composition and preparation. (**2** hrs)
3. Aseptic techniques in *in vitro* culture – sterilization – different methods – sterilization of instruments and glassware, medium, explants; working principle of laminar air flow and autoclave. (**2** hrs)
4. Preparation of explants– surface sterilization, inoculation, incubation, subculturing. (**2** hrs)
5. Micropropagation - Different methods – apical, axillary bud proliferation, direct and indirect organogenesis and somatic embryogenesis. (**2** hrs)
6. Different phases of micropropagation – multiple shoot induction, shoot elongation, *in vitro* and *in vivo* rooting hardening, transplantation and field evaluation; advantages and disadvantages of micropropogation, somaclonal variation. (**2** hrs)

Module – II **(8 hrs)**

1. Methods and Applications of tissue culture:
    1. Shoot tip and meristem culture.
    2. Somatic embryogenesis and synthetic seed production.
    3. Embryo culture.
    4. Protoplast isolation culture and regeneration – transformation and transgenics
    5. Somatic cell hybridization, cybridization.
    6. *In vitro* secondary metabolite production — cell immobilization, bioreactors
    7. *In vitro* production of haploids – anther and pollen culture
    8. *In vitro* preservation of germplasm

PRACTICAL (TISSUE CULTURE)

1. Preparation of nutrient medium – Murashige and Skoog medium using stock solutions,
2. Familiarize the technique of preparation of explants, surface sterilization, inoculation and subculturing.
3. Preparation of synthetic seeds
4. Demonstration of anther culture

REFERENCES (TISSUE CULTURE)

1. Gamborg, O.L. & G.C. Philips (Eds.) (1995). Plant Cell, Tissue and Organ Culture: Fundamental Methods. Narosa Pulishing House, New Delhi.
2. Razdan MK (1995) Introduction to Plant Tissue Culture. Oxford & IBH publishing Co. Pvt. Ltd.
3. Reinert & Bajaj. Plant Cell, Tissue and Organ Culture.
4. Edwin F. George, Michael A. Hall and Geert-Jan De Klerk. (2008) Plant propagation by tissue culture Volume 1. The Background. Springer, P.O. Box 17, 3300 AA Dordrecht. The Netherlands.
5. Madhavi Adhav (2010) Practical book of Biotechnology and Plant Tissue culture, S Chand, New Delhi.
6. Bhojwani, San Saran, Danu, Prem Kumar (2013) Tissue Culture : An Introductory Text. Springer.

HORTICULTURE

Module - I. **(5 hrs)**

1. Introduction, scope and significance; branches of horticulture. (**1** hr)
2. Soil- components of soil, types of soil. (**1** hr)
3. Fertilizers – Chemical, organic, biofertilizer, compost. (**1** hr)
4. Pots & potting – earthen, fibre, polythene bags, potting mixture, potting, repotting, top dressing. (**1** hr)
5. Irrigation – Surface, sprinkle, drip and gravity irrigation. (**1** hr)

Module – II (7 hrs)

1. Seed propagation –seed quality tests, seed treatment, essential condition for successful propagation: raising of seed beds, transplanting techniques. (**3** hrs)
2. Vegetative propagation: (**4** hrs)
    1. Cutting (stem, roots)
    2. Grafting (approach, cleft)
    3. Budding (T-budding, patch)
    4. Layering (simple, air).

Module - III. (6 hrs)

1. Gardening – site selection; propagating structure: green house, poly house, moist chamber, net frame – Garden tools and implements. (**1** hr)
2. Indoor gardening – selection of indoor plants, care and maintenance of indoor plants, Bonsai – Principle, creating the bonsai. (**1** hr)
3. Outdoor gardening; landscaping- goals, types. (**1** hr)
4. Cultivation and post-harvest management of vegetables and ornamental plants. (**1** hr)

5. Protection of horticultural plants: Precautions to avoid pests and diseases, biopesticides. (**1** hr)
6. Mushroom cultivation – Oyster mushroom (**1** hr)

PRACTICAL (HORTICULTURE)

1. Preparation of nursery bed and polybag filling.
2. Preparation of potting mixture – Potting, repotting.
3. Field work in cutting, grafting, budding, layering **(**drawing not required).
4. Familiarizing gardening tools and implements. (drawing not required)
5. Establishment of vegetable garden/ Visit to a horticulture station.
6. A brief report of item no. 5 may be recorded.

REFERENCES (HORTICULTURE)

1. Andiance and Brison. (1971). Propagation Horticultural Plants.
2. Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India.
3. George Acquaah, (2005) Horticulture: Principles and Practices. Pearson Education, Delhi.
4. Hudson, T. Hartmann, Dale K. Kester, Fred T.Davies, Robert L. Geneve, Plant Propagation, Principles and Practices.
5. Katyal, S.C., Vegetable growing in India, Oxford, New York.
6. Kolay, A.K. Basic Concepts of Soil Science. New Age International Publishers, Delhi.
7. Naik, K.C., South Indian Fruits and their Culture.
8. Nishi Sinha: Gardening in India, Abhinav Publications, New Delhi.
9. Prakash, R and K. Raj Mohan, Jaivakrishi (Organic farming), State Institute of Languages, Thiruvananthapuram.
10. Prasad, S., and U. Kumar. Green house Management for Horticultural Crops, Agrobios, Jodhpur.

ECONOMIC BOTANY

Study the different category of economically important plants their Binomial, Family and Morphology of useful part, products and uses: (**9** hrs)

1. Cereals and Millets – Rice, Wheat, Maize and Ragi
2. Pulses and legumes – Green gram, Bengal gram, Black gram,
3. Sugar – Sugar cane
4. Fruits – Apple, Pine Apple, Papaya, Banana, Mango, Guava, Jack, Grapes, Sapota.
5. Vegetables – Carrot, Beet Root, Corm, Potato, bitter gourd, Cucumber, Snake gourd, Ladies finger, Cabbage, *Amaranthus*,
6. Ornamentals – Rose, *Anthurium*, Jasmine.
7. Masticatories – Betel vine, Betel nut, Tobacco.
8. Beverages – Coffee, Tea, Cocoa.
9. Fibre – Coir, Cotton, Jute.

10. Timber – Teak, Rose wood, Jack, *Ailanthus*.
11. Fats and oils – Coconut, Gingelly, Sun flower.
12. Latex – Rubber
13. Gums and Resins – Dammar, Gum Arabic, Asafoetida
14. Spices – Pepper, Ginger, Cardamom, Clove, Nutmeg, Allspice, Cinnamon
15. Medicinal – *Adhatoda*, *Catharanthus*, *Phyllanthus*, *Rauvolfia*, *Aloe*,

PRACTICAL (ECONOMIC BOTANY)

1. Students shall be able to identify plants or plant products (raw or processed) studied in theory and shall be able to write Botanical names, Family and morphology of useful parts of source plants.
2. Students need not make any illustrations but make a table in the record giving the details of the items mentioned in the theory syllabus.

REFERENCES (ECONOMIC BOTANY)

1. Bendre Kumar 2000: Economic Botany' Rastogi Publcations, Shivaji road, Meerut.
2. Jain. S. K. 1981. Glimpses of Indian Economic Botany. Oxford.
3. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.

ETHNOBOTANY

1. Introduction, scope and significance (**1** hr)
2. Major tribes of South India. Importance of Traditional Botanical Knowledge, TBGRI model of Benefit Sharing. (**2** hrs)
3. Ethnobotanical significance of the following: (**6** hrs)
    1. *Aegle marmelos*
    2. *Ficus religiosa*
    3. *Curcuma longa*
    4. *Cynadon dactylon*
    5. *Ocimum sanctum*
    6. *Trichopus zeylanicus*

PRACTICAL (ETHNOBOTANY)

Students are expected to identify the plants mentioned in the Ethnobotany syllabus and it must be given as a table showing Common name, Binomial, Family and Ethnobotanical significance in the record book. (Drawing not required)

REFERENCES (ETHNOBOTANY)

1. Baker. H.g. (1970) Plant and Civilization.
2. Jain. S. K. (1995). A Manual of Ethnobotany. Scientific Publishers, Jodhpur.
3. Cotton, C.M. (1996) Ethnobotany – Principles and Applications. Wiley and Sons.

MODEL QUESTION PAPER

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE- 8

SJBOT5B08: TISSUE CULTURE, HORTICULTURE, ECONOMIC BOTANY AND ETHANOBOTANY

TIME: 2 Hrs **Max. Marks 60**

SECTION A

(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. What is the principle of plant tissue culture?
2. Define organogenesis? Explain the different types.
3. Write a short note on haploids, their production and significance?
4. What are the different branches of horticulture?
5. What is a gelling agent? Give examples.
6. Name two plants of ethnobotanical significance and their uses.
7. Comment on the formation of humus.
8. Explain the different types of green houses.
9. Write the binomial and family of four oil yielding plants.
10. Comment on compost activators.
11. What are the advantages of drip irrigation?
12. Explain the types and advantages of biofertilisers.

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Explain the steps involved in creating bonsai.
14. What are the different types of soil?
15. What is a nutrient medium, and what are its components? Cite an example of a commonly used medium.
16. Name four plants used for their medicinal importance, and the chemical constituents responsible for these properties?
17. Give an account of various tribal communities of Kerala.
18. Explain the major stages in micropropagation.
19. Explain how you can obtain virus free plants through tissue culture,

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Explain the different methods of vegetative propagation in plants? Compare nature of such plants with sexually propagated plants.
21. Explain the steps involved in somatic hybridization and the relevance of the technique.

Course Code: SJBOT5B09

Name of the Course: CELL BIOLOGY AND BIOCHEMISTRY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Appreciate the ultra-structure of a plant cell.	1	U	C	7	10
CO2	Enumerate the functions of each cell organelles.	4 & 5	R	C	20	10
CO3	Draw and explain the structure of biomolecules.	5	R	C	27	16

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Cell Biology	27	9	36
2	Biochemistry	27	27	54
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Cell Biology	Biochemistry	Total
2 marks (total 12) quesions)	6	6	Ceiling 20
5 marks (total 7)	4	3	Ceiling 30
10 marks (total 2)	1	1	1x10 = 10
TOTAL			**60**

CELL BIOLOGY

Module – I. (**14** hrs)

1. Architecture of cells. Prokaryotic and Eukaryotic cells. (**1** hr)
2. Structure and function of the following: Cell membrane (fluid mosaic model),

Endoplasmic reticulum, Golgi complex, mitochondria, chloroplast, Lysosomes Glyoxisomes Ribosomes Cytoskeleton Cytosol Vacuole (**5** hrs)

3. Nucleus - Nuclear membrane; Nuclear pore complex; organization of interphase Nucleus; Euchromatin and heterochromatin; Nucleolus. (**4** hrs)
4. Chromosomes - Morphology, classification, Centromere and Telomere, Chemical Composition and organization. (**4** hrs)

Module-II (**13** hrs)

1. Special types of chromosomes–Polytene chromosomes, lampbrush chromosomes (**1** hr)
2. Cell division - cell cycle - Mitosis & Meiosis – significance- molecular control of cell division (**5** hrs)
3. Chromosomal changes: structural aberrations: deletion, duplication, inversion, translocation - their meoitic consequences and significance (**3** hrs)
4. Numerical aberration - Defintion - Basic chromosome number (Genomic Number) Aneuploidy, Haploidy and Polyploidy - their meiotic behaviour and significance. (**4** hrs)

PRACTICAL (CELL BIOLOGY)

1. Mitosis - Acetocarmine squash preparation of Onion root tip.
2. Calculation of mitotic index
3. Demonstration of meiosis in *Rhoeo/ Chlorophytum*/ Maize and identification of different stages of Meiosis.

REFERENCE (CELL BIOLOGY)

1. Arumugham. N. (2014) Cell Biology. Sara Publication, Nagercoil.
2. Avinash Upadhyaya & Kakoli Upadhayayo (2005). Basic Molecular Biology. Himalaya Publishers.
3. De Robertis. E.D.P., & De Robertis E.M.S. (1998) Cell and Molecular Biology -Lea & Febiger.
4. Geoffery M. Cooper & Robert E. Haufman. (2007) The cell - a molecular approach. A.S.S. Press Washington, U.S.A.
5. Lewis. J. Kleinsmith & Valerie M. Kish (1995) Principles of Cell & Molecular Biology.
6. Lewin B. (2017) Genes XII. Oxford University press.
7. Lodish. H. *et. al*., (2000) Molecular Cell Biology, Freeman & Company.
8. Powar C.B. (1988) Essentials of Cytology, Himalaya Publishing House.
9. Rastogi S.G. Cell Biology. Tata Mc Graw Hill Publishing Company New Delhi
10. Rastogi. V.B. (2008) Fundamentals of Molecular Biology, Ane Books India.

BIOCHEMISTRY

1. Macromolecules: building block biomolecules,metabolic intermediates, precursors) (**2** hrs)
2. Carbohydrates. Classification; structure and functions of simple sugars and compound carbohydrates. (**5** hrs)
3. Lipids. Classification. Complex lipids, Simple lipids and derived lipids; Fatty acids saturated and unsaturated, triacyl glycerols, phospholipids, sphingolipids. (**4** hrs)
4. Amino acids, peptides and proteins. Amino acids: classification based on polarity; zwitterions, dipeptides. (**3** hrs)
5. Proteins: Primary, secondary, tertiary and quaternary structures of proteins. Native conformation and biological functions of proteins. Denaturation and renaturation. (**3** hrs)
6. Nucleotides: structure, Functions of nucleotides and nucleotide derivatives. (**4** hrs)
7. Secondary metabolites. A brief account of secondary metabolites, physiological roles. Significance: ecological importance. (**2** hrs)
8. Enzymes Classification (IUB), Mechanism of enzyme action, optimization of weak interactions in the transition state. Co-enzymes, inhibition, regulation: allosteric enzymes, covalently modulated enzymes. Isoenzymes. (**4** hrs)

PRACTICAL (BIOCHEMISTRY)

1.Qualitative tests for monosaccharides, and reducing non reducing oligosaccharides, starch, amino acids and protein.

