

**ASSUMPTION COLLEGE AUTONOMOUS
CHANGANACHERRY**

Reaccredited by NAAC with A Grade

Affiliated to Mahatma Gandhi University, Kottayam



CURRICULUM FOR UNDER GRADUATE PROGRAMME

**IN
BOTANY**

**Under Choice Based Credit System (CBCS)
(2017 Admission onwards)**

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY
BOARD OF STUDIES IN BOTANY

a. **Dr. Sr. Mariamma Joseph**, Head Dept. of Botany, Assumption College Autonomous Changanacherry, **Chairperson**

b. **TEACHERS FROM DIFFERENT AREAS OF SPECIALISATION.**

1. **Dr. Latha Sadanandan**, Assistant professor, Dept. of Botany, S.N. College, Kollam
2. **Dr. Jacob Thomas**, Assistant Professor & Research Guide, Dept. of Botany, Mar Thoma College Thiruvalla.
3. **Dr. I'ma Neerakkal**, Associate Professor, Dept. of Botany, S.H. College, Thevara.
4. **Dr. Saji Mariam George**, Associate Professor, Dept. of Botany, Assumption College Autonomous Changanacherry.
5. **Dr. Julie John**, Associate Professor, Dept. of Botany, Assumption College Autonomous Changanacherry.

c. **EXPERTS FROM OUTSIDE COLLEGE**

1. **Dr. M. Daniel**, Professor of Botany (Emeritus) MS University Baroda.
2. **Dr. C.T. Chandralekha**, Faculty, Postgraduate Dept. of Botany, Devamatha College Kuravilangad, Kottayam District.

d. **UNIVERSITY NOMINEE**

e. **REPRESENTATIVE FROM INDUSTRY/CORPORATE SECTOR/ALLIED AREAS**

1. **Mr. Joseph K Mathew**, Spices and Agri products Ltd, Near SB College, Changanacherry, Kottayam (Dist), Kerala
2. **Mr. Kurian Joseph**, Southern Fertilisers and Chemicals, Industrial Nagar P.O, Changanacherry, Kottayam (Dist), Kerala

f. **ALUMNUS**

Dr. Asha S Mathew, Assistant Professor, Dept. of Biochemistry, B.K. College for Women, Amalagiri, Kottayam (Dist).

**FACULTY MEMBERS WHO HAVE CONTRIBUTED TOWARDS
CURRICULUM AND SYLLABI OTHER THAN BOARD OF
STUDIES MEMBERS**

Ms. Riya Elias

Assistant Professor on Contract

Department of Botany

Assumption College Autonomous

Changanacherry

ACKNOWLEDGEMENT

We thank God, the Almighty, for His showers of blessings in the successful completion of the syllabus in Botany.

The Board of Studies in Botany expresses our deepest gratitude to the patron His Grace Mar Joseph Perumthottam, Arch Bishop of Changanacherry for the moral support and encouragement.

We place our special gratitude to Rev. Dr. James Palackal, our manager for stimulating suggestions and encouragement and also for sharing his vision of Higher Education.

We put on record our sincere thanks to the Honorable Vice Chancellor, Pro Vice Chancellor, Registrar and the members of the syndicate and all the academic bodies of Mahatma Gandhi University, for the guidance and help extended towards the college.

We acknowledge with much appreciation Rev. Dr. Sr. Marykutty Joseph, Principal, Assumption College for her imparted enthusiasm and willingness to support in all the junctures of our venture.

We express our special gratitude to Rev. Sr. Cherukusumam CMC and Dr. Regimol C Cherian, the Vice Principals of the college, for their stimulating suggestions and encouragement.

We wish to express our sincere thanks to all the Board of Studies members for their help and expert guidance rendered by them to restructure the syllabus. We are indebted to all the subject experts for their helpful comments & suggestions.

Our heartfelt gratitude towards the Governing Council and Academic Council for their support and motivation in this regard.

The Board of Studies acknowledges the contribution of the faculty members of the department for their contribution towards the curriculum and syllabus restructuring.

Dr. Sr. Mariamma Joseph
Chairperson, Board of Studies

**MINUTES OF MEETING OF THE BOARD OF STUDIES IN BOTANY
(UG) HELD ON 20 DECEMBER 2016 AT 10.30 AM AT CONFERENCE
HALL, ASSUMPTION COLLEGE AUTONOMOUS
CHANGANACHERRY.**

The following members were present.

- | | | | |
|----|--|----------------|------|
| 1. | Dr. Sr. Mariamma Joseph Head, Dept. of Botany, Assumption College Autonomous Changanacherry | Chairperson | (Sd) |
| 2. | Dr. Chandralekha C.T. Head, P.G. Dept. of Botany, Devamatha College, Kuravilangad, Kottayam (Dist) | Subject Expert | (Sd) |
| 3. | Dr. Jacob Thomas Assistant Professor & Research Guide Dept. of Botany Mar Thoma College, Thiruvalla. | | (Sd) |
| 4. | Dr. Latha Sadanandan Assistant Professor, Dept. of Botany, S.N. College, Kollam | | (Sd) |
| 5. | Dr. I'ma Neerakkal Associate Professor, Dept. of Botany S.H. College Autonomous Thevara. | | (Sd) |
| 6. | Dr. Saji Mariam George Associate Professor, Dept. of Botany Assumption College Autonomous Changanacherry | | (Sd) |
| 7. | Dr. Julie John | | (Sd) |

Associate Professor, Dept. of Botany
Assumption College Autonomous
Changanacherry

8. **Mr. Joseph K Mathew** (Sd)

Spices and Agri products Ltd,
Near SB College,
Changanacherry,
Kottayam (Dist), Kerala

9. **Dr. Asha S Mathew** (Sd)

Assistant Professor,
Dept. of Biochemistry,
B.K. College for Women,
Amalagiri, Kottayam (Dist).

The meeting proceeded to the matters in Agenda

Approval of the minutes of the previous Board of Studies meeting held on 30th May 2016 at 10.30 am in the Department of Botany, Assumption College.

The Board of Studies approved the minutes of the previous meeting

1. Discussion on the draft syllabus of UG Programme from 2017 -2018 admission onwards and its finalization.
2. Preparation of Board of Examiners (Theory and Practical) for the II Semester Examiners of UG Programme 2016 -2017.
3. Other items permitted by the chair.

Recommendations/ Suggestions

1.
 - i) In Module 1 for Core theory paper 1, Classification of Organisms and Phycology of Semester I, it is decided to include the salient features of Prokaryotes and Eukaryotes.
 - ii) In Module 2 of Semester I, it is decided that developmental studies of reproductive organs are not necessary.
 - iii) In Module 3 of Core theory paper 2, Microbiology, Mycology and Lichenology, of Semester II, Stemonitis is included instead of Physarum.

- iv) In Semester II practical, observation of fungal succession on cowdung is omitted.
 - v) In Module 4 of Core theory paper 3, 'Bryology, Pteridology, Gymnosperms and Paleobotany of Semester III, fossil study of Gymnosperm Williamsonia is only required.
 - vi) In Semester III practical, it is decided to give Marchantia only as a spotter.
 - vii) In Module 1 of Core theory paper 5, Research Methodology, Biophysics and Biostatistics of Semester V, Patenting and Copy right were included.
 - viii) In Module 2, use of median and mode in EXCEL is omitted.
 - ix) In Module 4, Test of Hypothesis and Student's t - test were included.
 - x) In Module 4 of Core theory paper 7, Plant breeding, Horticulture and Plant Pathology of Semester V, it is decided to omit tobacco decoction preparation and to include root wilt of coconut and quick wilt of pepper.
 - xi) In Open course paper, Agribased Microenterprises, preparation of tobacco decoction is omitted.
 - xii) In Module 2 of Core theory paper 9, Plant Physiology and Biochemistry of Semester VI, a brief account of Abscission and senescence were included.
 - xiii) In Module 1 of Core theory paper 11, Angiosperm morphology, Taxonomy and Economic Botany, special type of inflorescence, Thyrsus is included.
 - xiv) In Module 2(b) of Choice based course, Agribusiness of Semester VI, terrace gardening was added.
2. The panels of question paper setters for II Semester Core and Complementary courses were decided.

The meeting came to an end at 4 pm.