1. Molisch's test for all carbohydrates
2. Benedict's test for reducing sugars
3. Barfoed's test for monosaccharides
4. Seliwanoff's test for ketoses
5. Fearson's test (methyl amine test) for reducing disaccharides
6. Iodine test for starch
7. Ninhydrin test for amino acids and protein
8. Xanthoproteic test for amino acids with aromatic R-groups
9. Millon's test for tyrosine
10. Hopkins- Cole test for tryptophan
11. Biuret test for peptide linkage and proteins

2. Quantitative estimation of protein by Biuret method. (Demonstration only)
3. Quantitative estimation of DNA and RNA by colorimetric/ spectrophotometric method (Demonstration only)
4. Colorimetric estimation of reducing sugars in germinating seeds (Demonstration only)

REFERENCES (BIOCHEMISTRY)

1. David L; Nelson and Michael M Cox (2000). Lehninger. Principles of Biochemistry. 3rd edition. Macmillon, Worth U.K.
2. Sadasivam and Manickam (2007) Biochemical methods. New Age International Publishers. New Delhi.
3. Secondary plant products, vol.8. Encyclopedia of Plant Physiology (1980) Springer – Verlag, Berlin
4. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.
5. Donald Voet and Judith Voet. (2004). Biochemistry. 3rd Edition. Wiley International Edition.
6. Keith Wilson and John Walker. (2008). Principles and techniques of Biochemistry and Molecular Biology. 6th edition. Cambridge University Press.
7. Trevor Palmer. (1991) Enzymes- Biochemistry, Biotechnology and Clinical Chemistry. Norwood Publishing, Chichester.

MODEL QUESTION PAPER

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-9:
SJBOT5B09: CELL BIOLOGY AND BIOCHEMISTRY

TIME: 2 hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Describe the function of nucleolus
2. Mention the features of nucleosomes.
3. Differentiate between euchromatin and heterochromation
4. Describe any two features of fluid mosaic model of plasma membrane.
5. What is crossing over? Mention its significance.
6. What are the functions of vacuoles?
7. Give any two properties of amino acids.
8. What are co enzymes? Give examples.
9. Describe switter ions.
10. What are peptide bonds? How is it formed?
11. What are polysaccharides? Give two examples.
12. What are allosteric enzymes?

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Explain the structure and function of ATP.
14. Write a brief note on polytene chromosome and its significance.
15. Describe the morphology and chemical composition of chromosomes.
16. Analyse the ecological importance of secondary metabolites.
17. Explain the structure and function of Mitochondria.
18. Differentiate between prokaryotic and eukaryotic cell.
19. Comment on denaturation and renaturation of proteins.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Give an account of numerical aberration of chromosomes and its significance.
21. Explain the structure and biological functions of proteins.

Course Code: SJBOT6B10

Name of the Course: GENETICS AND PLANT BREEDING

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Appreciate the facts behind heredity and variations.	3	U	C	7	2
CO2	Understand the basic principles of inheritance.	1	U	C	7	2
CO3	Solve problems related to classical genetics.	3	A	C	10	8
CO4	Predict the pattern of inheritance.	3 & 4	A	F	10	8
CO5	Understand various plant breeding techniques.	4	U	C	10	8
CO6	Realize the role of plant breeding in increasing crop productivity.	4	U	C	10	8

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Genetics	36	27	63
2	Plant breeding	18	9	27
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Genetics	Plant breeding	Total
2 marks (total 12)	8	4	Ceiling 20
5 marks (total 7)	4	3	Ceiling 30
10 marks (total 2)	2		1x10 = 10
Total			**60**

GENETICS

Module – I (23 hrs)

1. Introduction- Mendel's life history (brief), Mendelian experiments: Monohybrid cross and dihybrid cross, Mendelian ratios, Laws of inheritance; Back cross, test cross. **(5 hrs)**
2. Modified Mendelian ratios:
   a. Allelic interactions: dominant – recessive, Incomplete dominance – flower color in Mirabilis; Co dominance – Coat colour in cattle, Blood group in human beings; Lethal genes – Sickle cell anemia in Human beings. Modified dihybrid ratios by incomplete dominance of one pair of gene (3:6:3:1:2:1) and both pairs (1:2:1:2:4:2:1:2:1). **(6 hrs)**
   b. Interaction of genes: Non epistatic - Comb pattern inheritance in poultry (9:3:3:1): Epistasis: dominant - Fruit colour in summer squashes; Recessive epistasis - Coat color in mice; Complementary gene interaction- flower color in *Lathyrus*. **(6 hrs)**
3. Multiple alleles- general account: ABO blood group in man, Self sterility in *Nicotiana*, Coat colour in Rabbits. **(3 hrs)**
4. Quantitative inheritance / polygenic inheritance / continuous variation- Skin color in human beings, Ear size in maize. **(3 hrs)**

Module –II (13 hrs)

1. Linkage and crossing over- importance of linkage, linkage and independent assortment. Complete and incomplete linkage. Crossing over general account, 2 point and 3 – point crossing over, cytological evidence of genetic crossing over. Determination of gene sequences; interference and coincidence; mapping of chromosomes. **(7 hrs)**
2. Extra nuclear inheritance- general account- maternal influence- plastid inheritance in *Mirabilis*, Shell coiling in snails. **(3 hrs)**
3. Population genetics; Hardy –Weinberg law and equation **(3 hrs)**

PRACTICAL (GENETICS)

1.Students are expected to work out problems related to the theory syllabus. One problem each from all the types mentioned should be recorded.

a. Monohybrid cross
b. Dihybrid cross
c. Test cross and back cross
d. Determination of genotypic and phenotypic ratios and genotype of parents
e. Non epistasis
f. Complementary gene interaction
g. Epistasis: dominant and recessive
h. Polygenic interaction
i. Multiple allelism
j. Chromosome mapping

k. Calculation of Coincidence and interference

REFERENCE (GENETICS)

1. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
2. Gunther, S. Spend & Richard Calender (1986) - Molecular Genetics CBS Publishers Delhi.
3. Gupta, P.K. (2018 -19) Genetics. Revised edition. Rastogi Publications, Meerut
4. John Ringo (2004) Fundamental Genetics Cambridge University Press.
5. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
6. Lewin B. (2000) Genes VII Oxford University Press.
7. RastogiV.B. (2008) Fundamentals of Molecular Biology, Ane Books, India.
8. Sinnot, W.L.C. Dunn & J. Dobzhansky (1996) Principles of Genetics. Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
9. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
10. Verma, P.S. & Agarwal (1999) Text book of Genetics. S. Chand & Co., New Delhi.

PLANT BREEDING

Module-I (**4** hrs)

1. Definition and objectives of Plant breeding – Organization of ICAR and its role in plant breeding. (**2** hrs)
2. Plant Genetic Resources - Components of Plant Genetic Resources. (**2** hrs)

Module-II (**14** hrs)

1. Breeding techniques (**12** hrs)
    1. Plant introduction: Procedure, quarantine regulations, acclimatization- agencies of plant introduction in India, major achievements.
    2. Selection -mass selection, pureline selection and clonal selection, genetic basis of selection, significance and achievements.
    3. Hybridization – procedure; intergeneric, interspecific and intervarietal hybridization with examples; composite and synthetic varieties.
    4. Heterosis breeding - genetics of heterosis and inbreeding depression.
    5. Mutation breeding – methods - achievements.
    6. Polyploidy breeding
    7. Breeding for disease and stress resistance
2. Modern tools for plant breeding: Genetic Engineering and products of genetically modified crops (brief mentioning only). (**2** hrs)

PRACTICAL (PLANT BREEDING)

1. Techniques of emasculation and hybridization of any bisexual flower.
2. Floral biology of Paddy, any one Pulse and Coconut tree.
3. Visit to a plant breeding station and submission of its report.

REFERENCES (PLANT BREEDING)

1. Allard. R.W. (1960). Principles of Plant breeding, John Wiley & Sons, Inc, New York.
2. Chaudhari. H.K. Elementary Principles of Plant breeding, Oxford & IBH Publishers.
3. Singh, B.D. (2005). Plant Breeding: Principles & methods, Kalyani Publishers, New Delhi.
4. Sinha U. & Sunitha Sinha (2000) Cytogenetics, Plant breeding & Evolution, Vikas Publishing House.
5. Swaminathan, Gupta & Sinha (1983) Cytogenetics of Crop plants Macmillan India Ltd.

MODEL QUESTION PAPER

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE- 10

SJBOT6B10: GENETICSAND PLANTBREEDING

TIME: 2 Hrs **Max. Marks 60**

SECTION A

(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Differentiate between sex chromosomes and autosomes.
2. Define lethal genes. Cite one example.
3. Define heterosis. Write a suitable example
4. Differentiate between pure line and pure breeding.
5. Explain the significance of linkage.
6. What are multiple alleles?
7. Enumerate the characteristics of quantitative inheritance.
8. Explain the complementary gene action.
9. Write an account on clonal selection.
10. What is the significance of crossing over?
11. State Hardey Weinberg law.
12. Differentiate between back cross and test cross.

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Describe extra nuclear inheritance with suitable example.
14. What is the role of polyploidy in plant breeding?
15. What is recessive epistasis? Explain it with example.

16. Explain the genetics of inheritance of Fruit colour in summer squashes.
17. What is incomplete dominance? Explain with examples.
18. Write the achievements of mutation breeding.
19. Explain the various steps involved in pure line selection.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Explain the various steps involved in plant introduction?
21. Explain the pattern of extranuclear inheritance with suitable examples

Course Code: SJBOT6B11

Name of the Course: BIOTECHNOLOGY, MOLECULAR BIOLOGY AND BIOINFORMATICS

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Analyze the role of biotechnology in daily life.	4	Z	C	18	12
CO2	Understand the basic aspects of bioinformatics.	3	U	C	18	12
CO3	Explain the concepts in molecular biology.	3 & 5	R	C	18	12

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl	Subject	Theory	Practical	Total
1	Biotechnology	18	12	30
2	Molecular Biology	18	12	30
3	Bioinformatics	18	12	30
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Biotechnology	Molecular Biol.	Bioinformatics	Total
2 marks (total 12)	4	4	4	Ceiling 20
5 marks (total 7)	2	2	3	Ceiling 30
10 marks (total 2)	2			1x10 = 10
Total				**80**

BIOTECHNOLOGY

Module –I (13 hrs)

1. Introduction, concept, history of biotechnology **(1** hr)
2. Recombinant DNA Technology: Gene cloning strategies – recombinant DNA construction –cloning vectors –plasmids pBR322, bacteriophage based vectors, Ti plasmids. Restriction endonucleases and ligases transformation and selection of transformants – using antibiotic resistances markers, southern blotting; PCR. **(7** hrs)
3. Different methods of gene transfer – chemically stimulated DNA uptake by protoplast, electroporation, microinjection, biolistics. Agrobacterium mediate gene transfer gene library, gene banks. **(5** hrs)

Module –II (5 hrs)

1. Applications of Biotechnology **(5** hrs)

   a. Medicine - Production of human insulin, human growth hormone and
   b. Forensics - DNA finger printing.
   c. Agriculture -Genetically modified crops –Bt crops, Golden rice, Flavr Savr Tomato, Virus, herbicide resistant crops, Edible vaccines.
   d. Environment- Bioremediation- use of genetically engineered bacteria-super bug.
   e. Industry- Horticulture and Floriculture Industry, production of vitamins, amino acids and alcohol.

PRACTICAL (BIOTECHNOLOGY)

1. Extraction of DNA from plant tissue.
2. Study of genetic engineering tools and techniques using photographs/diagram (Southern blotting, DNA finger printing, PCR)

REFERENCES (BIOTECHNOLOGY)

1. Brown T.A. (2006) Gene cloning and DNA analysis; Blackwell scientific publishers
2. Chawla H.S. (2000) Introduction to Plant Biotechnology
3. Das, H.K. (Ed) (2005). Text book of Biotechnology (2nd ed) Wiley India (Pvt.), Ltd. New Delhi.
4. Gupta, P.K. (1996) Elementary Biotechnology. Rastogi & Company, Meerut.
5. Hammond, J., Megary, P *et al. (*2000) Plant Biotechnology. Springer Verlag.
6. Ignacimuthu S. (1997) Plant Biotechnology, New Hampshire Science Publishers
7. Lewin B. (2004) Genes VIII. Oxford University Press
8. Purohit S.S. (2003) Agricultural Biotechnology, Agrobios (India)
9. Sobti R.C. & Pachauri S.S. (2009) Essentials of Biotechnology; Ane Books, New Delhi.

MOLECULAR BIOLOGY

1. Nucleic acids - DNA– the genetic material; the discovery of DNA as the genetic material; bacterial transformation (Griffith's & Avery's experiments); Hershey and Chase experiment; Structure of DNA, Watson & Crick's Model, Types of DNA- (A,B,Z); Replication: semi conservative replication–Meselson and Stahl's experiment; Molecular mechanism of Replication, RNA- structure, types and properties. (**6** hrs)
2. Gene action - One gene - one enzyme hypothesis, one cistron one polypeptide hypothesis; concept of colinearity; modern concept of gene- cistrons, recons and mutons (**2** hrs)
3. Genetic code - Characters of genetic code (**2** hrs)
4. Central dogma protein synthesis; Transcription, post-transcriptional modification of RNA, translation; Teminism. (**3** hrs)
5. Gene regulation in prokaryotes - operon concept, (Lac operon, trp. operon) (**1** hr)
6. Gene regulation in eukaryotes (brief account) (**1** hr)
7. Mutation-spontaneous and induced; causes and consequences. Types of mutagens and their effects. Point mutations- molecular mechanism of mutation-Transition, Transversion and substitution (**3** hrs)

SUBMISSION (MOLECULAR BIOLOGY)

Visit a research station with well-equipped Biotechnology / Molecular biology lab and submit a duly certified detailed report of the same during the practical examination.

REFERENCES (MOLECULAR BIOLOGY)

1. Brown T A. (2003) Genomes. John Willey and Sons.
2. Hawkins, J D. (1996) Gene Structure and Expression. Cambridge University Press
3. Lewin Benjamin. (2017) Gene XII. Oxford University Press
4. Malathi, V. (2010). Essentials of Molecular Biology, Pearson Education Inc.
5. Russell, P. J. (2010). Genetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
6. Waseem Ahmad, (2009). Genetics and Genomics. Pearson Education Inc.
7. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York. 6th edition.

BIOINFORMATICS

Module-I (**3** hrs)

1. IT in teaching, learning and research: Web page designing and web hosting. Academic web sites, e-journals, Open access initiatives and open access publishing, education software, academic services - INFLIBNET, NICNET, BRNET.
2. E-wastes and green computing.
3. Futuristic IT - Artificial intelligence, virtual reality, bio-computing.

Module- II (5 hrs)

1. Introduction to Bioinformatics, brief history, scope and relevance, wet lab to web lab
2. Basics of Genomics, Proteomics and comparative genomics
3. Biological data bases:
   Nucleotide sequence database – EMBL, Gen Bank, DDBJ.
   Protein database – SwissProt, PDB.
   Organismal database /Biodiversity database – Species 2000 /Human genome database
4. Information retrieval from Biological database, sequence alignment types and tools: pair wise sequence alignment, multiple sequence alignment, BLAST, Clustal W.

Module- III (6 hrs)

1. Genomics: DNA sequencing, Sangers procedure, automation of DNA sequencing, genome sequence assembly.
2. Genome projects – Major findings and relevance of the following genome projects – Human, *Arabidopsis thaliana*, Rice, *Haemophilus influenza*.
3. Proteomics: Protein sequencing- automation of sequencing, protein structure prediction and modelling (Brief account only)

Module- IV (4 hrs)

A brief account on

1. Molecular phylogeny and phylogenetic trees.
2. Molecular visualization – use of Rasmol.
3. Molecular docking and computer aided drug design.

PRACTICAL (BIOINFORMATICS)

1. Familiarizing with the different data bases mentioned in the syllabus.
2. Molecular visualization using Rasmol.
3. Blast search of nucleotide sequences.

REFERENCE (BIOINFORMATICS)

1. Jin Xiong (2006): Essential Bioinformatics, Cambridge University Press, Replika Press Pvt. Ltd.
2. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
3. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
4. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

MODEL QUESTION PAPER

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE- 11

SJBOT6B11: BIOTECHNOLOGY, MOLECULAR BIOLOGY & BIOINFORMATICS

TIME: 2 Hrs **Max. Marks 60**

SECTION A

(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Write a short note on Bioremediation.
2. Explain the relevance of Flavr Savr tomato.
3. Define Protein databases and highlight the relevance of any one.
4. What are the different types of gene banks?
5. Explain one-gene one-enzyme hypothesis.
6. What are point mutations?
7. Give a short note on pBR322.
8. What are the highlights of Semi-conservative replication?
9. Explain Teminism.
10. Write a note on the future of AI.
11. Define and explain the importance of any one of the Genome projects.
12. What is the importance of ClustalW?

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Describe the different gene transfer methods.
14. Explain the process of rDNA synthesis.
15. Explain the various Open access initiatives and discuss the advantages of these.
16. Describe the characteristics of a Genetic Code.
17. How would you differentiate genomics and Proteomics?
18. Explain the various DNA sequencing methods.
19. Explain the process of gene regulation and expression in *lac* operon.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Explain the principle, topology, types and importance of phylogenetic trees.
21. Describe how Biotechnology has been applied for human welfare.

Course Code: SJBOT6B12

Name of the Course: PLANT PHYSIOLOGY AND METABOLISM

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Identify the physiological responses of plants.	1	A	C	8	6
CO2	Analyze the role of external factors in controlling the physiology of plants.	2 & 3	Z	P	16	10
CO3	Explain the metabolic processes taking place in each cell.	3	R	C	15	10
CO4	Appreciate the energy fixing and energy releasing processes taking place in cells.	1 & 4	U	C	15	10

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Module 1	9	36	45
2	Module II	6		6
3	Module 1II	15		15
4	Module 1V	9		9
5	Module V	15		15
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Mod. 1	Mod. I1	Mod. I1I	Mod. IV	Mod. V	Total
2 marks (total 12)	2	2	3	2	3	Ceiling 20
5 marks (total 7)	1	1	2	1	2	Ceiling 30
10 marks (total 2)	2					1x10 = 10
TOTAL						**60**

Module - 1.

1. Plant cell and Water. Water as a solvent, cohesion and adhesion. Diffusion, osmosis, imbibition, plant cell as an osmotic system, osmotic pressure, osmotic potential, turgor pressure, wall pressure, water potential and its components (**4** hrs)
2. Transpiration. Types and process. Mechanism of guard cell movement. K^+ ion mechanism. Why transpiration? Antitranspirants. (**3** hrs)
3. Absorption of water by transpiration pull and cohesion of water molecules. Radial movement of water through root. Soil-plant-atmosphere continuum of water. (**2** hrs)

Module-II

1. The ascent of sap; Transpiration pull and cohesion of water molecules. Merits and demerits of cohesion-tension theory. (**2** hrs)
2. Plants and inorganic nutrients. Macro and Micro nutrients. Uptake of mineral elements. Difference between passive uptake and active uptake. Simple and facilitated diffusion. Active uptake. Carrier concept. Evidences. (**4** hrs)

Module - III

1. Photosynthesis in higher plants: Photosynthetic apparatus. Electromagnetic radiation. Absorption of light. Fluorescence and phosphorescene. Organization of light harvesting antenna pigments. Photochemical and chemical phases of photosynthesis and its evidences. Red drop and Emerson enhancement effect. Two pigment systems, components. Photosynthetic electron transport and photophosphorylation. Assimilatory powers- ATP and NADPH. Photosynthetic carbon reduction cycle (PCR), RUBISCO, C3, C4, and CAM pathways. Ecological significance of C4, and CAM metabolism. Photorespiration. (**8** hrs)
2. Biological nitrogen fixation, symbiotic nitrogen fixation in leguminous plants. Biochemistry of Nitrogen fixation, Ammonia assimilation, assimilation of nitrate. Biosynthesis of amino acids. (**4** hrs)
3. Translocation and distribution of photo assimilates. Mechanism of phloem transport. Phloem loading and unloading; pressure flow hypothesis. (**3** hrs)

Module - IV

1. Plant growth and development. Auxins, gibberellins, cytokinins, abscisic acid and ethylene, their physiological roles. Photoperiodism and vernalization. (**3** hrs)
2. Plant movements- phototropism, gravitropism. nyctinastic and seismonatic movements. (**3** hrs)
3. Photomorphogenesis: Phytochrome: chemistry and physiological effects. (**2** hrs)
4. Seed dormancy and germination. (**1** hr)

Module – V

1. Intermediary metabolism: anabolism, catabolism, amphibolic pathways and anapleurotic reactions. (**3** hrs)
2. Catabolism of hexoses. Glycolysis: Two phases of glycolysis. Overall balance sheet. Fate of pyruvate under aerobic and anaerobic conditions. Citric acid cycle: Formation of acetate, Reaction of citric acid cycle, Anapleurotic reactions of citric acid cycle. Amphibolic nature of citric acid cycle. (**5** hrs)
3. Oxidation of fatty acids. β oxidation of saturated fatty acids in plants. (**2** hrs)
4. Oxidative phosphorylation: Electron transport reactions in mitochondrion. Electron carriers, redox potential, electron carriers functioning as multienzyme complexes, ATP synthesis. Chemiosmotic hypothesis, cyanide-resistant respiration, factors affecting respiration. (**5** hrs)

PRACTICAL

Students should familiarize experiments and details must be recorded. (Drawing not required)

1. Fruit ripening/Rooting from cuttings (Demonstration only).
2. Relation between water absorption and transpiration.
3. Separation of leaf pigments by paper chromatography/ column chromatography /TLC.
5. Effects of light intensity on photosynthesis by Wilmot's bubbler.
4. Thistle funnel osmoscope
5. Ganong's Potometer
6. Ganong's light-screen
7. Ganong's respirometer
8. Kuhne's fermentation vessel
9. Mohl's half-leaf experiment
10. Absorbotranspirometer
11. Demonstration of gravitropism using Klinostat.

REFERENCES

1. Frank B. Salisbury and Cleon W. Ross (2002). Plant Physiology 3rd edition. CBS publishers and distributers.
2. Noggle G. R and.Fritz G J (1983) Introductory Plant Physiology Prentice Hall.
3. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.
4. Hopkins WG (1999). Introduction to Plant Physiology, 2nd edition, John Wiley A Sons,

Inc. U.S.A. 4th edition
5. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons.
6. Lincoln Taiz and Eduardo Zeiger (2002). Plant Physiology 2nd edition. Sinauer Associates, Inc. Publishers. Sunderland, Massachusetts
7. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A. (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.

MODEL QUESTION PAPER

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
CORE COURSE - 12
SJBOT6B12: PLANT PHYSIOLOGY AND METABOLISM

TIME: 2 Hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Describe facilitated diffusion.
2. What are antitranspirants? Give examples.
3. Outline the energy yielding steps in glycolysis
4. Differentiate between osmosis and diffusion.
5. Give an account of Ascent of sap.
6. Discuss the role of electron carriers in electron transport chain.
7. Difference between active and passive uptake of mineral ions.
8. What is RUBISCO? What is its importance?
9. Discuss the importance of assimilatory power.
10. Give an account of physiological role of abscisic acid.
11. Comment on fatty acid synthase enzyme complex.
12. Define photosystem. Add a note on is significance.

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Critically analyse the significance of photorespitration.
14. Describe the significance of HMP pathway.
15. What is water potential? Explain its components
16. Explain transpiration pull theory. Comment on its merits and demerits
17. Examine the special photosynthetic pathway that helps xerophytic plants to survive in desert condition.
18. Summarise the biological nitrogen fixation in leguminous plants.
19. Phytochromes are the key photomorhogenic pigment in a plant system. Justify.

SECTION C
(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Describe the pathway and significance of β oxidation of fatty acids.
21. Explain Photosynthetic electron transport and photophosphorylation.

Course Code: SJBOT6B13

Name of the Course: ENVIRONMENTAL SCIENCE

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Realize the importance of ecological studies.	3 & 2	U	C	10	8
CO2	Develop environmental concern in all their actions and practice Reduce, Reuse and Recycle.	2	A	C	10	8
CO3	Try to reduce pollution and environmental hazards and change their attitude towards throwing away plastic wastes.	2 & 3	A	P	10	8
CO4	Spread awareness of the need of conservation of biodiversity and natural resources.	2 & 3	A	C	10	8
CO5	Analyze the reasons for climate change and find out ways to combat it.	2 & 3	Z	C	14	4

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Module 1	14	9	25
2	Module II	13	9	16
3	Module II1	14	9	25
4	Module 1V	13	9	24
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Module 1	Module 1I	Module 111	Module 1V	Total
2 marks (total 12)	3	3	3	3	Ceiling 20
5 marks (total 7)	2	2	2	1	Ceiling 30
10 marks (total 2)	2				1x10 = 10
TOTAL					**60**

ENVIRONMENTAL SCIENCE

Module - I

1. Ecosystem: Definition, abiotic and biotic factors, trophic structure, Food chain and food web, Ecological pyramids, Energy flow, Productivity of ecosystems. (**4** hrs)
2. Biogeochemical cycles (Carbon, Nitrogen, Phosphorous) (**3** hrs)
3. Plant adaptations: Adaptations in Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites. (**3** hrs)
4. Plant Succession: Definition – Primary and Secondary succession; Autogenic and allogenic succession; Mechanism of plant succession–Xerosere and Hydrosere (**4** hrs)

Module-II

1 Biodiversity and Conservation: Definition; Biodiversity - Global and Indian Scenario; Megadiversity nations and hotspots: Biosphere reserves; Biodiversity centres in India.

(**5** hrs)

2 Threats to biodiversity; Endangered and endemic plant species, Red data book, Exotic and indigenous plant species, Keystone species, Flagship species, Umbrella species, Indicator species. (**4** hrs)

3 Conservation strategies *ex situ* and *in situ* methods. Organizations– IUCN, UNEP & WWF; (NBPGR), Kerala state Biodiversity Board (KSBB). (**4** hrs)

Module-III

1 Pollution: Sources and types of pollution – air, water, soil, thermal and noise; biodegradable and non-biodegradable pollutants; biomagnification; BOD. (**4**

hrs)

2 Global environmental changes – climatic changes – global warming and greenhouse gases, acid rains, el-nino, efforts of world organizations in the regulation of greenhouse gases emission. (**5** hrs)

3 Management of environmental pollution – conventional and phytotechnological approaches – solid wastes management including e-wastes- environmental legislations in India (Prevention and Control of Pollution act, 1981). Composting techniques: open air composting (hot composting), Direct composting (in – ground composting), tumbler composting, worm farm composting (**5** hrs)

Module- IV

1 Major ecosystems of the Biosphere; Sea; Estuarine ecosystem; Lentic ecosystem: lake, Pond; Lotic ecosystem: river; Desert; Forest; Grass land. (**5** hrs)

2 Techniques in plant community studies – Quadrat and transect methods– species area curve– density, frequency, abundance, dominance of populations– importance value index – construction of phytographs. (**8** hrs)

PRACTICAL

1. Construct a food web from the given set of data, (Representative of a natural ecosystem). (Drawing not required).
2. Construct ecological pyramids of number, biomass and energy from the given set of data (Representative of a natural ecosystem). (Drawing not required).
3. Study of plant communities: Determination of density, abundance, dominance, frequency by quadrat method.
4. Demonstration of determination of Dissolved Oxygen by Winkler's method.
5. Study of morphological and anatomical characteristics of plant groups: Hydrophytes, Xerophytes, halophytes, epiphytes, parasites. (Drawing not required).

REFERENCES

1. Beeby A. & Brennan A.M. (2004) First Ecology. Ecological Principles and Environmental Issues. Oxford University Press.
2. Cunninghan W.P. and M.A. Cunningham (2003). Principles of Environmental Science: Inquiry and Applications. Tata McGraw Hill Pub. N.D.
3. Dash M.C. (1993). Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd. New Delhi.
4. Dix J.H. (1989). Environmental Pollution. Atmosphere, Land, Water and Noise. Wiley Chichester.

5. Khitoliya R.K. (2007). Environmental Pollution – Management and Control for Sustainable development S. Chand and Company Ltd., New Delhi.
6. Mishra D.D (2008). Fundamental Concepts in Environmental Studies. S. Chand & Co., New Delhi.
7. Mishra S.P. & S.N. Pandey (2008). Essential Environmental Studies. Ane Books Pvt. Ltd. Thiruvananthapuram.
8. Odum E.P. (1983). Basics of Ecology. Saunders International UN Edition.
9. Shukla R.S. & P.S. Chandel (2005). A Text Book of Plant Ecology S. Chand & Co. Ltd. New Delhi.
10. Wise, D.L.(2005) Global Environmental Biotechnology. Ane Books. Thiruvananhapuram.
11. Bharucha E. (2005) Text Book of Environmental Studies for UG courses. University Press (India) Private Limited Hyderabad.
12. Diamond, J., T.J. Case (1986). Community ecology. Harper & Row, New York.
13. Futuyma P.J., Slatkin M. (1983) Co-evolution. Sinauer Associates, Sunderland Mass.
14. Krebs, C.J. (1985). Ecology 3rd edn. Harper & Row New York.
15. Sharma, P.D. (2008-2009). Ecology and Environment. Rastogi Publication.
16. Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.

MODEL QUESTION PAPER

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
CORE COURSE – 13
SJBOT6B13: ENVIRONMENTAL SCIENCE

TIME: 2 Hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Give an account of the biological factors of an ecosystem.
2. Describe he morphological adaptations in epiphytes.
3. What are biogeochemical cycles? Give an example.
4. Comment on biodiversity hotspots.
5. What is a flagship species?
6. Discuss the role of IUCN in biodiversity conservation.
7. Analyze the impacts of water pollution.
8. Give critical analysis of global warming and greenhouse gases
9. Define biomagnificaion and explain is biological significance.
10. Write short note on importance value index.
11. Describe he ecological significance of estuarine ecosystem.
12. What is meant by dominance of populations

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Discuss he ecological relevance of Grass lands.
14. Discuss e-waste accumulation. Suggest methods to manage this.
15. What is el-nino?
16. Discuss *ex situ* and *in situ* methods of conservation.
17. What is mean by Red data book?
18. Describe Energy flow in an ecosystem.
19. Discuss the anatomical adaptations in hydrophytes

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Discuss the strategies of solid waste management.
21. Give a detailed account of the process and mechanism of ecological succession.