Read and confirmed

Dr. Sr. Mariamma Joseph
Chairperson

Dr. Sr. Marykutty Joseph
Principal, Assumption College

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PREFACE

As per the regulations for Under Graduate Programme under Choice Based Credit System 2016, the members of Board of Studies in Botany was entrusted with the task of restructuring and updating the syllabus for Botany Core and Complementary courses.

The members of BoS in Botany.

1. Dr. Sr. Mariamma Joseph
2. Dr. Jacob Thomas
3. Dr. Chandralekha C T
4. Dr. Latha Sadanandan
5. Dr. I'ma Neerakkal
6. Dr. Saji Mariam George
7. Dr. Julie John
8. Mr. Joseph K Mathew
9. Dr. Asha S Mathew

As instituted by the Academic Council, a workshop was conducted from 24th to 28th October 2016, including the members of teachers handling the undergraduate courses. The participants of the workshop were all permanent faculty and Assistant Professors on contract.

The curriculum for BSc Botany has been designed to have a broad outlook about the Programme and to make them knowledgeable in various fields of the discipline. The theoretical and the experimental learning, both in the basics as well as in the emerging fields equip them for higher learning. The curriculum also develop entrepreneurial skills, particularly in the fields of Mushroom Cultivation and production of value added products, Horticulture and Nursery management etc.

ABOUT UNDER GRADUATE PROGRAMME IN BOTANY

Under Graduate Programme in BSc Botany envisages to give a comprehensive knowledge in Plant Science. The syllabi are formulated in such a way that the various inherent potentials of the students can be channelized into different fields of their own choice. They get ample opportunities to get acquainted with many plants which are of much importance in day to day life, which will in turn create love for Mother Nature and instill in them, the need for conservation.

Aims and Objectives of the Programme

1. To know the importance and scope of Botany
2. To create awareness about plant diversity and evolutionary trends in Plant World.
3. To impart knowledge to identify major environmental problems, their causes and consequences which enable them to combat various environmental issues there by contributing to the conservation of Nature and natural resources.
4. To develop creativity and open mindedness.
5. To impart scientific knowledge in the emerging areas of Life science.
6. To develop basic skills related to Biological instrumentation, Statistical tools and Information Technology which will enable them to pursue research.

Course Structure

The BSc Programme in Botany includes Common courses I & II, Core courses, Complementary courses, Open Course and Project. Open Course shall be offered in any subject and the student shall have the option to do courses offered by other departments.

Scope of the programme

The Undergraduate Programme in Botany mainly focus on the understanding of various disciplines like Morphology, Taxonomy, Anatomy, Physiology, Cytology, Genetics, Biotechnology, Bioinformatics, Environmental Science, Conservation Biology, Ecotourism and so on. After the completion of the programme, the Graduates can opt for any job for which a Graduation in any Discipline is the minimum educational requirement. They also can opt self employment as they have acquired the technical skill

for the production of various Agri products, Mushroom cultivation, Horticultural and Nursery Management Practices etc.

The Graduates in Botany can go for higher studies like Post Graduate Course in Botany and in other areas mentioned above and there after for a Ph.D programme which will enable them to seek a job in various academic institutions as a faculty or a scientist in reputed research institutes and can contribute significantly towards the understanding of various life processes, discovery of new plant species from hitherto unexplored areas, invention of new plant based drugs etc. They can also become successful entrepreneurs in industries based on Biotechnology, Phytochemistry, Horticulture & Nursery Management and Agribased enterprises. A career in Botany can be highly rewarding for those who are allured with the aesthetic beauty of Nature and Flora.

COURSE CODING

1. The first two letters forms the programme Botany, i.e., BO.
2. One digit to indicate Semester. BO1(1st Semester)
3. Next two letters forms the type of Courses such as CC for common courses, CR for core courses, CM for complementary courses, CB for choice based course, OP for open course., PR for project.
4. Two digits to indicate the course number of that semester, i.e., BO1CRT01.

REGULATIONS FOR UNDER GRADUATE PROGRAMMES UNDER CHOICE BASED CREDIT SYSTEM 2016

1. TITLE

These regulations shall be called “**Regulations for Under Graduate Programmes under Choice Based Credit System, 2016**”, Assumption College Autonomous.

2. SCOPE

Applicable to all regular and self-financing Under Graduate Programmes conducted by the College with effect from 2017 admissions.

3. DEFINITIONS

- 3.1. **‘Academic Week’** is a unit of five working days in which distribution of work is organized from day-one to day-five, with five contact hours of one hour duration on each day. A sequence of 18 such academic weeks constitutes a semester.
- 3.2. **‘College Co-ordinator’** is a teacher nominated by the College Council to co-ordinate the continuous evaluation undertaken by various departments within the college. She shall be nominated by the College Principal.
- 3.3. **‘Common Course I’** means a course that comes under the category of courses for English and **‘Common Course II’** means additional language, a selection of both is compulsory for Model I and Model II undergraduate programmes.
- 3.4. **‘Complementary Course’** means a course which would enrich the study of core courses.
- 3.5. **‘Core course’** means a course in the subject of specialization within a degree programme.
- 3.6. **‘Course’** means Paper(s) which will be taught and evaluated within a semester.
- 3.7. **‘Credit’** is the numerical value assigned to a paper according to the relative importance of the content of the syllabus of the programme.
- 3.8. **‘Department’** means any teaching department in a college.

- 3.9. **'Department Co-ordinator'** is a teacher nominated by the Head of Department to co-ordinate the continuous evaluation undertaken in that department.
- 3.10. **'Extra Credits'** are additional credits awarded to a student over and above the minimum credits required for a programme for achievements in co-curricular activities carried out outside the regular class hours as directed by the college.
- 3.11. **Grace Marks** shall be awarded to candidates as per the Orders issued from time to time.
- 3.12. **'Grade'** means a letter symbol (e.g., A, B, C, etc.), which indicates the broad level of performance of a student in a course/ semester/programme.
- 3.13. **'Grade point'** (GP) is the numerical indicator of the percentage of marks awarded to a student in a course.
- 3.14. **'Institutional Average (IA)'** means average mark secured (Internal+External) for a paper at the College level.
- 3.15. **'Open course'** means a course outside the field of specialization of a student and offered by the Departments which can be opted by a student.
- 3.16. **'Parent Department'** means the department which offers core courses in an under graduate programme.
- 3.17. **'Programme'** means a three year programme of study and examinations spread over six semesters, according to the regulations of the respective programme, the successful completion of which would lead to the award of a degree.
- 3.18. **'Semester'** means a term consisting of a minimum of **450** contact hours distributed over **90** working days, inclusive of examination days, within **18** five-day academic weeks.
- 3.19. Words and expressions used and not defined in this regulation shall have the same meaning assigned to them in the Act and Statutes of the University.

4. ELIGIBILITY FOR ADMISSION AND RESERVATION OF SEATS

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- 4.1 Eligibility of admission, Norms for admission, reservation of seats for various Under Graduate Programmes shall be according to the rules framed by the University in this regard from time to time.
- 4.2 Students can opt for any one (other than core and complementary subjects) of the Open course offered by different departments of the college in the fifth semester (subject to the availability of vacancy in the concerned discipline). Selection of students in the open course will be done in the college based on the interest of the students.

5. DURATION

- 5.1 The duration of U.G. programmes shall be **6 semesters**.
- 5.2 There shall be two semesters in an academic year. The duration of odd semesters shall be from **June to October** and that of even semesters from **November to March**. There shall be three days semester break after odd semesters and two months vacation during April and May in every academic year.
- 5.3 A student may be permitted to complete the Programme, on valid reasons, within a period of 12 continuous semesters from the date of commencement of the first semester of the programme.

6. REGISTRATION

- 6.1 The strength of students for each course shall remain as per existing regulations, as approved by the University except in case of open courses for which there shall be a minimum of 15 and maximum of sanctioned strength including marginal increase.
- 6.2 The number of courses/credits that a student can take in a semester is governed by the provisions in these regulations pertaining to the minimum and maximum number of credits permitted.
- 6.3 Those students who possess the required minimum attendance and progress during an academic year/semester and could not register for the annual/semester examination are permitted to apply for Notional Registration to the examinations concerned enabling them to get promoted to the next class.