ELECTIVE PAPERS

Course Code: SJBOT6B14 (1)

Name of the Course: ELECTIVE-1: GENETIC ENGINEERING

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Appreciate various techniques employed in genetic engineering.	3	U	C	14	10
CO2	Develop general awareness on genetically modified organisms.	3 & 4	R	C	20	13
CO3	Understand the ethical, social and legal issues associated with genetic engineering.	3 & 4	U	C	20	13

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Module 1	12	36	48
2	Module II	15		15
3	Module II1	15		15
4	Module 1V	12		12
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN

Type of questions	No of questions	Total marks
2 marks	12	Ceiling 20
5 marks	7	Ceiling 30
10 marks	2	1x10 = 10
TOTAL	**21**	**60**

GENETIC ENGINEERING

Module -I

Introduction to gene cloning (**12** hrs)

1. DNA isolation; DNA isolation solutions, isolation buffer pH, concentration and ionic strength, DNase inhibitors, detergents used for isolation, methods for breaking the cells
2. Removal of proteins from cell homogenate; using organic solvents, Kirby method and Marmur method, using CTAB
3. Removal of RNA; using RNase A, RNase T1
4. Concentrating the isolated DNA; precipitating with alcohols, salts added along with alcohol
5. Determination of the concentration and purity of DNA; using UV spectrophotometry
6. Storage of DNA samples
7. Commercially available kits for genomic and plasmid DNA isolation

8. Preparation of genomic DNA from animal cells, plant cells and bacterial cells; protocol for small scale and large scale preparations
9. Isolation of plasmid DNA; protocol for small scale and large scale preparations
10. Isolation and purification of RNA; purification of total RNA, RNase inhibitors, preparation of cell material, preparation of glass wares, guanidinium hot phenol method, high salt lithium chloride method, isolation of poly A RNA

Module-II

Agarose Gel electrophoresis of DNA and RNA (**15** hrs)

1. Principles of electrophoresis,
2. Buffers used for electrophoresis of nucleic acids,
3. Gel concentration, sample concentration, sample loading solutions,
4. Gel staining,
5. Determination of molecular weight using molecular weight markers, special precautions and treatments required for electrophoresis of RNA, Elution of DNA from agarose gels; electroelution, using low-melting point agarose.
6. Nucleic acid transfer and hybridization; Southern blot transfer, dot-blot transfer, plaque and colony transfer, Southern blot hybridization, Northern blot transfer and hybridization, in situ hybridization
7. Preparation of probes for hybridization, radioactive labeling, digoxigenin labeling, nick translation, preparation of primer using PCR, RNA probes

Module - III

Principle of DNA cloning (**12** hrs)

1. Cloning vectors; essential features of a cloning vector, plasmid derived vectors, bacteriophage derived vectors, hybrid vectors, high capacity cloning vectors; BACs, PACs and YACs, Agrobacterium based vectors, shuttle vectors, expression vectors
2. Enzymes used in recombinant DNA technology; type II restriction endonucleases, ligases, S1 nuclease, alkaline phosphatase, terminal transferase, DNA polymerase I, reverse transcriptase, exonuclease III, bacteriophages λ exonuclease,
3. Finding gene of interest; shot gun cloning followed by screening, construction and use of genomic DNA library and cDNA library, screening DNA libraries, chromosome walking, in silico gene discovery, cloning of the gene of interest, altering the gene of interest through site directed mutagenesis,
4. Preparation of recombinant DNA molecule, blunt ends and sticky ends, using tailing method, using polylinkers
5. Methods to transfer the recombinant DNA molecule into the cloning host; transformation, transfection, transduction, electroporation, microinjection, microprojectiles and DNA gun, Agrobacterium mediated transfer
6. Methods to select the recombinants; antibiotic markers, insertional inactivation, replica plating, blue-white selection, use of reporter genes; GUS, luciferase and GFP genes

Module -IV

Transgenesis; introduction to transgenic organisms and their applications (**15** hrs)

1. Mechanism of gene transfer into eukaryotic cells, transfection methods; using polyethelene glycol, chemical transfection using lithium acetate, calcium phosphate, and DEAE-dextran, lipofection, electroporation, microinjection, DNA gun, fate of DNA transferred to eukaryotic cells, random integration transgenesis – gain of function effects and loss of function effects, gene targeting,
2. Examples of transgenic crop plants and animals
3. Antisense and RNAi technology
4. Production of knock out models and their use
5. Applications of recombinant DNA technology
6. Ethical, Social and legal issues associated with recombinant DNA technology

PRACTICAL:

Students should be given sufficient exposure to the experiments listed below either by visiting nearby biotechnology labs or showing video clippings of the same. Centers selecting this elective are supposed to procure the required facilities in the meantime.

Protocols of the listed experiments should be recorded.

1. Isolation of genomic DNA from plants and its quantification and purity checking using spectrophotometric method.
2. Agarose gel electrophoresis of the isolated plant genomic DNA, its visualization and photography.
3. Isolation of plasmid DNA from bacterium, and its quantification and purity checking using spectrophotometric method.
4. Agarose gel electrophoresis of the isolated plasmid DNA, its visualization and photography
5. Preparation of competent *E.coli* cells.
6. Preparation of recombinant plasmids, transformation of *E.coli* and selection of transformants.

Record of the practical works done together with the detailed report of the Biotechnology Laboratory visit should be duly certified and submitted for the valuation at the time of practical examination.

REFERENCES

1. Recombinant DNA , JD Watson, (1992) Scientific American Books
2. Recombinant DNA: genes and genomes – a short course, JD Watson et al., (2006) WH Freeman & Co.
3. Recombinant DNA technology and applications, Alex Prokop et al., (1997) McGraw Hill.
4. Principles of Gene Manipulation: An Introduction to Genetic Engineering, by R.W. Old and B001H6L956 S.B. Primrose, (2000) Blackwell Scientific
5. Molecular Cloning: a Laboratory Manual. Sambrook J, Russel DW & Maniatis T. (2001) Cold Spring Harbour Laboratory Press.

MODEL QUESTION PAPER

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
CORE COURSE – 14
SJBOT6B14: GENETIC ENGINEERING

TIME: 2 hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. How is DNA precipitated after isolation?
2. Distinguish between electroporation and microinjection
3. List out any two GM crops and note down their special feature.
4. Comment on site directed mutagenesis
5. What is CTAB?
6. Define a probe. Mention its use
7. What are reporter genes? Give one example
8. Write critical notes on chromosome walking
9. What is RNase? Mention its use.
10. Mention the buffers used for electrophoresis of nucleic acids?
11. Comment on knock out models
12. Mention two methods adopted for cell lysis

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Give an account on southern blotting
14. Briefly describe RNAi technology
15. Mention the use and procedure of blue white selection
16. How will you alter the gene of interest through site directed mutagenesis
17. Give an account on Agrobacterium mediated gene transfer
18. Comment on Type II Restriction endonuclease, alkaline phosphatase and DNA polymerase I
19. Write a critical note on ethical and social issues associated with rDNA technology

SECTION C
(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Write an account on vectors used in genetic engineering
21. Give a detailed account on construction and use of genomic DNA library and cDNA library.

Course Code: SJBOT6B14 (2)

Name of the Course: ELECTIVE-2: ADVANCED ANGIOSPERM SYSTEMATICS

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Develop deep knowledge in angiosperm systematics.	1	R	C	15	10
CO2	Demonstrate ability to identify and classify plants in a faster and better way.	1 & 4	A	P	24	16
CO3	Apply imaging technologies in plant systematics.	4	A	P	15	10

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Module 1	12	36	48
2	Module II	22		22
3	Module II1	5		5
4	Module 1V	15		15
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN

Type of questions	No of questions	Total marks
2 marks	12	Ceiling 20
5 marks	7	Ceiling 30
10 marks	2	1x10 = 10
Total	**21**	**60**

ADVANCED ANGIOSPERM SYSTEMATICS

Module -I

1. Scope and importance of Taxonomy. (**2** hrs)
2. The history of taxonomy- Ancient classification; Evolution of different concepts in taxonomy. The herbalists; Early taxonomists; Linnaeus; Post Linnaean natural systems; Post Darwinian phylogenic; Modern Phenetic methods (Numerical taxonomy); Modern Phylogenic methods (Cladistics). APG system of classification (**10** hrs)

Module-II

The material basis of Systematics

1. Concept of character; Correlation of characters; character weighting; Character variation, isolation and speciation. (**4** hrs)
2. Sources of Taxonomic characters: Morphology, Anatomy, Palynology, Embryology, Cytology, Phytochemistry, Molecular Taxonomy. Role of the above mentioned branches in taxonomic studies (**6** hrs)

3. Identification techniques: Taxonomic literature: Flora, Revision, monograph, use and construction of taxonomic keys. Herbarium: Definition, Steps involved in preparation and maintenance of herbarium, Herbarium consultation; General account of Regional and National herbaria with special emphasis to Kew, CAL, MH, CALI. (**5** hrs)
4. Botanic gardens and their importance in taxonomic studies – Important National and International Botanic Gardens – Royal Botanic Gardens, Kew; Indian Botanic Gardens, Calcutta; National Botanic Garden, Lucknow; JNTBGRI Thiruvananthapuram; MBGIPS Kozhikode. (**3** hrs)
5. Digital resources in taxonomy: Softwares, Databases, Online tools; use of TROPICOS, IPNI, Virtual herbaria, Digital flora/databases of Flora of Kerala. (**4** hrs)

Module – III

Plant Nomenclature (**5** hrs)

1. History of nomenclature – Polynomial and binomial systems
2. Brief outline of ICN
3. Major rules; Typification; Rule of priority; Effective and valid publication; author citation

Module – IV

Taxonomic review of selected families (**15** hrs)

Critical study of the following families with emphasis on identification of local members, economic importance, inter relationships and evolutionary trends: Nymphaceae, Capparidaceae, Sterculiaceae, Rutaceae, Combretaceae, Lythraceae, Scrophulariaceae, Convolvulaceae, Bignoniaceae, Asclepiadaceae, Verbenaceae, Amaranthaceae, Urticaceae, Amaryllidaceae, Arecaceae, Cyperaceae

PRACTICAL:

1. Identification of locally available plants belonging to the families mentioned under module - IV using local Floras.
2. Familiarize local flora and study the preparation of taxonomic keys and taxon card for plants coming under the families in module IV.
3. Students must workout at least one member of the every families mentioned in module IV, and has to submit a photo album instead of record. The photo album should carry details like systematic position, GPS location, date, name and reg. no. of the student etc. Habitat, habit, inflorescence, single flower etc. should be represented. Web sourced or outsourced images should not be used. Individuality should be strictly maintained while preparing the photo album.

REFERENCES

1. Gurucharan Singh, (2012) Plant Systematics - Theory and Practice. Oxford & IBH, New Delhi.
2. Henry & Chandrabose.(1997) An aid to International code of Botanical Nomenclature.

BSI.
3. Heywood, V H & Moore, D M. (Eds) (1984) Current concepts in Plant Taxonomy
4. Lawrance, G H M. Taxonomy of vascular plants. Oxford & IBH
5. Mondal A.K. (2009) Advanced Plant Taxonomy, New Central Book agency Pvt. Ltd. Kolkata.
6. Nicholas J. Turland *e al*. (2018) International Code of Nomenclature for algae, fungi, and plants- Shenzhen Code (printed/ electronic version) Koeltz Botanical Books.
7. Pandey, S.N. & S.P. Misra. (2008) Taxonomy of Angiosperms. Ane Books India, New Delhi.
8. Simpson, M.G. (2006) Plant Systematics. Elsevier Academic Press, London
9. Singh, V & D K Jain. (1997) Taxonomy of Angiosperms. Rastogi Publications, Meerut.
10. Sivarajan, V. V. (1991) Introduction to principles of plant Taxonomy. Oxford & IBH.
11. Stace, C A. (1989). Plant Taxonomy and Biosystematics. Edward Arnold, London
12. Vasishta, P C. Taxonomy of Angiosperms. R. Chand & Co. New Delhi.

MODEL QUESTION PAPER

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
CORE COURSE – 14
SJBOT6B14: ADVANCED ANGIOSPERM SYTEMATICS

TIME: 2 hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. What is meant by acronym?
2. Define tautonym. Give an example.
3. Write notes on taxonomic indices.
4. Describe obdiplostemony. Give an example.
5. Write short notes on herbalists.
6. Explain virtual herbarium.
7. Enumerate the primitive traits of Nymphaeceae
8. What is mean by effective publication?
9. Explain character correlation.
10. What are the identifying features of Amaranthaceae?
11. Explain the Rule of priority.
12. Write short note on DNA Barcoding.

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Differentiate cladistics and phenetics.

14. Give an account of five major databases used in Taxonomic studies.
15. What is meant by character weighing?
16. Explain how phytochemical evidences are utilized in Taxonomy?
17. Give an account of five major herbaria in India.
18. Differentiate Bignoniaceae and Verbenaceae
19. Enumerate the characteristic features of the family Arecaceae giving special emphasis on its economic value.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Give the structure of ICN. What is typification? Explain the various types used in plant nomenclature
21. What are botanic gardens? Explain the role of botanic gardens and enumerate the major botanical gardens in India.

Course Code: SJBOT6B14 (3)

Name of the Course: ELECTIVE-3: GENETICS AND CROP IMPROVEMENT

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand various techniques employed for increasing crop productivity.	4	U	C	12	10
CO2	Identify diseases affecting crop plants.	4	A	C & P	12	10
CO3	Attain general awareness on various crop research stations of the country.	3 & 4	R	C	30	16

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Module 1	11	36	47
2	Module II	10		10
3	Module 1II	4		4
4	Module 1V	7		7
5	Module V	22		22
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN

Type of questions	No of questions	Total marks
2 marks	12	Ceiling 20
5 marks	7	Ceiling 30
10 marks	2	1x10 = 10
Total	**21**	**60**

GENETICS AND CROP IMPROVEMENT

Module -1.