7. SCHEME AND SYLLABUS

- 7.1. The U.G. programmes shall include (a) Common courses I & II, (b) Core courses, (c) Complementary Courses, (d) Open Course.
- 7.2. There shall be one Open course in the fifth semester.
- 7.3. There shall be one Choice based paper in the sixth semester with a choice of one out of three elective papers.
- 7.4. A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 40% are required for a pass for a paper. For a pass in a programme, a separate minimum of Grade D is required for all the individual papers. If a candidate secures F Grade for any one of the paper offered in a semester/programme, only F grade will be awarded for that semester/ programme until she improves this to D Grade or above within the permitted period.
- 7.5. Improvement/supplementary examinations will be conducted only in the even semesters following the publication of the results. As an exemption to this, prior to final semester, the improvement/supplementary examinations can be arranged along with the previous end semester exam.
- 7.6. Students discontinued from previous regulations, can pursue their studies in **Regulations for Under Graduate Programmes under Choice Based Course Credit System, 2016** after obtaining readmission. These students have to complete the programme as per **Regulations for Under Graduate Programmes under Choice Based Credit System, 2016**.

8. PROGRAMME STRUCTURE

Model I BA/BSc

| | | |
|---|---|-------------|
| a | Programme Duration | 6 Semesters |
| b | Total Credits required for successful completion of the programme | 120 |
| c | Credits required from common course I | 22 |
| d | Credits required from common course II | 16 |
| e | Credits required from Core + complementary including Project | 79 |
| f | Credits required from Open course | 3 |
| g | Minimum attendance required | 75% |

Model I B Com

| | | |
|---|---|-------------|
| a | Programme Duration | 6 Semesters |
| b | Total Credits required for successful completion of the programme | 120 |
| c | Credits required from common course I | 14 |
| d | Credits required from common course II | 8 |
| e | Credits required from Core + complementary including Project | 95 |
| f | Credits required from Open course | 3 |
| g | Minimum attendance required | 75% |

Model II BA/BSc

| | | |
|---|---|-------------|
| a | Programme Duration | 6 Semesters |
| b | Total Credits required for successful completion of the programme | 120 |
| c | Credits required from common course I | 16 |
| d | Credits required from common course II | 8 |
| e | Credits required from Core + complementary+vocational courses including Project | 93 |
| f | Credits required from Open course | 3 |
| g | Minimum attendance required | 75% |

Model III BA/BSc/B Com

| | | |
|---|---|-------------|
| a | Programme Duration | 6 Semesters |
| b | Total Credits required for successful completion of the programme | 120 |
| c | Credits required from common course I | 8 |
| d | Credits required from Core + complementary + vocational courses including Project | 109 |
| e | Credits required from Open course | 3 |
| f | Minimum attendance required | 75% |

9. EXAMINATIONS.

9.1 The evaluation of each course shall contain two parts:

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- (i) Internal or In-Semester Assessment (ISA)
- (ii) External or End-Semester Assessment (ESA)

9.2 The internal to external assessment ratio shall be 1:4, for both courses with or without practical. There shall be a maximum of **80** marks for external evaluation and maximum of **20** marks for internal evaluation. For all courses (theory & practical), grades are given on a 7-point scale based on the total percentage of marks. **(ISA+ESA)** as given below

| Percentage of Marks | Grade | Grade Point |
|---------------------|-------------------|-------------|
| 95 and above | O - Outstanding | 10 |
| 85 to below 95 | A+ - Excellent | 9 |
| 75 to below 85 | A - Very Good | 8 |
| 65 to below 75 | B+ - Good | 7 |
| 55 to below 65 | B - Above average | 6 |
| 50 to below 55 | C - Average | 5 |
| 40 to below 50 | D - Pass | 4 |
| Below 40 | F - Fail | 0 |
| | Ab - Absent | 0 |

Note: Decimal are to be rounded to the next whole number

10. CREDIT POINT AND CREDIT POINT AVERAGE

Credit Point (CP) of a course is calculated using the formula

$CP = C \times GP$, where $C = \text{Credit}$; $GP = \text{Grade point}$

Credit Point Average (CPA) of a Semester/Programme is calculated using the formula

$CPA = TCP/TC$, where $TCP = \text{Total Credit Point}$; $TC = \text{Total Credit}$

Grades for the different semesters and overall programme are given based on the corresponding CPA as shown below:

| CPA | Grade |
|----------------------------|-------------------|
| Equal to 9.5 and above | O - Outstanding |
| Equal to 8.5 and below 9.5 | A+ - Excellent |
| Equal to 7.5 and below 8.5 | A - Very Good |
| Equal to 6.5 and below 7.5 | B+ - Good |
| Equal to 5.5 and below 6.5 | B - Above average |
| Equal to 5 and below 5.5 | C - Average |
| Equal to 4 and below 5 | D - Pass |
| Below 4 | F - Fail |

Note: A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 40% are required for a pass for a course. For a pass in a programme, a separate minimum of Grade D is required for all the individual courses. If a candidate secures **F** Grade for any one of the courses offered in a Semester/Programme only **F** grade will be awarded for that Semester/Programme until he/she improves this to **D** grade or above within the

permitted period. Candidate who secures **D** grade and above will be eligible for higher studies.

11. MARKS DISTRIBUTION FOR EXTERNAL EXAMINATION AND INTERNAL EVALUATION

The external examination of all semesters shall be conducted by the College at the end of each semester. Internal evaluation is to be done by continuous assessment.

All the components of the internal assessment are mandatory. Mark distribution for external and internal assessments and the components for internal evaluation with their marks are shown below:

11.1 For all courses without practical

a) **Marks of external Examination : 80**

b) **Marks of internal evaluation : 20**

| Components of Internal Evaluation | MARKS |
|--|--------------|
| Attendance | 5 |
| Assignment /Seminar/Viva | 5 |
| Two Test papers (2×5=10) | 10 |
| Total | 20 |

11.2 For all courses with practical

a) **Marks of theory - External Examination : 60**

b) **Marks of theory - Internal Evaluation : 10**

| Components of Theory – Internal Evaluation | Marks |
|---|--------------|
| Attendance | 3 |
| Assignment/Seminar/Viva | 2 |
| Test Papers (2×2.5=5) | 5 |
| Total | 10 |

c) **Marks of Practical - External Examination : 40**
(only in even semesters)

d) **Marks of Practical – Internal Examination : 20**
(odd and even semesters combined annually)

| Components of Practical – Internal Evaluation | Marks |
|--|--------------|
| Attendance | 4 |
| Test Paper | 5 |
| Record* | 7 |

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| | |
|-----------------|-----------|
| Lab Involvement | 4 |
| Total | 20 |

* Marks awarded for record should be related to the number of experiments recorded and duly signed by the concerned teacher in charge.

11.3 Project Evaluation: (Max. marks 100)

(a) Marks of external examination : 80

(b) Marks of internal examination : 20

| Components of External evaluation of Project | Marks |
|---|--------------|
| Dissertation (External) | 50 |
| Viva-Voce (External) | 30 |
| Total | 80 |

| Components of Internal evaluation of Project | Marks |
|---|--------------|
| Punctuality | 5 |
| Experimentation/Data collection | 5 |
| Knowledge | 5 |
| Report | 5 |
| Total | 20 |

12. Attendance Evaluation

1) For all courses without practical

| % of attendance | Marks |
|------------------------|--------------|
| 90 and above | 5 |
| 85 – 89 | 4 |
| 80-84 | 3 |
| 76-79 | 2 |
| 75 | 1 |

(Decimals are to be rounded to the next higher whole number)

2) For all courses with practical

| % of attendance | Marks for theory | | % of attendance | Marks for practical |
|------------------------|-------------------------|--|------------------------|----------------------------|
| 90 and above | 3 | | 90 and above | 4 |
| 80 – 89 | 2 | | 85 – 89 | 3 |
| 75 – 79 | 1 | | 80-84 | 2 |

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| | | | | |
|--|--|--|-------|---|
| | | | 75-79 | 1 |
|--|--|--|-------|---|

(Decimals are to be rounded to the next higher whole number)

13. ASSIGNMENTS/SEMINAR/VIVA

Assignments/Seminar/Viva is to be done from 1st to 5th Semesters. Each teacher can decide the mode of evaluation. The student shall appear for compulsory viva-voce in the 6th semester for each paper.

14. INTERNAL ASSESSMENT TEST PAPERS

Two internal test-papers are to be conducted in each semester for each course. The evaluations of all components are to be published and are to be acknowledged by the candidates. All documents of internal assessments are to be kept in the Department for three years and shall be made available for verification. The responsibility of evaluating the internal test papers is vested on the teacher(s), who teach the paper.

14.1 Grievance Redressal Mechanism

Internal assessment shall not be used as a tool for personal or other types of vengeance. A student has all rights to know, how the teacher arrived at the marks. In order to address the grievance of students a two-level Grievance Redressal mechanism is envisaged. A student can approach the upper level only if grievance is not addressed at the lower level.

Level 1: Dept. Level: The department cell chaired by the Head, Dept. Coordinator and teacher in-charge, as members.

Level 2: College level: A committee with the Principal as Chairman, Controller of Examination and College Coordinator as members.

14.2 The college council shall nominate a senior teacher as coordinator of internal evaluations. This coordinator shall make arrangements for giving awareness of the internal evaluation components to students immediately after commencement of I semester.

14.3 The internal evaluation report in the prescribed format should reach the Controller of Examination office before the 4th week of October and March in every academic year.

15. EXTERNAL EXAMINATION

The external examination of all semesters shall be conducted by the College at the end of each semester.

- 15.1 Students having a minimum of 75% average attendance for all the courses only can register for the examination. Condonation of shortage of attendance to a maximum of 10 days or 50 hours in a semester subject to a maximum of 2 times during the whole period of the programme may be granted by the Principal/Controller of Examination on valid grounds. This condonation shall not be counted for internal assessment.
- Benefit of attendance may be granted to students attending University/College union/Co-curricular activities by treating them as present for the days of absence, on production of participation/attendance certificates, within one week, from competent authorities and endorsed by the Head of the institution. This is limited to a maximum of 10 days per semester and this benefit shall be considered for internal assessment also.
- Those students who are not eligible even with condonation of shortage of attendance shall repeat the course along with the next batch.
- 15.2 All students are to do a **project in the area of core course**. This project can be done individually or as a group of 3 students. The projects are to be identified during the II semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department at the sixth semester and are to be produced before the examiners appointed by the College. External project evaluation and Viva is compulsory for all subjects and will be conducted at the end of the programme.
- 15.3 A student who registers her name for the external exam for a semester will be eligible for promotion to the next semester.
- 15.4 A student who has completed the entire curriculum requirement, but could not register for the Semester examination can register notionally, for getting eligibility for promotion to the next semester.
- 15.5 A candidate who has not secured minimum marks/credits in internal examinations can re-do the same registering along with the examination for the same semester, subsequently.
16. All programmes and courses shall have unique alphanumeric code.

17. PATTERN OF QUESTIONS

Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set. The question setter shall also submit a detailed scheme of evaluation along with the question paper.

Question paper shall be a judicious mix of short answer type, short essay type /problem solving type and long essay type questions according to the question paper blue print given.

Pattern of questions for external examination for theory paper without practical.

| Pattern | Total no. of questions | No. of questions to be answered | Marks of each question | Total marks |
|----------------------------|-------------------------------|--|-------------------------------|--------------------|
| Very short answer | 10 | 10 | 1 | 10 |
| Short Answer | 12 | 8 | 2 | 16 |
| Short essay/problem | 9 | 6 | 4 | 24 |
| Essay | 4 | 2 | 15 | 30 |
| | 35 | 26 | X | 80 |

Pattern of questions for external examination for theory paper with practical.

| Pattern | Total no. of questions | No. of questions to be answered | Marks of each question | Total marks |
|----------------------------|-------------------------------|--|-------------------------------|--------------------|
| Very short answer | 8 | 8 | 1 | 8 |
| Short Answer | 10 | 6 | 2 | 12 |
| Short essay/problem | 6 | 4 | 4 | 16 |
| Essay | 4 | 2 | 12 | 24 |
| | 28 | 20 | X | 60 |

Each BoS shall specify the length of the answers in terms of number of words.

Pattern of questions for external examination of practical papers will be decided by the concerned Board of Studies/ Expert Committees.

18. MARK CUM GRADE CARD

Curriculum and Syllabus 2017 Admission onwards

The College under its seal shall issue to the students a MARK CUM GRADE CARD on completion of each semester, which shall contain the following information:

- (a) Name of the College
 - (b) Name of the University
 - (c) Title & Model of the Under Graduate Programme
 - (d) Name of the Semester
 - (e) Name and Register Number of the student
 - (f) Code, Title, Credits and Max. Marks (Int., Ext. & Total) of each course opted in the semester.
 - (g) Internal, External and Total Marks awarded, Grade, Grade point and Credit point in each course opted in the semester.
 - (h) Institutional average (IA) of the marks of all papers.
 - (i) The total credits, total marks (Max. & Awarded) and total credit points in the semester.
 - (j) Semester Credit Point Average (SCPA) and corresponding Grade.
 - (k) Cumulative Credit Point Average (CCPA) corresponding to Common courses, Core and Complementary (separately and together) and whole programme, as the case may be.
 - (l) The final Mark cum Grade Card issued at the end of the final semester shall contain the details of all papers taken during the final semester examination and shall include the final grade/marks scored by the candidate from 1st to 5th semester and the overall grade/marks for the total programme.
19. There shall be **2 level monitoring** committees for the successful conduct of the scheme. They are -
- 1. Department Level Monitoring Committee (DLMC), comprising HOD and two senior-most teachers as members.
 - 2. College Level Monitoring Committee (CLMC), comprising Principal, Dept. Co-ordinator and A.O./Superintendent as members.

**PROGRAMME STRUCTURE AND SYLLABI OF
UNDER GRADUATE PROGRAMME IN BOTANY**

Total Credits: 120

Semester I

Total Credits : 17

| No. | Course Title | Hrs/Week | Credits |
|-----|---|--------------|-----------|
| 1 | Common Course English -1 | 5 | 4 |
| 2 | Common Course English -2 | 4 | 3 |
| 3 | Common Course Additional language -1 | 4 | 4 |
| 4 | Core Course-1 Classification of Organisms and Phycology Core practical | 2 2 | 2 - |
| 5 | 1 st Complementary – Chemistry -1 | 2 | 2 |
| 6 | 1 st Complementary – Chemistry -1 + Practical | 2 | - |
| 7 | 2 nd Complementary – Zoology -1 | 2 | 2 |
| 8 | 2 nd Complementary – Zoology -1 +Practical | 2 | - |
| | Total | 25hrs | 17 |

Semester II

Total Credits: 23

| No. | Course Title | Hrs/Week | Credits |
|-----|--|--------------|-----------|
| 1 | Common Course English -3 | 5 | 4 |
| 2 | Common Course English -4 | 4 | 3 |
| 3 | Common Course Additional language -2 | 4 | 4 |
| 4 | Core Course-2 Microbiology, Mycology and Lichenology Core practical | 2 2 | 2 2 |
| 5 | 1 st Complementary – Chemistry-2 | 2 | 2 |
| 6 | 1 st Complementary – Chemistry -2 + Practical | 2 | 2 |
| 7 | 2 nd Complementary – Zoology -2 | 2 | 2 |
| 8 | 2 nd Complementary – Zoology -2 +Practical | 2 | 2 |
| | Total | 25hrs | 23 |

Curriculum and Syllabus 2017 Admission onwards

Semester III

Total Credits: 17

| No. | Course Title | Hrs/Week | Credits |
|------------|--|-----------------|----------------|
| 1 | Common Course English -5 | 5 | 4 |
| 2 | Common Course Additional language -3 | 5 | 4 |
| 3 | Core Course-3 Bryology, Pteridology, Gymnosperms and Paleobotany | 3 | 3 |
| | Core practical | 2 | - |
| 4 | 1 st Complementary – Chemistry-3 | 3 | 3 |
| 5 | 1 st Complementary – Chemistry -3 + Practical | 2 | - |
| 6 | 2 nd Complementary – Zoology -3 | 3 | 3 |
| 7 | 2 nd Complementary – Zoology -3+Practical | 2 | - |
| | Total | 25hrs | 17 |

Semester IV

Total Credits: 23.

| No. | Course Title | Hrs/Week | Credits |
|------------|--|-----------------|----------------|
| 1 | Common Course English -6 | 5 | 4 |
| 2 | Common Course Additional language -4 | 5 | 4 |
| 3 | Core Course-4 Anatomy, Reproductive Botany and Micro technique | 3 | 3 |
| | Core practical | 2 | 2 |
| 4 | 1 st Complementary – Chemistry-4 | 3 | 3 |
| 5 | 1 st Complementary – Chemistry -4 + Practical | 2 | 2 |
| 6 | 2 nd Complementary – Zoology -4 | 3 | 3 |
| 7 | 2 nd Complementary – Zoology -4+Practical | 2 | 2 |
| | Total | 25hrs | 23 |