Crop genetics - General account of origin, genetic variability, floral biology, breeding techniques and achievements in: Rice, Coconut, Rubber, Arecanut, Cashew and Pepper. (**11** hrs)

Module –II

1. Plant genetic resources- Definition; Classification of Plant Genetic resources. Activities– exploration, conservation, evaluation, documentation and utilization. (**2** hrs)
2. Agencies involved in plant genetic resources activities – NBPGR and IPGRI (**4** hrs)
3. International institutes for crop improvement – IRRI, ICRISAT,CIMMYT, IITA. Brief account on research activities and achievements of national institutes – IARI, CCMB, IISc, BARC, CPCRI, IISR, RRII, CTCRI, KFRI, JNTBGRI. (**4** hrs)

Module- III

1. Methods of crop Improvement (**4** hrs)

1.Plant introduction

2.Selection - Principles, Selection of segregating populations, achievements

3. Hybridization – Interspecific hybridization; intergeneric – achievements. Genetics of back crossing, Inbreeding, Inbreeding depression, Heterosis and Heterobeltiosis

Module - IV.

1 Heteroploidy in crop improvement – achievements and future prospects – Significance of haploids and polyploids (**2** hrs)

2 Mutations in crop improvement – achievements and future prospects (**2** hrs)

3 Genetics of nitrogen fixation – Use of biofertilizers in crop improvement (**2** hrs)

4 Genetics of photosynthesis (**1** hr)

Module- V.

1. Breeding for resistance to abiotic stresses – Introduction, importance of abiotic and biotic stresses and its characteristics. (**10** hrs)

   1. Breeding for drought resistance: Genetics of drought resistance; Breeding methods and approaches; Difficulties in breeding for drought resistance.
   2. Breeding for mineral stress resistance: Introduction, Salt affected soils, Management of salt affected soils: Salinity resistance –general account.

2. Breeding for resistance to biotic stresses. (**12** hrs)

   1. Disease resistance – History of breeding for disease resistance; Genetics of pathogenicity – Vertical and horizontal resistance; Mechanism of disease resistance; Genetics of disease resistance – Oligogenic, polygenic and cytoplasmic inheritance – Sources of disease resistance – Methods of breeding for disease resistance.
   2. Insect resistance – Introduction, Mechanism, Nature and genetics of insect resistance,

Oligogenic, Polygenic and cytoplasmic resistance, sources of insect resistance, Breeding methods for insect resistance, Problems in breeding for insect resistance, Achievements, Breeding for resistance to parasitic weeds.

PRACTICAL

1. Visit a leading breeding station in South India and a detailed report should be included in the practical record. The record duly certified by HoD should be submitted at the time of practical examination.
2. Make illustrations on the floral biology of Rice, Cashew and *Solanum* spp.
3. Demonstration of hybridization in Rice, Cashew and *Solanum* and describe the procedure.
4. Study the variability under induced stress (salinity and moisture) of seedlings of rice and green gram and record the observations.

REFERENCES

2 Singh, B D. (2000) Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
3 Sharma, J R. (1994) Principles and Practice of Plant Breeding. Tata Mcgraw – Hill Publishing Company, New Delhi.
4 Benjamin Levin. (2007) Genes VIII.
5 Allard, R W. (1960) Principles of Plant Breeding. John Wiely & Sons, New York.
6 Chahal, G S & S S Gosal, (1994) Principles and procedures of Plant Breeding. Narosa Publishing House, New Delhi.
7 Chrispeels M J and Sadava, D E. (1994) Plants, Genes and Agriculture. Jones and Bartlet Publishers, Boston, USA.

MODEL QUESTION PAPER

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
CORE COURSE – 14
SJBOT6B14: GENETICS AND CROPIMPROVEMENT

TIME: 2 hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Write a note on the origin of Pepper.
2. Expand NPBGR and add a note on its activities.
3. What are *nif* genes?
4. Mention the importance of making saline tolerant crops.
5. Give an account of biopesticides.

6. What are the causes of abiotic stress in plants?
7. Differentiate between vertical and horizontal resistance.
8. Expand ICRISAT and add a note on its activities.
9. What are the methods adopted for emasculation.
10. Write a note on the achievements on rice breeding programmes.
11. Define plant introduction and explain its relevance.
12. Explain the role of somaclonal variations in crop improvement.

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Explain the genetics of chloroplast.
14. Write briefly on selection as a method of crop improvement.
15. What is the role of IISR in pepper breeding?
16. Describe the breeding techniques and achievements in Coconut.
17. What is the role of IISc in plant research and development?
18. Give an account on the exploration and documentation of plant genetic resources.
19. Explain the genetics of salt tolerance.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Write an essay on mutation breeding. Comment on its major advantages over the other methods of breeding
21. Explain different types of hybridization and the steps involved the process.

Course Code: SJBOT6B15

Name of the Course: B.Sc. BOTANY CORE PRACTICAL EXAMINATION Paper – II

B.Sc. BOTANY CORE PRACTICAL EXAMINATION

Paper – II : SJBOT6B15

(Gymnosperms, Palaeobotany, Phytogeography, Angiosperm Morphology, Systematics, Tissue culture, Horticulture, Economic Botany, Ethnobotany Cell Biology & Biochemistry)

Time: 4 Hours **Max: 80 Marks**

1. Prepare T.S. of the given material **A**, draw labeled diagram and identify the specimen
   7 x1 =7 Marks
2. Submit any two stages of mitosis using the given material **B**
   (Preparation-2; Identification-2×2=4; Diagram-1×2=2)
   8 x1 =8 Marks
3. Describe the given taxon **C**, determine the family and list out the salient features
   (Identification-1; Technical description-4; Salient features-3)
   8 x1 =8 Marks
4. Draw a labeled diagram of the V.S. of the flower **D**
   4 x1 =4 Marks
5. Identify the given sample **E** qualitatively
   8 x1 =8 Marks
6. Give the binomial, family and morphology of the following: **F, G & H**
   (Binomial-1; Family-1; Morphology-1)
   3×3 =9 Marks
7. Give the binomial, family and ethnobotanical significance of the following: **I** and **J**
   (Binomial-1; Family-1; Ethnobotanical significance-1)
   3×2 =6 Marks
8. Write down the binomial and family of **K, L, M** and **N**
   (Binomial-1; Family ½)
   1 ½ ×4 =6 Marks
9. Comment on the morphology of the specimen **O** and **P**
   2.5 x 2= 5 Marks
10. Add critical note on the given specimen **Q** and **R**
    1.5 x 2 =3 Marks
11. Spot at sight **S - Z** 8 x 2= 16 Marks

Practical	**: 80 Marks**
Record	**: 15 Marks**
Submission	**: 10 Marks**
Study tour	**: 5 Marks**
Total	**: 110 Marks**

Course Code: SJBOT6B16

Name of the Course: B.Sc. BOTANY CORE PRACTICAL EXAMINATION, Paper – III

B.SC. BOTANY CORE PRACTICAL EXAMINATION

Paper – III: SJBOT6B16

(Genetics, Pl. Breeding, Biotechnology, Molecular Biology, Plant Physiology & Environmental Science)

Time: 4 Hours **Max: 80 Marks**

1. Prepare a unidirectional chromatogram using the given extract **A** and calculate the Rf value of each component 10 x1 = 10marks

2. Workout the genetics problems **B** and **C** 8 +7=15 marks

3. Enumerate aim, procedure and inference of the experiment setup of **D, E** and **F** 3×3 = 9 marks

4. Isolate the DNA from the given sample **G** 10 x1= 10marks

5. Demonstrate hybridization in Specimen **H** 6 x1 = 6 marks

6. Read the Gel from the diagram provided in **I** 5 x 1 =5 marks

7. Find out the ecological group of **J** and add a note on its adaptations 5x1 = 5marks

8. Spot at sights **K – T** 2×10=20 marks

Practical	**: 80 Marks**
Record	**: 10 Marks**
Submission	**: 5 Marks**
Total	**: 95 Marks**
Elective Record	**: 10 Marks**

COMPLEMENTARY COURSES

Course Code: SJBOT1C01

Name of the Course: ANGIOSPERM ANATOMY AND MICROTECHNIQUE

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Explain the types, structure and functions of plant tissues	1 & 5	U	C	6	6
CO2	Explain primary and secondary (normal and anomalous) structures of plant organs.	1 & 5	U	A	10	10
CO3	Identify plant organs by observing anatomical features.	5	A	P	6	6
CO4	Illustrate primary and secondary (normal and anomalous) structures of plant organs.	3 & 5	R	C	6	6
CO5	Apply the histochemical techniques in laboratory works	4	A	P	8	8

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Angiosperm Anatomy	27	30	57
2	Microtechnique	9	6	15
Total		**36**	**36**	**72**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Angiosperm Anatomy	Microtechnique	Total
2 marks (total 12)	9	3	Ceiling 20
5 marks (total 7)	5	2	Ceiling 30
10 marks (total 2)	2		1x10 = 10
TOTAL			**60**

ANGIOSPERM ANATOMY

Module – I (**9** hrs)

1 Tissues - Definition, Kinds - Meristematic & Permanent (**8** hrs)

1. Meristematic tissues - Classification – based on origin & position; Organization of root apex and differentiation of tissue – Histogen theory; Organization of stem apex and differentiation of tissues - Tunica & Corpus theory.
2. Permanent tissues - Definition - classification; Simple tissues (Parenchyma, Collenchyma and Sclerenchyma), Complex tissues (Xylem & Pholem) Secretory tissues - Glandular tissues (Nectaries in *Euphorbia pulcherrima*, Stinging hairs in *Tragia*) Oil glands in *Citrus, Eucalyptus*; Digestive glands in *Nepenthes*; Laticiferous tissues (Non-articulate latex ducts in *Euphorbia* and articulate latex duct – latex vessels in *Hevea*). Hydathodes

2 Vascular bundles – types: conjoint - collateral, bicollateral, concentric and radial. (**1** hr)

Module – II (**6** hrs)

1. Primary structure of dicot and monocot root, dicot and monocot stem and leaf in dicot and monocot (**6** hrs)

Module – III (**12** hrs)

1. Normal secondary thickening in dicot stem (*Vernonia*) (**10** hrs)
   a. Intra stelar thickening: formation of cambial ring, its structure, fusiform and ray initials, storied and non - storied cambium, activity of the cambium, formation and structure of secondary wood, secondary phloem and vascular rays.
   b Extra stelar thickening: formation, structure and activity of the phellogen, formation of periderm in stem and root; bark and lenticel.
   c Growth rings, ring and diffuse porous wood, sapwood and heart wood, tyloses.
   d Normal secondary thickening in dicot root (*Tinospora*)
2 Anomalous secondary growth in *Boerhaavia*. (**2** hrs)

PRACTICAL (ANGIOSPERM ANATOMY)

1 Identity simple and complex tissues and determine the type of vascular bundles using microscope.

2 Make suitable micro preparations to study the anatomy of the following:

A Dicot stem: *Cephalandra Centella* (Primary); *Vernonia* (secondary).

b. Monocot stem: Bamboo

c. Dicot root: Tinospora (young –Primary; mature –Secondary)

d. Monocot root: *Colocasia*,

e. Anomalous secondary growth (*Boerhaavia*).

f. Dicot leaf: *Ixora* and Monocot leaf: grass

REFERENCES: (ANGIOSPERM ANATOMY)

1. Cuttler, EG. 1969. Plant Anatomy - Part I Cells & Tissue. Edward Arnold Ltd., London.
2. Cuttler, E.G. 1971. Plant Anatomy, Part III Organs Edward Arnold Ltd., London.
3. Esau K. 1985. Plant Anatomy (2nd ed.) Wiley Eastern Ltd. New Delhi.
4. Pandey B.P. Plant Anatomy, S. Chand & Co. Delhi.
5. Vasishta P.C. 1974. Plant Anatomy, Pradeep Publication, Jalandhar.
6. Tayal M.S Plant Anatomy. Rastogi Publishers, Meerut.

MICROTECHNIQUE

Module – I (**9** hrs)

1. Microtechnique - Brief Introduction
2. Microscopy: simple, compound and electron microscope
3. Microtomy: Rotary type, serial sectioning, paraffin method, significance.
4. Killing and fixing: Killing and fixing agents and their composition (Farmer's fluid and FAA.)
3. Dehydration and clearing - reagents (mention only)
4. Stains – Saffranin and acetocarmine, preparation and use.

PRACTICAL (MICROTECHNIQUE)

1 Familiarise the structure and working of compound microscope (drawings not required)

2 Preparation of Safranin, FAA and Acetocarmine

REFERENCES (MICROTECHNIQUE)

1. Johansen, D.A. (1940) Plant Microtehnique. Mc Graw – Hill Book Company, Inc. New York.
2. Kanika, S. (2007) Manual of Microbiology – Tools and Techniques. Ane's student edition.
3. Khasim, S.K. (2002) Botanical Microtechnique; principles and Practice, Capital Publishing Company, New Delhi.
4. Toji, T. (2004) Essentials of Botanical Microtechnique. Apex Infotec Publ.

MODEL QUESTION PAPER

FIRST SEMESTER B.Sc. DEGREE PROGRAMME
COMPLEMENTARY COURSE I
SJBOT1C01: ANGIOSPERM ANATOMY AND MICROTECHNIQUE

TIME: 2 hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Differentiate between lateral meristem and intercalary meristem.
2. What is FAA? How is it prepared?
3. Explain Tunica Corpus theory.
4. What is quiescent centre?
5. How do tracheids differ from vessels?
6. What are hydathodes?
7. Explain the structure and function of bulliform cells.
8. What are annual rings? What is its relevance?
9. What are tyloses?
10. Write short note on rotary microtome.
11. Different between protoxylem and metaxylem
12. What is acetocarmine? What is its use?

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Write short note on simple tissues.
14. What are the different types of vascular bundles?
15. Explain the principle and types of electron microscopes.
16. Describe the laticiferous tissues in plants.
17. Explain the structure of a dicot leaf.
18. With a neat labeled diagram, explain the primary structure of monocot root.
19. Explain killing and fixing. Add a note on various agents used for it.

SECTION C
(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. What are permanent tissues? Explain the major classes with their functions.
21. Explain the secondary growth in dicot stem with the help of a diagram.

Course Code: SJBOT2C02

Name of the Course: CRYPTOGAMS, GYMNOSPERMS AND PLANT PATHOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Analyze the role of the lower plants in the process of evolution.	2 & 4	Z	C	13	6
CO2	Explain the ecological significance of lower plants	2	R	C	15	20
CO3	Identify plant diseases and take remedial measures to control them.	3 & 4	A	P	8	10

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Module I: Virus, Bacteria, BGA	9	5	14
2	Module II: Phycology, Mycology, Lichenology	12	13	25
3	Module III: Bryology, Pteridology , Gymnosperms	12	13	25
4	Plant Pathology	3	5	8
Total		**36**	**36**	**72**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Mod 1	Mod II	Mod III	Mod IV	Total marks
2 marks (total 12)	2	4	4	2	Ceiling 20
5 marks (total 7)	2	2	2	1	Ceiling 30
10 marks (total 2)	2				1x10 = 10
TOTAL					**60**

CRYPTOGAMS & GYMNOSPERMS

Module – I : Virus, Bacteria, BGA (9 hrs)

1. Virus: General account of viruses, including structure of TMV & Bacteriophage. (**2** hrs)
2. Bacteria: Classification based on shape of flagella, structure, nutrition (brief account), reproduction and economic importance - agriculture, industry and medicine. (**5** hrs)
3. Cyanobacteria: General Account structure, life - history and economic importance of *Nostoc.* (**2** hrs)

Module – II : Phycology, Mycology, Lichenology (12 hrs)

1. Phycology: General characters, classification, evolutionary trends in algae. (**2** hrs)
2. Structure, reproduction, life history and economic importance of the following classes with suitable examples: (**4** hrs)
   a) Chlorophyceae (*Spirogyra*)
   b) Phaeophyceae (*Sargassum*)
   c) Rhodophyceae (*Polysiphonia*).
3. Mycology: General characters, classification (Alexopoulos, 1979) (brief mention only) and evolutionary trends, economic importance in fungi. (**2** hrs)
4. Important features of the following divisions (brief account only) (**1** hr)
   a) Mastigomycotina
   b) Zyomycotina
   c) Ascomycotina
   d) Basidiomycotina.
5. Structure and life history of *Puccinia* (developmental details not required) (**2** hrs)
6. Lichenology: General account and economic importance of Lichens with special reference to Usn*ea*. (**1** hrs)

Module – III : Bryology, Pteridology , Gymnosperms (12 hrs)

1. Bryology: General account, morphology and life - history of *Riccia* (**4** hrs)
2. Pteridology: General account, morphology and life history of *Selaginella* (**4** hrs)
3. Gymnosperms: General account, morphology and life history of *Cycas* (**4** hrs)

PRACTICAL (CRYPTOGAMS & GYMNOSPERMS)

1. Make suitable micro preparations of vegetative and reproductive structures of *Sargassum*, *Puccinia, Riccia, Selaginella* and *Cycas*
2. Identify and draw labeled diagrams of all the types mentioned in the syllabus

REFERENCES (CRYPTOGAMS & GYMNOSPERMS)

1 Fritsch, F.E. (1935). The structure and reproduction of the algae. Vol. 1 and II, Uni. Press. Cambridge.
2 Morris, I. (1967) An Introduction to the algae. Hutchinson and Co. London.

3 Papenfuss, G.F. (1955) Classification of Algae.
4 B.R. Vasishta. Introduction to Algae
5 Mamatha Rao, (2009) – Microbes and Non-flowering plants. Impact and applications. Ane Books, New Delhi.
6 Sanders, W.B. (2001) Lichen interface between mycology and plant morphology. Bioscience, 51: 1025-1035.
7 B.R. Vasishta. Introduction to Fungi.
8 P.C. Vasishta Introduction to Bryophytes.
9 B.P. Pandey Introduction to Pteridophytes
10 Chamberlain C.J., (1935) Gymnosperms – Structure and Evolution, Chicago University Press.
11 Sreevastava H.N. (1980) A Text Book of Gymnosperms. S. Chand and Co. Ltd., New Delhi.
12 Vasishta P.C. (1980) Gymnosperms. S. Chand and Co., Ltd., New Delhi.

PLANT PATHOLOGY

Module – I (3 hrs)

1. Plant Pathology: Study the following plant diseases with special reference to pathogens, symptoms, method of spreading and control measures.
   1) Leaf mosaic of Tapioca 2) Citrus canker 3) Blast of paddy

PRACTICAL (PLANT PATHOLOGY)

1. Identify the diseases (mentioned in the theory syllabus) on the basis of symptoms and causal organisms. (Drawings can be replaced by photos pasted in the record)

REFERENCES: PLANT PATHOLOGY

1. Agros, G.N. (1997) Plant Pathology (4th ed) Academic Press.
2. Bilgrami K.H. & H.C. Dube. (1976) A textbook of Modern Plant Pathology. International Book Distributing Co. Lucknow.
3. Pandey, B.P. (1999) Plant Pathology. Pathogen and Plant diseases. Chand & Co. New Delhi.

MODEL QUESTION PAPER

FIRST SEMESTER B.Sc. DEGREE PROGRAMME
COMPLEMENTARY COURSE: 2
SJBOT2C02: CRYPTOGAMS, GYMNOSPERMS & PLANT PATHOLOGY

TIME: 2 hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Differentiate between fimbriae and pili.
2. What are plasmids? Mention the different types.
3. Explain the structure of cell wall of bacteria.
4. Give an account of morphology of *Sargassum* thallus.
5. What are heterocysts? Give its function.
6. Briefly explain scalariform conjugation in *Spirogyra*.
7. Comment on the structure and function of ligule in *Selaginella*.
8. Write a short note about the sporogonium of *Riccia*.
9. What are coralloid roots? What is its function?
10. List out the important symptoms of Leaf mosaic disease of Tapioca.
11. Describe vegetative reproduction in bryophytes.
12. Enumerate the important control measures of citrus canker.

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Give an account of the multiplication of bacteriophages
14. Name the pathogen, symptoms and control measures of Blast of Paddy.
15. With the help of a labelled diagram explain the anatomy of *Riccia* thallus.
16. What is the ecological and economic importance of lichens?
17. How are bacteria classified based on flagella? Add a note on bacterial growth.
18. Briefly explain the post fertilization changes in *Polysiphonia.*
19. Write about the sexual reproduction in *Cycas*.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Write an essay on the vegetative, asexual and sexual reproduction of bacteria.
21. With the help of suitable diagrams describe the stages of life cycle of *Puccinia*

Course Code: SJBOT3C03

Name of the Course: MORPHOLOGY, SYSTEMATIC BOTANY, ECONOMIC BOTANY, PLANT BREEDING AND HORTICULTURE

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Appreciate the diverse morphology of angiosperms.	1	R	C	10	8
CO2	Identify and classify plants based on taxonomic principles	1 & 5	U	C	15	10
CO3	Make scientific illustrations of vegetative and reproductive structures of plants	3	R	C	6	8
CO4	Identify the economically important plants	4 & 5	A	P	6	4
CO5	Understand the basic principles of plant breeding	3 & 4	U	C	7	3
CO6	Apply various horticultural practices in the field.	4	A	P	10	3

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Morphology	8	4	12
2	Systematic Botany	28	20	48
3	Economic Botany	4	4	8
4	Plant Breeding	7	4	11
5	Horticulture	7	4	11
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Morphol.	Syst. Bot.	Econ. Bot.	Pl. Br.	Horti.	Total
2 marks (total 12)	2	4	2	2	2	Ceiling 20
5 marks (total 7)	1	3	1	1	1	Ceiling 30
10 marks (total 2)	2					1x10 = 10
TOTAL						**60**

MORPHOLOGY

Module - I

1. Leaf – Structure, simple, compound, venation and phyllotaxy. (**2** hrs)
2. Inflorescence - racemose, cymose , special, types with examples (**3** hrs)
3. Flower - as a modified shoot- structure of flower - floral parts, their arrangement, relative position, cohesion and adhesion of stamens, symmetry of flowers, types of aestivation and placentation. (**3** hrs)

PRACTICAL (MORPHOLOGY)

1. Identify the types of inflorescence mentioned in the syllabus. All the types mentioned must be represented in the photo album. (All drawings in records are replaced by photo album submission).

REFERENCE (MORPHOLOGY)

1 Sporne, K.R. (1974) Morphology of Angiosperms. Hutchinson.

SYSTEMATIC BOTANY

Module- I

1. Introduction, scope and importance (**1** hrs)
2. Herbarium techniques: collection, drying, poisoning, mounting & labeling. Significance of herbaria and botanical gardens; important herbaria and botanical gardens in India. (**3** hrs)
3. Nomenclature - Binomial system of nomenclature, basic rules of nomenclature (validity, effectivity and priority), ICN for algae, fungi and plants. (**4** hrs)
4. Systems of classification - Artificial, Natural of Phylogenetic (Brief account only). Bentham & Hooker's system of classification in detail. (**4** hrs)
5. Modern trends in taxonomy - Chemotaxonomy, Numerical taxonomy and Cytotaxonomy (brief account only) (**4** hrs)
6. Study the following families: Malvaceae, Fabaceae (with sub-families) Rubiaceae, Apocynaceae, Euphorbiaceae and Poaceae. (1**2** hrs)

PRACTICAL (SYSTEMATIC BOTANY)

1. Determine the systematic position of local plants comes under the syllabus based on their vegetative and floral characters
2. Students shall be able to describe the plants in technical terms and draw the L.S. of flower of two plants belong to each family and record the same.
3. Familiarization of herbarium techniques (Demonstration only).
4. Mounting of a properly dried and pressed specimen of any wild plant from any one of the families mentioned in the syllabus, with proper herbarium label (to be submitted in the record book).
5. Students shall submit original images of plants, at least one from each family mentioned in the syllabus duly certified by HoD, at time of examination. Web sourced and outsourced images should not be used. The images of plants should be properly identified and they should carry details like systematic position, GPS location, date, name and register no. of the student etc. Habitat, Habit, Inflorescence and single flower should be represented. The images can be submitted along with the photo album containing images of inflorescence mentioned under morphology. Individuality should be strictly maintained while preparing the photo album.

REFERENCES (SYSTEMATIC BOTANY)

1 Radford, A.E. (1986) Fundamentals of Plant Systematics. Harpor & Row Publishers, New York.
2 Sivarajan, V.V. (1991) Introduction to Principles of Plant Taxonomy. Oxford & IBH, New Delhi.
3 Jeffrey,C. (1968) An introduction to Plant Taxonomy, London
4 Gurucharan Singh, (2001) Plant Systematics. Theory and practice. Oxford & IBH Publications New Delhi.
5 Sharma O.P. (1990) Plant Taxonomy – Tata McGraw Hills. Publishing company Ltd
6 Subramanyam N.S. (1999) Modern Plant Taxonomy. Vikas Publishing House Pvt Ltd.
7 Pandey & Misra. (2008) Taxonomy of Angiosperms. Ane books Pvt Ltd.

ECONOMIC BOTANY

Module –I (**4** hrs)

1 Brief account on the various categories of plants based on their economic importance
2. Study the following plants with special reference to their binomial, family, morphology of the useful part and their uses.
    1. Cereals: Paddy, Wheat
    2. Pulses: Black gram, Green gram
    3. Oil: Coconut, Gingelly

4. Fibre: Cotton
5. Latex: Rubber
6. Beverages : Tea, Coffee
7. Spices: Pepper, Cardamom, Clove
8. Medicinal plants: *Rauvolfia serpentina, Justicia adhatoda, Santalum album* and *Curcuma longa*.

PRACTICAL (ECONOMIC BOTANY)

1 Identify at sight the economically important plant produces and products mentioned in module III, and learn the binomial and family of the source plants, morphology of the useful parts and uses. (Drawing not required)

REFERENCES (ECONOMIC BOTANY)

1. Pandey B. P (1987) - Economic Botany
2. Verma V. (1984) - Economic Botany
3. Hill A.W (1981) - Economic Botany, McGraw Hill Pub

PLANT BREEDING

1. Objectives of plant breeding (**1** hr)

2. Methods of plant breeding: a) Plant introduction b) Selection - Mass, Pure line and clonal, c) Hybridization: intervarietal, interspecific and intergeneric hybridization. d) Mutation breeding e) polyploidy breeding and f) breeding for disease resistance. (**6** hrs)

PRACTICAL (PLANT BREEDING)

1 Demonstration of hybridization technique

REFERENCES (PLANT BREEDING)

1 Allard. R.W. (1960) Principles of Plant breeding, John Wiley & Sons, Inc, New York.
2 Singh, B.D. (2005) Plant Breeding - Principles & methods, Kalyani Publishers, New Delhi.
3 Chaudhari. H.K. Elementary Principles of Plant breeding, Publishers. Oxford & IBH

HORTICULTURE

1. Horticulture- introduction: definition, branches, significance (**1** hr)
2. Methods of plant propagation (**6** hrs)
   a. Seed propagation
   b. Vegetative propagation
      1. Cutting – stem, root, leaf
      2. Layering –air layering
      3. Grafting: Approach grafting, Tongue grafting
      4. Budding: Patch and T-budding

PRACTICAL (HORTICULTURE)

1 Demonstration of layering, grafting and budding References:- Horticulture

2 Text book of Horticulture - K. Manibhushan Rao - Macmillan India Ltd.
3 Introduction to Horticulture – N. Kumar (First Edition, Rajalakshmi Publication, 1996)

MODEL QUESTION PAPER

FIRST SEMESTER B.Sc. DEGREE PROGRAMME
COMPLEMENTARY COURSE: 3
SJBOT3C03: MORPHOLOGY, SYSTEMATIC BOTANY, ECONOMIC BOTANY, PLANT BREEDING AND HORTICULTURE

TIME: 2 hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Differentiate between stock and scion.
2. Write a short note on the inflorescence of Poaceae.
3. Explain the significance of quarantine.
4. What are the advantages of seed propagation?
5. What is aestivation? What are the different types?
6. Name any two chemicals used for the poisoning of specimens.
7. Differentiate between synandrous stamens and syngenecious anthers.
8. Name any two major herbaria in India.
9. Differentiate between numerical taxonomy and chemotaxonomy?
10. Write the binomial and family of clove and turmeric.
11. What are beverages?
12. Describe emasculation. What are the different types of emasculation?

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Expand ICN? What are the major rules of ICN?
14. What are the different types of inflorescences?
15. Write short note on cereals and pulses.
16. Enumerate the characteristic features of family Fabaceae.
17. Describe polyploidy breeding. What are their applications in crop improvement?
18. What are the important vegetative propagation methods in plants?
19. Comment on the phylogenetic system of classification

SECTION C
(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. What is a natural system of classification? Explain with an example. Write down the major merits and demerits.
21. Describe the different selection processes in plat breeding? Explain.