Curriculum and Syllabus 2017 Admission onwards

Semester V

Total Credits: 15.

| No. | Course Title | Hrs/Week | Credits |
|------------|--|-----------------|----------------|
| 1 | Core Course-5 Research Methodology, Biophysics and Biostatistics | 3 | 3 |
| | Core practical | 2 | - |
| 2 | Core Course-6 Genetics and Evolution | 3 | 3 |
| | Core practical | 2 | - |
| 3 | Core Course-7 Cell and Molecular Biology | 3 | 3 |
| | Core practical | 2 | - |
| 4 | Core Course-8 Environmental Studies and Human Rights | 4 | 3 |
| | Core practical | 2 | - |
| 5 | Open Course Agri-based Microenterprises / Horticulture and Nursery Management/Environmental Pollution and Ecotourism | 4 | 3 |
| | Total | 25hrs | 15 |

Semester VI

Total Credits: 25.

| No. | Course Title | Hrs/Week | Credits |
|------------|---|-----------------|----------------|
| 1 | Core Course-9 Plant Physiology and Biochemistry | 4 | 3 |
| | Core practical | 2 | 2 |
| 2 | Core Course-10 Angiosperm Morphology, Taxonomy and Economic Botany | 4 | 3 |
| | Core practical | 2 | 2 |
| 3 | Core Course- Biotechnology and Bioinformatics | 3 | 3 |
| | Core practical | 2 | 2 |
| 4 | Core Course-12 Plant Breeding, Horticulture and Plant Pathology | 3 | 3 |
| | Core practical | 2 | 2 |
| 5 | Core Choice based - 13 Agribusiness/ Plant Genetic Resources / Phytochemistry | 3 | 3 |
| 6 | Project + Viva voce | - | 2 |
| | Total | 25 hrs | 25 |

SCHEME: CORE COURSE

| Semester | Course Code | Course title | Hrs/ Week | No. of Credits | Total Hrs/ Semester |
|------------|-------------|--|-----------|----------------|---------------------|
| I | BO1CRT01 | Classification of Organisms and Phycology | 2 | 2 | 36+36 |
| | | Core practical | 2 | - | 72 |
| II | BO2CRT02 | Microbiology, Mycology and Lichenology | 2 | 2 | 36+36 |
| | | Core practical | 2 | 2 | 72 |
| III | BO3CRT03 | Bryology, Pteridology, Gymnosperms and Paleobotany | 3 | 3 | 54 + 36 |
| | | Core practical | 2 | - | 90 |
| IV | BO4CRT04 | Anatomy, Reproductive Botany and Microtechnique | 3 | 3 | 54 + 36 |
| | | Core practical | 2 | 2 | 90 |
| V | BO5CRT05 | Research Methodology, Biophysics and Biostatistics | 3 | 3 | 54 + 36 |
| | | Core practical | 2 | - | 90 |
| | BO5CRT06 | Genetics and Evolution | 3 | 3 | 54 + 36 |
| | | Core practical | 2 | - | 90 |
| | BO5CRT07 | Cell and Molecular Biology | 3 | 3 | 54+ 36 |
| | | Core practical | 2 | - | 90 |
| | BO5CRT08 | Environmental Studies and Human Rights | 4 | 3 | 72 + 36 |
| | | Core practical | 2 | - | 108 |

Curriculum and Syllabus 2017 Admission onwards

| Semester | Course Code | Course title | Hrs/ Week | No. of Credits | Total Hrs/ Semester |
|-----------------|----------------------------------|---|------------------|-----------------------|----------------------------|
| V | BO5OPT01 BO5OPT02 BO5OPT03 | Open Course: Agribased Microenterprises / Horticulture and Nursery Management/ Environmental Pollution and Ecotourism | 4 | 3 | 72 |
| VI | BO6CRT09 | Plant Physiology and Biochemistry Core practical | 4 2 | 3 2 | 72 + 36 108 |
| | BO6CRT10 | Angiosperm Morphology, Taxonomy and Economic Botany Core practical | 4 2 | 3 2 | 72 + 36 108 |
| | BO6CRT11 | Biotechnology and Bioinformatics Core practical | 3 2 | 3 2 | 54+ 36 90 |
| | BO6CRT12 | Plant Breeding, Horticulture and Plant Pathology Core practical | 3 2 | 3 2 | 54+36 90 |
| | BO6CBT01 BO6CBT02 BO6CBT03 | Agribusiness Plant Genetic Resources Phytochemistry | 3 | 3 | 54 |
| | | Project + Viva voce | - | 2 | |
| | | | | | |

EXAMINATION SCHEME – CORE THEORY

| Semester | Title of Course | No. of Credits | Total hrs per Semester | Exam Duration Hrs | Total Marks | |
|------------|---|----------------|------------------------|-------------------|-------------|-----------|
| | | | | | Internal | External |
| I | Core-1 Classification of Organisms and Phycology | 2 | 36 | 3 | 10 | 60 |
| II | Core-2 Microbiology, Mycology and Lichenology | 2 | 36 | 3 | 10 | 60 |
| III | Core-3 Bryology, Pteridology, Gymnosperms and Paleobotany | 3 | 54 | 3 | 10 | 60 |
| IV | Core-4 Anatomy, Reproductive Botany and Microtechniques | 3 | 54 | 3 | 10 | 60 |
| V | Core-5 Research Methodology, Biophysics and Biostatistics. | 3 | 54 | 3 | 10 | 60 |
| | Core-6 Genetics and Evolution | 3 | 54 | 3 | 10 | 60 |
| | Core-7 Cell and Molecular Biology | 3 | 54 | 3 | 10 | 60 |
| | Core-8 Environmental Studies and Human Rights | 3 | 72 | 3 | 10 | 60 |
| | OPEN COURSE : Agribased Microenterprises | 3 | 72 | 3 | 20 | 80 |
| VI | Core-9 Plant Physiology and Biochemistry | 3 | 72 | 3 | 10 | 60 |
| | Core-10 Angiosperm Morphology, Taxonomy and Economic Botany | 3 | 72 | 3 | 10 | 60 |
| | Core-11 Biotechnology and Bioinformatics | 3 | 54 | 3 | 10 | 60 |
| | Core-12 Plant Breeding, Horticulture and Plant Pathology | 3 | 54 | 3 | 10 | 60 |
| | Choice Based Course : Agribusiness | 3 | 54 | 3 | 20 | 80 |
| | Project and Viva voce | 2 | | | 20 | 80 |

EXAMINATION SCHEME – CORE PRACTICAL

| Semester | Title of Course | No. of Credits | Total hrs per Semester | Exam Duration | Total Marks | |
|------------------------------|--|----------------|------------------------|---------------|-------------|-----------|
| | | | | | Internal | External |
| I & II Combined | BO1CRP01 & BO2CRP02 Classification of Organisms, Phycology & Microbiology, Mycology and Lichenology | 2 | 72 | 3 | 20 | 40 |
| III & IV Combined | BO3CRP03 & BO4CRP04 Bryology, Pteridology, Gymnosperms, Paleobotany & Anatomy, Reproductive Botany and Microtechniques | 2 | 72 | 3 | 20 | 40 |
| V & VI Combined | BO5CRP05 & BO6CRP09 Research Methodology, Biophysics, Biostatistics & Plant Physiology and Biochemistry | 2 | 72 | 3 | 20 | 40 |
| V & VI Combined | BO5CRP06 & BO6CRP10 Genetics, Evolution & Angiosperm Morphology, Taxonomy and Economic Botany | 2 | 72 | 3 | 20 | 40 |
| V & VI Combined | BO5CRP07 & BO6CRP11 Cell, Molecular Biology & Biotechnology and Bioinformatics | 2 | 72 | 3 | 20 | 40 |
| | BO5CRP08 & BO6CRP12 Environmental Studies & Plant Breeding, | 2 | 72 | 3 | 20 | 40 |

Curriculum and Syllabus 2017 Admission onwards

| | | | | | | |
|--|----------------------------------|----------|--|--|-----------|-----------|
| | Horticulture and Plant Pathology | | | | | |
| | Project and Viva voce | 2 | | | 20 | 80 |

B. Sc. BOTANY COMPLEMENTARY COURSE

SCHEME: COMPLEMENTARY COURSE

| Semester | Course Code | Course title | Hrs/ Week | No. of Credits | Total Hrs/ Semester |
|-----------------|--------------------|---|----------------------|---------------------------|--------------------------------|
| I | BO1CMT01 | Cryptogams, Gymnosperms and Plant Pathology Compl. Practical | 2 2 | 2 - | 36 + 36 72 |
| II | BO2CMT02 | Plant Physiology Compl. Practical | 2 2 | 2 2 | 36+ 36 72 |
| III | BO3CMT03 | Angiosperm Morphology, Taxonomy and Economic Botany Compl. Practical | 3 2 | 3 - | 54+ 36 90 |
| IV | BO4CMT04 | Anatomy and Applied Botany Compl. Practical | 3 2 | 3 2 | 54+36 90 |

SYLLABUS FOR B.Sc BOTANY (MODEL I) CORE COURSE

SEMESTER I

CLASSIFICATION OF ORGANISMS AND PHYCOLOGY

Course Code : BO1CRT01
Teaching hours : 2 Hrs/ week (Hrs / Sem 36)
Credits : 2

CORE
THEORY - 1

Objectives

- Appreciate the world of organisms and its course of evolution and diversity.
- To understand the identifying characters of Algae and familiarize them.

CLASSIFICATION OF ORGANISMS

6 hrs

Module-1

Need for classification: The phylogenetic classification (August W. Eichler, 1878). Study the salient features of Prokaryotes, Eukaryotes- Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

PHYCOLOGY

30 hrs

Module -2

24 hrs

Algae- Introduction, General characters, Habitat diversity, Range of thallus structure, Reserve food materials and Pigments in algae.

Salient features, thallus structure and reproduction (developmental studies not needed) of the following types.

Cyanophyceae (Cyanobacteria) - *Nostoc*

Chlorophyceae - *Chlamydomonas, Volvox, Spirogyra, Oedogonium, Chara.*

Xanthophyceae - *Vaucheria.*

Bacillariophyceae - *Pinnularia*

Phaeophyceae - *Sargassum*

Rhodophyceae - *Polysiphonia.*

Module-3

2 hrs

Algal Culturing: Scope and methods (brief account only). Preservation of Micro algae and Macro algae.

Module-4

4 hrs

Economic importance of algae: Algae as food, SCP, fodder, role of algae in N₂ fixation, medicine and biofuels, role of algae in pollution studies: as indicators of pollution and as bioremediation agents; Commercial Products – Carrageenin, Agar-agar, Alginates and Diatomaceous earth.

Harmful effects: Water bloom, Eutrophication, Neurotoxins and Parasitic algae.

REFERENCES

1. Fritsch, F.E., 1935. The structure and reproduction of the Algae. Vol. I and II, Uni. Press. Cambridge.
2. Morris, I., 1967. An Introduction to the Algae. Hutchinson and Co. London.
3. Robert Edward Lee, 2008. Phycology. Cambridge University Press, London
4. Singh, V., Pande, P.C. and Jain, D.K., 2010. A text book of Botany. Rastogi Publishers, New Delhi.
5. Vashishta, B.R., 2014. Text Book of Algae. Published by S. Chand & Company Ltd, New Delhi.
6. Ganguly and Kar., 2011. College Botany Vol. II. New Central Book Agency, Calcutta.
7. Kanika Sharma, 2007. Manual of Microbiology. Tools and Techniques 2nd Edition. Ane Books Pvt. Ltd., New Delhi.
8. Rines, George Edwin, 1920. (ed.) "Eichler, August Wilhelm". Encyclopaedia Americana.
9. Agarwal, S. K., 2008, Foundation course in Biology, Ane Books Pvt. Ltd., New Delhi.
10. Harold C Bold, 1999. The Plant Kingdom. Prentice Hall of India Pvt. Ltd., Delhi.
11. Prithipalsingh, 2007. An Introduction to Biodiversity, Ane Books Pvt. Ltd., New Delhi.
12. Sobti, R.C. and Sharma, V.L., 2008. Essentials of Modern Biology. Ane Books Pvt. Ltd. New Delhi.

SEMESTER II
MICROBIOLOGY, MYCOLOGY AND LICHENOLOGY

Course Code : BO2CRT02
Teaching hours : 2 Hrs/ week (Hrs / Sem 36)
Credits : 2

**CORE
THEORY - 2**

Objectives

- Understand the world of microbes
- Understand the diversity of fungal and lichen world and their significance.

MICROBIOLOGY **12 hrs**

Module- 1 **5 hrs**

Introduction, Scope of Microbiology; Bacteria - General characters and classification based on staining, Morphology and Flagellation. Ultra structure and Nutrition of bacteria; Reproduction- asexual; Genetic recombination - conjugation, transformation and transduction. Economic importance of bacteria; General characters of Archaeobacteria and Mycoplasma (Brief account only).

Module-2 **7 hrs**

Virus - General characters, Structure of TMV, HIV and Bacteriophage T4, Multiplication of bacteriophage T4, Lytic and Lysogenic life cycles.

Applied microbiology - Role of microbes in Nitrogen cycle, Reconversion of waste products, Antibiotic production, Bio fertilizers, Production of vinegar and Curd. Single cell protein.

MYCOLOGY **24 hrs**

Module-3 **16 hrs**

Introduction, Classification of Fungi upto sub division (Ainsworth, 1973).

Salient features, Thallus structure and Reproduction of the following types:

Myxomycotina – *Stemonitis*

Mastigomycotina – *Albugo*

Zygomycotina – *Rhizopus*

Ascomycotina – Hemiascomycetes – *Saccharomyces*

Plectomycetes – *Penicillium*

Pyrenomycetes – *Xylaria*

Discomycetes – *Peziza*

Basidiomycotina – Teliomycetes – *Puccinia*

Hymenomycetes – *Agaricus*

Deuteromycotina – *Fusarium*

Module-4

6 hrs

Economic importance of Fungi- useful and harmful aspects – (Medicinal, industrial, food, genetic studies, spoilage, fungal toxins and diseases) Fungi of Agricultural importance – mycoherbicides, myconematicides, mycoparasites, Mycorrhiza –Diversity, Function and Significance ; Fungal Biotechnology; Mushrooms- Edible and Poisonous types, cultivation technique-Spawn production and cultivation of Oyster mushroom.

LICHENOLOGY

2 hrs

Lichens- Introduction, types and structure. Economic and ecological importance of lichens.

Structure, Reproduction and life cycle of *Parmelia*.

REFERENCES

1. Ahamadjian Vernon and Hale M.E 1973. (eds). The Lichens, Academic press, New Delhi.
2. Ainsworth G.C., Sparrow K.F and Sussman A.S 1973. (eds). The Fungi an advanced Treatise, Vol. 4a & 4b, a Taxonomic review with keys, Academic Press New York.
3. Alexopoulos C.J, Mims and C.W and C.W Blackwell, M 1996 Introductory Mycology .John Willy and sons, INC. New York.
4. Campbell, R 1987.Plant Microbiology. ELBS Edward Arnold, London.

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5. Gupta V .K and Paul T.S 2004. Fungi and Plant diseases. Kalyani Publishers, New Delhi
6. Hale M.E 1983.The Biology of Lichen.3rd edition Edward Arnold, London.
7. Jim Deacon, 2007. Fungal Biology, 4th edition, Blackwell Publishing, Ane Books Pvt. Ltd. New Delhi
8. Krishnamurthy, K.V, 2004. An Advanced Text Book on Biodiversity Principles and practice. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
9. Misra, A and Agarwal, P.R. 1978. Lichens. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
10. Nair M.C 1990. (eds). Mushroom Technical Bulletin 17, Kerala Agricultural University Mannuthy
11. Nita Bahl, 2002. Hand book on Mushrooms, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
12. Sharma, P.D 2004. The Fungi, 2nd Edition, Rasthogi publications. New Delhi.
13. Singh, Pande, Jain 2007. Diversity of Microbes and Cryptogams, Rastogi Publications. New Delhi.
14. Tripathi, D.P 2005. Mushroom Cultivation, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
15. Dubey, H C.2012.An Introduction to Fungi, Fourth Edition. Published by Scientific Publishers, Rajasthan.