Course Code: SJBOT4C04

Name of the Course: PLANT PHYSIOLOGY, ECOLOGY AND GENETICS

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Explain the physiological processes in plants.	5	U	C	25	15
CO2	Understand the basic principles of heredity and variation.	3	U	C	9	4
CO3	Realize the importance of ecology.	2	R	C	6	8
CO4	Spread awareness of the necessity of conservation of biodiversity and natural resources	2	A	P	6	4
CO5	Solve problems related to classical genetics	1 & 3	Z	P	8	5

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Plant physiology	36	18	54
2	Ecology	9	9	18
3	Genetics	9	9	18
Total		**54**	**36**	**90**

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Plant physiol.	Ecology	Genetics	Total
2 marks (total 12)	8	2	2	Ceiling 20
5 marks (total 7)	4	1	2	Ceiling 30
10 marks (total 2)	2			1x10 = 10

TOTAL	60

PLANT PHYSIOLOGY

Module – I (16 hrs)

1. Structure of plant cell and cell organelles (Brief account only)
2. Water relations - Permeability, Imbibition, Diffusion, Osmosis and water potential
3. Absorption of water- Active and passive mechanisms
4. Ascent of sap -Root pressure theory, Transpiration pull or cohesion-tension theory.
5. Transpiration -Types, mechanism of stomatal movement: K^+ ion theory, significance of transpiration, antitranspirants.
6. Mineral nutrition- General account on Micro and macro nutrients. Methods of studying plant nutrition- solution culture-The essential elements - criteria of essentiality. function and deficiency symptoms of the following mineral nutrients: N, P, K, Mg, Fe, Zn, Mn

Module – II (10 hrs)

1. Photosynthesis-Introduction, significance, Two pigment systems, red drop, Emerson enhancement effect, action and absorption spectra, Mechanism of photosynthesis - Light reaction, cyclic & non-cyclic photo phosphorylation, Dark reactions–Calvin cycle, C_4 cycle, photorespiration (a brief account only). Factors affecting photosynthesis.

Module – III (10 hrs)

1. Plant growth-Definition, phases of growth, natural plant hormones, synthetic auxins (Brief account only)
2. Senescence and abscission, Photo-periodism & vernalization.
3. Dormancy of seeds- Factors causing dormancy, photoblastin, techniques to break dormancy, physiology of fruit ripening.

PRACTICAL (PLANT PHYSIOLOGY)

Learn the principle and working of the following apparatus/experiments

1. Thistle funnel osmoscope
2. Ganong's potometer
3. Ganong's light-screen
4. Absorbo transpirometer .
5. Kuhne's fermentation vessel
6. Mohl's half-leaf experiment
7. Experiment to show evolution of O_2 during photosynthesis

REFERENCES (PLANT PHYSIOLOGY)

1 William G. l-lopkins,(1999). Introduction to Plant Physiology, 2nd edition, John Wiley A Sons, Inc.

2 Frank B. Salisbury and Cleon W. Ross (2002). Plant Physiology 3rd edition. CBS publishers and distributers.

3 G. Ray Noggle and George J.Fritz (1983) Introductory Plant Physiology Prentice Hall.

4 Goodwin Y.W. and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.

PLANT ECOLOGY

Module – I (**9** hrs)

1. Ecology-Definition, Ecosystem: ecological factors –biotic and abiotic.
2. Ecological adaptations: Morphological, anatomical and physiological adaptations of the following types: Hydrophyte (*Vallisnaria*, *Hydrilla*), Xerophyte (*Opuntia, Nerium*), Halophyte (*Avicennia*), Epiphytes (*Vanda*) and parasites. (*Cuscuta*).
3. Ecological succession –Process of succession, types of succession, Hydrosere

PRACTICAL (PLANT ECOLOGY)

Study the morphological and anatomical adaptations of the hydrophytes, xerophytes, halophytes, epiphytes and parasites mentioned in the syllabus (drawing not required)

REFERENCES (PLANT ECOLOGY)

1 Ambasht R.S. 1988. A text book of Plant Ecology. Students Friends Co. Varanasi.
2 Dash M.C. 1993. Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd. New Delhi.
3 Michael S. 1996. Ecology. Oxford University Press, London.
4 Sharma, P.D. 2008-2009. Ecology and Environment. Rastogi Publication.
5 Kumar H.D. 1977. Modern Concepts of Ecology. Vikas Publications. New Delhi.

GENETICS (**9** hrs)

1. Introduction and brief history of genetics
2. Mendel's experiments, symbolisation, terminology, heredity and variation;
3. Monohybrid cross, Dihybrid cross, Laws of Mendel, test cross and back cross.
4. Modified Mendelian ratios 1) Incomplete dominance in *Mirabilis jalapa*
5. Gene interactions: Complementary genes -flower colour in *Lathyrus odoratus* (9:7ratio), Epistasis - Fruit colour in *Cucurbita pepo* (12:3:1 ratio).

PRACTICAL (GENETICS)

1 Students are expected to work out problems related to Monohybrid, Dihybrid, Test cross, Incomplete dominance and Modified Mendelian ratios and has to be recorded.

REFERENCES (GENETICS)

1. Sinnot, W.L.C. Dunn & J. Dobzhansky (1996) Principles of Genetics. Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Verma, P.S. & Agarwal (1999). Text book of Genetics. S. Chand & Co., New Delhi.
4 RastogiV.B. (2008), Fundamentals of Molecular Biology, Ane Books, India.
5 Gupta, P.K. Text Book of Genetics. Rastogi Publications, Meerut.

MODEL QUESTION PAPER

FIRST SEMESTER B.Sc. DEGREE PROGRAMME
COMPLEMENTARY COURSE: 4
SJBOT4C04: PLANT PHYSIOLOGY, ECOLOGY AND GENETICS

TIME: 2 hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. What are antitranspirants? Give examples.
2. Define water potential? Write about its components.
3. Explain vernalization in brief.
4. Give an account of ATPase.
5. What is transpiration pull? Explain its role in plants.
6. Write about senescence and abscission. Add a note their significance.
7. Describe two important adaptations seen in halophytes.
8. What are haustoria? Mention its physiological importance.
9. Differentiate test cross and back cross.
10. What are complementary genes? Give example.
11. Write about Krantz anatomy.
12. Give an account of Hydroponics.

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Give an account of non-cyclic photophosphorylation.
14. Describe the K^+ ion theory of stomatal movements.
15. Write in detail about the adaptations of xerophytes.
16. List out the roles played by gibberellins in plant development.
17. Give an account of the epistatic interaction found in plants with an example.
18. Briefly explain the dihybrid cross conducted by Mendel and a note on the discovery of law of independent assortment.
19. Give an account of the causes and methods to overcome seed dormancy.

SECTION C
(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Define plant succession. Describe the stages of hydrosere in detail with suitable plant examples
21. With the help of schematic diagram describe the path of carbon in Photosynthesis.

Course Code: SJBOT4C05

Name of the Course: B.Sc. COMPLEMENTARY BOTANY PRACTICAL EXAMINATION

B.Sc. COMPLEMENTARY BOTANY PRACTICAL EXAMINATION

(Angiosperm Anatomy, Micro technique, Cryptogams, Gymnosperms, Plant Pathology, Morphology, Systematic Botany, Plant Physiology, Ecology, Genetics, Economic Botany, Plant Breeding & Horticulture)

Time: 3 hrs **Max: 60 marks**

1. Prepare a T.S. of specimen **A**. Stain and mount in glycerine. Draw cellular diagram and label the parts. Identify giving reasons. Leave the preparation for valuation.
   (Preparation-2; Diagram-2; Reasons-2; Identification-1) 7 x1=7 Marks

2. Refer specimen **B** to its family, giving diagnostic characters
   (Identification-1; Reasons-2) 3x1=3 Marks

3. Take a V.S. of flower **C**. Draw a labeled diagram 2x1=2 Marks

4. Make suitable micro-preparations of **D**. Draw labeled diagram. Identify giving reasons. Leave the preparation for valuation.
   (Preparation-2; Diagram-2; Identification-1; Reasons-1) 6x1=6 Marks

5. Determine the ecological group of specimen **E**, with important adaptations.
   (Identification-1; Adaptations-2) 3 x1=3 Marks

6. Identify the experiment **F** and **G**. Explain the aim and working
   (Identification-1; Aim-1; Working - 1) 3 x 2= 6 Marks

7. Give the binomial, family and morphology of useful parts in **H** and **I**
   (Binomial-1; Family- ½ ; Morphology of useful part- ½) 2×2=4 Marks

8. Name the disease, pathogen and important symptoms in **J**
   (Name- 1; Pathogen- 1 ; Symptoms-1) 3x1=3 Marks

9. Give the binomial and family of **K** and **L**
   (Binomial-1; Family ½) 2×1 ½ = 3 Marks

10. Work out the problem **M** 5x1=5 Marks

11. Spot at sight **N** to **V** 9 X 2= 18 marks

Practical	**: 60 Marks**
Record	**: 15 Marks**
Submission	**: 10 Marks**
Total	**: 85 Marks**

OPEN COURSES

Course Code: SJBOT5D01

Name of the Course: GENERAL BOTANY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Have a general awareness on various branches of plant science	1	R	C	17	-
CO2	Develop environmental concern in all their activities.	2	A	C	17	-
CO3	Realize the importance of plants in everyday life.	4	Z	P	20	-

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Total
1	Module 1	4
2	Module 2	6
3	Module 3	6
4	Module 4	12
5	Module 5	7
6	Module 6	7
7	Module 7	12
Total		**54**

QUESTION PAPER PATTERN

Type of questions	No of questions	Total
2 marks	12	Ceiling 20
5 marks	7	Ceiling 30
10 marks	2	1x10 = 10
Total		**60**

Module -1: Living World

Living and Non Living: Plants and Animals; Classification of plants: Eichler's system, general characters of each group with one example; introduction to the Life cycle of plants.

Module - 2: Morphology of Angiosperms

Typical angiosperm plant: Functions of each organ viz. Root, Stem, leaves, inflorescence, flowers, fruit and seed. Flower: Basic structure, essential and non essential parts, symmetry. Pollination, seed dispersal of fruits and seeds.

Module - 3: Anatomy

Definition, general structure, Cell division- mitosis and meiosis, significance, cell cycle. Tissues: simple, compound; structure and functions; Structure and functions of root, stem and leaves. Monocot and Dicot stem- general features; Secondary thickening. Annual rings, heart wood and sap wood.

Module- 4: Plant Physiology

General account on methods of absorption of water and nutrients; Osmosis, Diffusion, Imbibition. Transport of water and nutrients; transpiration and its significance. Mineral nutrients: macro and micro; deficiency symptoms Symbiotic nitrogen fixation and its significance. Photosynthesis- Light and Dark reactions-brief description, Respiration and Growth Hormones.

Module - 5: Genetics

Heredity, variation; Mendelian experiments and principles. Exceptions of Mendelism, Structure and significance of DNA; Mutation. DNA: as the Genetic Material; Blood groupism in man; Sex determination in man.

Module - 6: Plant Biotechnology

Tissue culture - Principle and procedure; Transgenic plants: Scope and applications, BT Cotton, BT Brinjal, Golden Rice; Bioreactors and their significance.

Module - 7 Environmental Science

Ecosystem: Structure - Abiotic and Biotic Factors, Ecosystem, Types of plant interactions; Mutualism, Commensalism, Predation, Symbiosis, Parasitism, Competition. Biodiversity, Conservation, *In situ* and *Ex situ* methods, National Parks, Sanctuaries, IUCN, Threat Categories, Red list. Green House Effect, Ozone depletion, Deforestation and Reforestation, Alternative energy resources, Sustainable development and Utilization of resources.

REFERENCES

1. Pandey B.P. Plant Anatomy, S. Chand & Co. Delhi.
2. Tayal M.S Plant Anatomy. Rastogi Publishers, Meerut.
3. Vasishta P.C. (1974) Plant Anatomy, Pradeep Publication, Jalandhar
4. Gangulee, H.C., J.S. Das & C. Dutta. (1982) College Botany (5th Ed.) New Central Book Agency, Calcutta.
5. Gupta, P.K. Text Book of Genetics. Rastogi Publications, Meerut.

6. Verma, P.S. & Agarwal (1999) Text book of Genetics. S. Chand & Co., New Delhi
7. John Ringo (2004) Fundamental Genetics Cambridge University Press
8. Chawla HS (2000) Introduction to Plant Biotechnology
9. Das, H.K. (Ed) (2005). Text book of Biotechnology (2nd ed) Wiley India (Pvt.), Ltd. New Delhi.
10. Dubey RC Introduction to Plant Biotechnology; S Chand & Co
11. Gupta, P.K. (1996) Elementary Biotechnology. Rastogi & Company, Meerut.
12. William G. Hopkins,(1999). Introduction to Plant Physiology, 2nd edition, John Wiley A Sons, Inc.
13. Frank B. Salisbury and Cleon W. Ross (2002). Plant Physiology 3rd edition. CBS publishers and distributers.
14. Ahluvalia V.K. Malhotra S. (2009). Environmental Science. Ane Books – New Delhi.
15. Ambasht R.S. (1988) A text book of Plant Ecology. Students Friends Co.Varanasi.
16. Dash M.C. (1993) Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd. New Delhi.
17. Kumar H.D. (1977) Modern Concepts of Ecology. Vikas Publications. New Delhi.

MODEL QUESTION PAPER

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
OPEN COURSE
SJBOT5D01: GENERAL BOTANY

TIME: 2 Hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Which plant group is known as 'amphibians of the plant kingdom? Why?
2. Name the first cell of sporophytic generation. Give its genetic constitution.
3. Distinguish between actinomorphic and zygomorphic flowers.
4. Comment on annual rings.
5. Distinguish between diffusion and osmosis.
6. Name any two major nutrients and their deficiency symptoms.
7. Name a gaseous hormone. What is its significance?
8. Write the names of any two alternative energy resources.
9. Distinguish between autosomes and allosomes.
10. Name any two transgenic plants. Mention their special feature.
11. With suitable examples distinguish between commensalism and symbiosis.
12. What is greenhouse effect? Name two major greenhouse gases.