SEMESTER I & II PRACTICAL
BO1CRP01 & BO2CRP02
CLASSIFICATION OF ORGANISMS, PHYCOLOGY
&
MICROBIOLOGY, MYCOLOGY, LICHENOLOGY

Credits : 2

72 Hrs

SEMESTER I : PRACTICAL

36 hrs

1. Conduct a field visit to any one of the ecosystems/ botanic gardens to experience the plant diversity. Submit a report with photographs.
2. From a lot of given materials identify a particular group (macroscopic) following the classification studied.
3. Make micro preparations of vegetative and reproductive structures of the types mentioned in the syllabus.
4. Identify the algal specimens up to the generic level and make labelled sketches of the specimens observed.
5. Collect and preserve any two types of algae from your locality.

SEMESTER II : PRACTICAL

36 hrs

1. Grams staining – Curd.
2. Culture of microbes from soil through serial dilution and streak plate method.
3. Micro preparation and detailed microscopic analysis of *Rhizopus*, *Albugo*, *Saccharomyces*, *Penicillium*, *Xylaria*, *Peziza*, *Puccinia*, *Fusarium*. and *Parmelia* (Spotter only).
4. Preparation of bed for mushroom cultivation.
5. Staining of fungus using Lactophenol - Cotton Blue stain

SEMESTER – III

BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS AND PALEOBOTANY

Course Code : BO3CRT03
Teaching hours : 3 Hrs/ week (Hrs / Sem 54)
Credits : 3

**CORE
THEORY - 3**

Objectives

- Understand the diversity in habits, habitats and organization of various groups of plants.
- Understand the evolutionary trends in plants of lower groups.
- Study the anatomical variations in lower groups of plants.
- Understand the significance of Paleobotany and its applications.

BRYOLOGY

18 hrs

Module - 1

Introduction, General characters, Evolution of Gametophyte and Sporophyte among Bryophytes (Development of sex organs not required). Morphology, Anatomy and Reproduction of the following types (Developmental details are not required)

Hepaticopsida - *Riccia, Marchantia*

Anthocerotopsida - *Anthoceros*

Bryopsida - *Funaria*

Economic importance of Bryophytes.

PTERIDOLOGY

18 hrs

Module- 2

Introduction, general characters. Study the morphology, anatomy and reproduction of the following types (Developmental details are not required)

Psilophyta - *Psilotum*

Lycophyta - *Lycopodium, Selaginella*

Sphenophyta - *Equisetum*

Pterophyta - *Pteris and Marsilea.*

Stellar evolution in Pteridophytes; Heterospory and Seed habit; Economic importance of Pteridophytes.

GYMNOSPERMS

12 hrs

Module- 3

Introduction, General characters, Morphology, Anatomy and Reproduction of the following types (Developmental details are not required):

Cycadopsida - *Cycas*

Coniferopsida - *Pinus*

Gnetopsida - *Gnetum*

Affinities of Gymnosperms with Pteridophytes and Angiosperms. Economic importance of Gymnosperms.

PALAEOBOTANY

Module-4

6 hrs

Introduction, Geological time scale, Fossil formation and types of fossils. Indian contributions to Palaeobotany - Birbal Sahni

Study of Fossil gymnosperm- *Williamsonia*

REFERENCES

1. Chamberlain, C.J, 1935. Gymnosperms – Structure and Evolution, Chicago University Press. USA
2. Sporne, K.R. 1967. The Morphology of Gymnosperms. Hutchinson and Co. Ltd. London.
3. Srivastava, H.N. 1980. A Text Book of Gymnosperms. S. Chand and Co. Ltd., New Delhi.
4. Vasishta, P.C. 1980. Gymnosperms. S. Chand and Co., Ltd., New Delhi.
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16. Srivastava, H.N. 1998. A text book of Pteridophyta. . S. Chand and Co. Ltd., New Delhi.
17. Vasishta B.R. 1993, Pteridophyta – S. Chand and Co., Ltd., New Delhi.
18. Arnold C.A., 1947, Introduction to Paleobotany, Tata McGraw Hill, New Delhi.
19. Srivastava H.N., 1998. Palaeobotany, Pradeep Publishing Company, Jalandhar.

SEMESTER – IV

ANATOMY, REPRODUCTIVE BOTANY AND MICROTECHNIQUE

Course Code : BO4CRT04

Teaching hours : 3 Hrs/ week (Hrs / Sem 54)

Credits : 3

**CORE
THEORY - 4**

Objectives

- Imparting an insight into the internal structure and reproduction of the most evolved group of plants, the Angiosperm.
- Identifies role of anatomy in solving taxonomic and phylogenetic problems.
- Understand the structural adaptations in plants growing in different environment.
- Understand the morphology and development of reproductive parts.
- Get an insight in to the fruit and seed development.
- Understand the individual cells and also tissues simultaneously.

ANATOMY

28 hrs

Module-1

10 hrs

Cell wall - Sub-microscopic structure of cell wall- cellulose, micelle, micro fibril and macro fibril; structure and function of plasmodesmata, simple and bordered pits ; Different types of cell wall thickening in tracheary elements; extra cell wall thickening materials: - lignin, cutin, suberin and callose ; growth of cell wall- apposition, Intussusceptions. Non-living inclusions in plant cell - reserve food materials – Carbohydrates, nitrogenous products, fats and oils; secretory products- pigments, enzymes and nectar ; excretory products -nitrogenous waste products – alkaloid, non nitrogenous waste products – tannin, gums, resins, essential oils, mucilage, latex, mineral crystals- raphide, cystolith and alkaloids.

Module-2

18 hrs

Tissues - classification, Meristematic tissue;-definition, structure, function and classification. Apical meristem and theories of apical organization -Apical cell theory, Histogen theory, Tunica-Corpus theory.

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Permanent Tissue: - Structure and function of simple and complex tissues.

Secretory tissues: - a) External secretory tissue- glands and nectaries

b) Internal secretory tissues- laticifers.

Tissue systems - Epidermal Tissue System- Epidermis, Cuticle, Trichome, Stomata-stomatal types, Bulliform cells, Cork and Silica cells ; Ground Tissue System- Cortex, Endodermis, Pericycle, Pith and Pith rays ; Vascular Tissue System - Different types of vascular bundles and their arrangement in root and stem ; vascular cambium - structure, role of cambium in wound healing and budding.

Primary structure of stem, root and leaf (dicot and monocot). Normal secondary growth in Dicot stem and root; Periderm: Structure and development- phellum, phellogen, phelloderm, Bark, and lenticels; Wood anatomy - basic structure, heart wood, sap wood, hard wood, soft wood, growth rings and dendrochronology, porous and non-porous wood, ring porous and diffuse porous wood, tyloses, reaction wood- tension wood and compression wood.

Anomalous secondary thickening:- *Bignonia* stem, *Boerhaavia* stem and *Dracaena* stem.

REPRODUCTIVE BOTANY

18 hrs

Module-3

Introduction to Angiosperm Embryology. Floral morphology- parts of flower; Structure and development of anther, microsporogenesis, development of male gametophyte, dehiscence of anther, structure of pollen, pollen germination, pollen tube growth and pollen viability ; Structure and development of ovule, megasporogenesis, embryosacs-monosporic (*Polygonum* type),bisporic (*Allium* type) and tetrasporic (*Peperomia* type).Structure of mature embryo sac.

Pollination mechanisms and agencies of pollination; pollen-stigma interaction; compatibility and incompatibility; syngamy -double fertilization, triple fusion; Apomixis ; Structure of embryo-Dicot (*Capsella*), Monocot (*Sagittaria*) and Endosperm type, its development and Functions ; Poly embryony.

MICROTECHNIQUE

8 hrs

Module-4

Introduction - Killing and fixing, Purpose, killing agents-formalin, ethyl alcohol, fixing agents - Carnoys fluid, Farmers fluid, FAA ; Dehydration - Purpose, Agent used - Ethyl

Alcohol; Sectioning- Hand sections, serial section Microtome - rotary, sledge (application only); Staining techniques - Principle of staining ; Stains - Safranin, Hematoxylin, Acetocarmine, Vital stains - Neutral red, Evans blue; Mordants - Purpose with examples; Types of staining - single staining, double staining; Mounting and Mounting Media, Purpose of mounting media, Glycerine, DPX, Canada balsam; Use of permanent whole mounts, Permanent sections; maceration, Smear and squash preparations.