SECTION B
(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Comment on symbiotic nitrogen fixation.
14. Compare the internal structure of dicot and monocot stem.
15. Outline Eichler's system of classification of plants.
16. Distinguish between heart wood and sap wood.
17. Give an illustration on mitosis.
18. Discuss the genetics of blood groups in man.
19. Write a critical account on *in situ* and *ex situ* methods of biodiversity conservation.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Give a detailed account on light and dark reactions of photosynthesis.
21. Discuss secondary thickening in a dicot stem with labeled sketches

Course Code: SJBOT5D02

Name of the Course: APPLIED BOTANY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Develop general awareness on applied aspects of Plant science. Realize the role of plants in everyday life.	1	U	C	12	-
CO2	Apply vegetative propagation methods in everyday life.	4	A	P	12	-
CO3	Realize the economic importance of plants	4	U	C	24	-
CO4	Develop general awareness on applied aspects of Plant science. Realize the role of plants in everyday life.	3 & 4	Z	C	6	-

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Total
1	Module –I Plant Propagation	12
2	Module – II Steps of growing plants	12
3	Module – III. Botany in Everyday life	24
4	Module – IV. Economic Botany	6
Total		**54**

QUESTION PAPER PATTERN

Type of questions	No of questions	Total
2 marks	12	Ceiling 20
5 marks	7	Ceiling 30
10 marks	2	1x10 = 10
Total		**60**

Module –I Plant Propagation

1. Seed propagation – Seed dormancy, seed treatment, conditions for successful propagation, rising of seed beds, care of seedling, transplanting techniques.
2. Vegetative propagation:
   - (a) Cutting (stem, roots)
   - (b) Grafting (approach, cleft)
   - (c) Budding (T-budding, patch)
   - (d) Layering (simple, air)
3. Micro propagation- General account

Module – II Steps of Growing Plants

1. Soil- Composition, Types, Texture, Soil pH, Correcting pH, Humus
2. Pots & Potting – Earthen, Fibre, Polythene bags, Potting mixture, Potting, Depotting, Repotting.
3. Chemical fertilizers: types, application, merits and demerits
4. Organic manure; types, application, merts and demarits
5. Need of water: Irrigation – Surface, spray, drip irrigation, sprinklers.
6. Plant protection: Biological, Physical and mechanical, Chemical, biopestcide

Module – III. Botany in Everyday life

1. Vegetable gardening
2. Mushroom cultivation
3. Vermi composting- technique
4. Biofertlizer Technology
5. Orchid and Anthurium cultivation
6. Creating Bonsai

Module – IV. Economic Botany

1. General account on various plants of economic importance
2. Study the Binomial, Family, Morphology of the useful part of the following plants.
   Cereals and Millets – Rice, Wheat
   Pulses -Greengram, Bengalgram, Blackgram
   Beverages – Coffee, Tea, Cocoa.

Fibre – Coir, Cotton
Timber – Teak, Rose wood, Jack
Spices – Pepper, Ginger, Cardamom
Medicinal – Adhatoda, Phyllanthus, Rauvolfia
Oil- coconut, Gingelly
Ornamental pants of economic importance – Rose, jasmine
Fruit – Mango, Banana

REFERENCES

1. Nishi Sinha: Gardening in India, Abhinav Publications, New Delhi.
2. Andiance and Brison. 1971. Propagation Horticultural Plants.
3. Rekha Sarin. The Art of Flower Arrangement, UBS Publishers, New Delhi.
4. Katyal, S.C., Vegetable growing in India, Oxford, New York.
5. Naik, K.C., South Indian Fruits and their Culture.
6. Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India.
7. Premchand, Agriculture and Forest Pest and their Management, Oxford Publication.
8. George Acquaah, Horticulture: Principles and Practices. Pearson Education, Delhi.
9. Prasad, S., and U. Kumar. Green house Management for Horticultural Crops, Agrobios, Jodhpur.
10. Kumar, U.: Methods in Plant Tissue Culture. Agrobios (India), Jodhpur.
11. Kolay, A.K. Basic Concepts of Soil Science. New Age International Publishers, Delhi.
12. Bal, J.S., Fruit growing, Kalyani Publishers, Delhi.
13. Rodgran, M.K. Plant Tissue Culture, Oxford & IBH Publishing Ltd., New Delhi.
14. Nesamony, Oushadha Sasyangal (Medicinal plants), State Institute of Language, Kerala, Trivandrum.
15. Prakash R., Raj Mohan K, Jaivakrishi (Organic farming), State Institute of Languages, Trivandrum.
16. Hudson, T. Hartmann, Dale K. Kester, Fred T. Davies, Robert L. Geneve, Plant Propagation, Principles and Practices.

MODEL QUESTION PAPER

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
OPEN COURSE
SJBOT5D02: APPLIED BOTANY

TIME: 2 Hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Distinguish between loamy soil and clay soil.
2. What is the composition of commonly used potting mixture?

3. What is 'Humus'? Give its significance.
4. Comment on legume-rhizobium association
5. Commonly used earthworms for vermicomposting technique
6. Give the binomial of medicinal plant used against jaundice
7. Why is *Azolla* grown in paddy fields?
8. Which spice is known as 'queen of spices'? Give its binomial.
9. Distinguish between depotting and repotting
10. Name two chemical fertilizers rich in phosphorus
11. Specify the hormones used for root and shoot differentiation in tissue culture.
12. How will you correct soil pH?

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Give an account on *Anthurium* cultivation
14. Write critical notes on seed dormancy
15. Compare the merits and demerits of chemical fertilizers and organic manures.
16. Briefly outline the art of making bonsai
17. Give the binomial, family and morphology of the useful parts of any two pulses.
18. Outline the procedure of cultivation of oyster mushroom.
19. What are biopesticides? Give the composition and procedure for the preparation of any two.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Give a detailed account on various practices of vegetative propagation
21. Discuss various types of irrigation and their significance

Course Code: SJBOT5D03

Name of the Course: BASIC TISSUE CULTURE

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand plant tissue culture as a rapid propagation method.	3	R	C	12	-
CO2	Explain the steps involved in tissue culture.	3 & 4	R	C	30	-
CO3	Realize the applications of plant tissue culture	4	R	C	12	-

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Total
1	Module 1	7
2	Module 2	12
3	Module 3	9
4	Module 4	18
5	Module 5	8
Total		**54**

QUESTION PAPER PATTERN

Type of questions	No of questions	Total
2 marks	12	Ceiling 20
5 marks	7	Ceiling 30
10 marks	2	1x10 = 10
Total		**60**

Module - I .

1. Introduction; Aims and objectives of Plant Tissue Culture.
2. Organization and facilities of a Tissue culture Laboratory.
3. Equipment and apparatus in a tissue culture lab.

4. Sterilization techniques – Autoclaving Flame sterilization, UV irradiation, Chemical sterilization. Sterilization of instruments and glass wares, medium, explants

Module-II

1. Plant tissue culture – Principles and techniques: Cellular totipotency, *in vitro* differentiation –de differentiation and re-differentiation.
2. Tissue culture medium – Basic components in tissue culture medium – Solid and liquid medium– suspension culture. Murashige and Skoog medium– composition and preparation.
3. Aseptic techniques in tissue culture - preparation of explants – surface sterilization. Inoculation, incubation and subculturing.

Module-III

1. Micropropagation - Different methods – axillary bud proliferation, direct and indirect organogenesis and somatic embryogenesis.
2. Different phases of micropropagation – hardening, transplantation and field Evaluation: Advantages and disadvantages of micro propagation.
3. Somaclonal variation.

Module – IV

1. Applications of plant tissue culture: Micropropagation; Somatic embryogenesis; Artificial seeds, Germplasm conservation, Embryo rescue culture, Protoplast isolation, culture and fusion, Anther, pollen and Ovary culture for production of haploids, Cryopreservation. Shoot apical meristem culture and production of pathogen free stocks and somaclonal variation.

Module –V

1. Transformation technology – Transgenic plant production, Gene transfer methods in plants, Multiple gene transfers, Vector less or direct gene transfer techniques.

REFERENCES

2. Dixon, R.A. & R.A. Gonzales. (1994). Plant Cell Culture – A Practical Approach (2nd Ed) Oxford University Press.
3. Mantel & Smith (1983) Plant Biotechnology. Cambridge University Press
4. Mantel, S. H, Mathew, J.A. *et al*. (1985). An introduction to Genetic Engineering in plants. Blackwell Scientific Publishers, London.
5. Gupta, P.K. (1996). Elementary Biotechnology. Rastogi & Company, Meerut.
6. Hammond, J., Megary, P *et al*. (2000). Plant Biotechnology. Springer Verlag.
7. Gamborg, O.L. & G.C. Philips (Eds.) (1995). Plant Cell, Tissue and Organ Culture Fundamental Methods. Narosa Publishing House, New Delhi.
8. Einert & Bajaj Plant Cell, Tissue and Organ Culture.
9. Das, H.K. (Ed) (2005). Text book of Biotechnology. Wiley India (Pvt) Ltd. New Delhi.

MODEL QUESTION PAPER

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
OPEN COURSE
SJBOT5D03: BASIC TISSUE CULTURE

TIME: 2Hrs **Max. Marks 60**

SECTION A
(Answer all questions. Each question carries 2 marks. Ceiling: 20 Marks)

1. What are synseeds?
2. What is cryopreservation? Write examples for cryoprotectants.
3. Write the various instruments/ equipment used in tissue culture lab.
4. Explain the steps involved in hardening?
5. Define organogenesis. What are the different types of organogenesis?
6. What is a Cybrid? How is it produced?
7. What is an autoclave? Explain its principle and use.
8. Explain the role microelements in tissue culture.
9. Define incineration, and its usage in tissue culture?
10. Mention the categories of chemical sterilants used in plant tissue culture
11. What are the principles involved in plant tissue culture?
12. What is meristem culture? Explain its importance.

SECTION B
(Answer all questions. Each question carries 5 marks. Ceiling: 30 Marks)

13. Explain the various steps involved in microproagation.
14. Define Haploids. What are steps involved in haploid production?
15. What are secondary metabolites? Write its applications.
16. What are the various methods adopted to test protoplast viability.
17. What is LAF? Write the working principle of LAF.
18. Write an account on different sterilization methods adopted in plant tissue culture?
19. What are nutrient media, explain its components and role?

SECTION C
(Answer any one. Each question carries 10 marks. 1x10=10 Marks)

20. Explain the various gene transfer methods.
21. Describe the applications of plant tissue culture in overcoming specific problems.

Course Code: SJBOT5D04

Name of the Course: HORTICULTURE TECHNIQUES & HERBAL COSMETOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Develop general awareness on applied aspects of Plant Science.	1	U	C	15	-
CO2	Understand recent trends in herbal techniques.	3 & 4	U	C	15	-
CO3	Apply vegetative propagation methods in everyday life.	4	A	P	10	-
CO4	Apply herbal products in cosmetics.	4	A	P	14	-

***R-remember, U-understand, A- apply, Z- analyze, E- evaluate, C- create**
***F-factual, C-conceptual, P-practical/procedural**

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl no	Subject	Total
1	Module 1	9
2	Module 2	14
3	Module 3	11
4	Module 4	20
Total		**54**

QUESTION PAPER PATTERN

Type of questions	No of questions	Total
2 marks	12	Ceiling 20
5 marks	7	Ceiling 30
10 marks	2	1x10 = 10
Total		**60**

Module –I

Steps of Growing Plants

1. Soil- Composition, Types, Texture, Soil pH, Correcting pH, Humus
2. Pots & Potting – Earthen, Fibre, Polythene bags, Potting mixture, Potting, Depotting, Repotting.
3. Chemical fertilizers: types, application, merits and demerit
4. Organic manure; types, application, merits and demerits
5. Need of water: Irrigation – Surface, spray, drip irrigation, sprinklers.
6. Plant protection: Biological, Physical and mechanical, Chemical, biopestcide

Module – II

Plant Propagation

1. Seed propagation – Seed dormancy, seed treatment, conditions for successful propagation, rising of seed beds, care of seedling, transplanting techniques.
2. Vegetative propagation:
   (a) Cutting (stem, roots)
   (b) Grafting (approach, cleft)
   (c) Budding (T-budding, patch)
   (d) Layering (simple, air)
3. Micro propagation- General account

Module– III. Recent trends in horticulture

1. Vegetable gardening
2. Mushroom cultivation
3. Vermi-composting -technique
4. Bio-fertlizer Technology
5. Orchid and Anthurium cultivation
6. Creating Bonsai
7. Pipe composting

Module- 1V Herbal cosmetology

1. Introduction to herbal cosmetology, relevance, commercial aspects of herbal cosmetology, scope and applications
2. Study of plants commonly used in herbal cosmetics ,morphology of the parts used
   Aloe vera, Turmeric, Amla, Henna, Sandal Wood, Licorice, Manjista, Neem, Tulsi, Eclipta, Curry leaves, Indigo, Fenugreek, Vetiver, Red Sandal wood, Garcinia
3. Preparation of herbal cosmetology products Aloe vera gel, Hair packs, Hair Oils, Face packs, Pimple face pack and regular face pack, Herbal lipstick and herbal shampoo
4. Fruits and nuts that can be used in herbal cosmetology
5. Visit to a herbal cosmetics production unit

REFERENCES

1. Nishi Sinha: Gardening in India, Abhinav Publications, NewDelhi.
2. Andiance and Brison. 1971. Propagation Horticultural Plants.
3. Rekha Sarin. The Art of Flower Arrangement, UBS Publishers, NewDelhi.
4. Katyal, S.C., Vegetable growing in India, Oxford, New York.
5. Naik, K.C., South Indian Fruits and their Culture.
6. Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India.
7. Premchand, Agriculture and Forest Pest and their Management, Oxford Publication.
8. George Acquaah, Horticulture: Principles and Practices. Pearson Education, Delhi.
9. Prasad, S., and U. Kumar. Green house Management for Horticultural Crops, Agrobios, Jodhpur.
10. Kumar, U.: Methods in Plant Tissue Culture. Agrobios (India),Jodhpur.
11. Kolay, A.K. Basic Concepts of Soil Science. New Age International Publishers, Delhi.
12. Bal, J.S., Fruit growing, Kalyani Publishers, Delhi.
13. Patkar KB, Bole PV. Herbal cosmetics in ancient India with a treatise on planta cosmetica. Bharatiya Vidya Bhavan Mumbai, India Mumbai: World Wide Fund for Nature; 1997.
14. H. Panda, The Complete Technology Book on Herbal Beauty Products with Formulations and Processes, Asia Pacific Business Press Inc.

MODEL QUESTION PAPER

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
OPEN COURSE
SJBOT5D04: HORTICULTURE TECHNIQUES & HERBAL COSMETOLOGY

TIME: 2 Hrs **Max. Marks 60**

SECTION A
(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. What is the scope of herbal cosmetology
2. Write the names and morphology of the useful parts of four plants used in herbal cosmetics.
3. What is 'Humus'? Give its significance.
4. Comment on legume-rhizobium association
5. Commonly used earthworms for vermicomposting technique
6. Distinguish between loamy soil and clay soil.
7. Why is *Azolla* grown in paddy fields?
8. What is the composition of commonly used potting mixture?
9. Distinguish between depotting and repotting
10. Name two chemical fertilizers rich in phosphorus
11. Specify the hormones used for root and shoot differentiation in tissue culture.

12. How will you correct soil pH?

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Explain the preparation of a herbal shampoo, herbal face pack and a herbal lipstick.
14. Write critical notes on seed dormancy
15. Compare the merits and demerits of chemical fertilizers and organic manures.
16. Briefly outline the art of making bonsai
17. Give an account on *Anthurium* cultivation.
18. Outline the procedure of cultivation of oyster mushroom.
19. What are biopesticides? Give the composition and procedure for the preparation of any two.

SECTION C

(Answer any one question, each question carries 10 marks. 1×10 = 10 Marks)

20. Give a detailed account on various practices of vegetative propagation
21. Discuss various types of irrigation and their significance