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SEMESTER III & IV PRACTICAL
BO3CRP03 & BO4CRP04
BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS, PALEOBOTANY
&
ANATOMY, REPRODUCTIVE BOTANY, MICROTECHNIQUE

Credits : 2

Practical hours : 72 Hrs

SEMESTER III : PRACTICAL

36 hrs

1. Study habit, anatomy of thallus and reproductive structures of *Riccia*, *Marchantia* (spotter only), *Anthoceros*, and *Funaria*.
2. Study habit and anatomy of stem of the following types.
Psilotum, *Lycopodium*, *Selaginella*, *Equisetum*, *Pteris*, *Marsilea*.
3. Study habit, anatomy of leaf and stem, morphology of reproductive structures of *Cycas*, *Pinus* and *Gnetum*.

SEMESTER IV : PRACTICAL

36 hrs

1. Cell types and tissues.
2. Non-living inclusions – starch grains, cystolith, raphides.
3. Primary structure of stem, root and leaf- Dicots and Monocots.
4. Stomatal types: - anomocytic, anisocytic, paracytic and diacytic type.
5. Normal Secondary structure of dicot stem and root.
6. Anomalous secondary structure of *Bignonia* stem, *Boerhaavia* stem, and *Dracaena* stem.
7. Identification of C.S. of anther and embryo.
8. Identification of various anther types - Monothealous, Dithealous
9. Pollen germination study (*in vitro*)
10. Familiarize stains, fixatives and mounting media.
11. Demonstration of hand sectioning.
12. Micropreparation using simple staining.

SEMESTER – V

RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

Course Code : BO5CRT05

Teaching hours : 3 Hrs/ week (Hrs / Sem 54)

Credits : 3

**CORE
THEORY - 5**

Objectives

- To understand the principles, working and applications of various instruments used in biological research.
- To learn various techniques used in Plant Science.

RESEARCH METHODOLOGY

12 hrs

Module- 1

Introduction to science. Steps in scientific methods - Observation and thoughts, Selection of a Problem, Formulation of a hypothesis Searching the literature .Experiments and need of control, Necessity of units and dimensions; Units of length, volume, area, concentration, temperature, pressure (SI Units). Laboratory Etiquette, Laboratory Hygiene Scientific literature - Books, Research Journals, Reputed National and International journals in Life sciences, INSDOC services; Patenting and Copyright.

Preparation of a dissertation: Introduction, review of literature, materials and methods, results, discussion, summary, conclusion, bibliography.

Preliminary pages - Title page, certificates, acknowledgements, contents page.

BASIC COMPUTER SKILLS

18 hrs

Module-2

Computer organization

Major components of a Digital computer - Input devices, Output devices – Monitor and Printers. CPU - Control Unit, ALU, Memory - types, Storage devices, Types of computers.

Operating system MS-WINDOWS. Application software's. MS-WORD - word processing using WORD, editing tools (cut, copy, paste,) formatting tools (font, paragraph) use of spell check, inserting tables (draw), inserting graphs and pictures; MS-EXCEL - Creating a worksheet, data entry, sorting (ascending and descending), use

of statistical tools in EXCEL (SUM, MEAN), preparation of graphs (bar diagram, pie chart and line graph and trendlines);

MS-POWERPOINT - Creating a presentation, inserting tables, charts and pictures into slides, Use of animation tools.

Network and communication - Computer networks - LAN, WAN, E-mail, Internet- as a knowledge repository, Internet terminologies URL, HTML, Web Browsers Search Engines, Wi Fi, Blue tooth, Study of educational sites related to life sciences (NCBI, DNAi, Scitable), academic search techniques,(Science direct and INFLIBNET)

BIOPHYSICS

14 hrs

Module-3

Microscopy – Introduction, Limits of resolution, Light microscopy- Bright field and Dark field. Electron microscopy – SEM, TEM (Brief account of working) Principles, working and applications of the following - Soxhlet extractor, Colorimeter, spectrophotometer (Beer-Lambert's Law), Centrifuge.

Chromatography- Paper, TLC, Column; Electrophoresis; PAGE; pH paper and pH meter.

BIOSTATISTICS

10 hrs

Module-4

Introduction, statistical terms and symbols.

Sample-concept of sample, sampling methods

Collection and presentation of data, graphic presentation of data (Line graph, Bar diagram, Pie diagram & Histogram)

Measures of central tendency - mean, median, mode.

Measures of dispersion - standard deviation.

Probability Distribution - normal distribution

Test of Hypothesis- Chi-square test and student's t- test-introduction, uses, procedure

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SEMESTER – V
GENETICS AND EVOLUTION

Course Code : BO5CRT06
Teaching hours : 3 Hrs/ week (Hrs / Sem 54)
Credits : 3

CORE
THEORY - 6

Objectives

- Imparting an insight into the principles of heredity
- Understand the patterns of inheritance in different organisms
- Understand the process of evolution and its role in speciation.

GENETICS **45 hrs**

Module - 1 **18 hrs**

Experiment of Mendel with *Pisum sativum*, recessive and dominant traits, alleles, principles of inheritance.

Modified Mendelian ratios- incomplete dominance and co dominance, Interaction of genes- comb pattern in poultry (9:3:3:1) ; epistasis- recessive coat color in mice (9:3:4); dominant epistasis- fruit color in summer squash (12:3:1) ; complementary genes- flower color in *Lathyrus* (9:7) ; multiple alleles- general account - ABO blood group in man, inheritance of Rh factor, psuedoalleles ; pleiotropism.

Quantitative characters - polygenic inheritance, continuous variation- kernel color in wheat/ear size in maize; chromosome theory of inheritance; Linkage and crossing over, recombination frequency, two point and three point test crosses; interference and coincidence; construction of linkage map.

Module - 2 **18 hrs**

Extra chromosomal inheritance- chloroplast mutation: variegation in Four o'clock plant; Infective heredity-Kappa particles in *Paramecium*.

Sex determination- sex chromosomes and autosomes- chromosomal basis of sex determination; XX-XY, XX-XO mechanism; sex determination in higher plants (*Melandrium album*); Chromosome theory of inheritance. Sex Linkage, eye color in

Curriculum and Syllabus 2017 Admission onwards

Drosophila, hemophilia in man; sex chromosomal abnormalities in man- Down's syndrome, Turner's syndrome, Klinefelter's syndrome.

Module – 3

9 hrs

Population Genetics - Genepool, Gene frequencies, Genotype frequencies, Hardy Weinberg Law, Agents of Evolution- Selection, Migration, Mutation and Genetic drift.

EVOLUTION

9 hrs

Module - 4

Introduction, Progressive, Retrogressive, Parallel and Convergent Evolution.

Theories of evolution – Lamarckism, Darwinism, Mutation theory of Hugo De Vries, Germplasm theory of Weismann, Neo Darwinism.

Speciation - Role of isolation mechanisms - Geographical and Reproductive isolation.

Evolution with respect to hybridization, polyploidy and Mutation.

REFERENCES

1. Benjamin A Pierce (2012). Genetics; a conceptual approach (4th Ed.), WH Freeman and Co.
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5. Monroe W Strickberger 2015 Genetics, Pearson Education Limited, London.

SEMESTER – V

CELL AND MOLECULAR BIOLOGY

Course Code : BO5CRT07
Teaching hours : 3 Hrs/ week (Hrs / Sem 54)
Credits : 3

**CORE
THEORY - 7**

Objectives

- Understand the Ultra structure and functioning of cell in the sub-microscopic and molecular level.
- Get an idea of origin, concept of continuity and complexity of life activities.
- Familiarization of life process.
- Understand the basic and scientific aspect of diversity.
- Understand the cytological aspects of growth and development.
- Understand DNA as the basis of heredity and variation.

CELL BIOLOGY

36 hrs

Module - 1

18 hrs

Historical account of cell Biology – Cell theory and Protoplasm theory, The physio-chemical nature of plasma membrane (Unit membrane and Fluid mosaic model) and cytoplasm. Ultra-structure of plant cell with structure and function of the following organelles- Endoplasmic reticulum, Plastids, Mitochondria, Ribosomes, Dictyosome, Microbodies, Lysosomes. Vacuole and cell sap (brief account only) Nucleus - ultra structure, structure and function of nucleolus, nuclear membrane, nucleoplasm and chromatin.

Module - 2

15 hrs

Morphology and types of chromosomes - Chromatin organisation -Nucleosome model -heterochromatin and euchromatin; karyotype and ideogram, Special types of chromosomes – giant chromosomes (salivary gland chromosomes and Lampbrush chromosomes –supernumerary chromosome (B chromosomes)
Cell cycle and its different stages, mitosis and meiosis; structure and function of Synaptonemal complex; significance of mitosis and meiosis.

Chromosomal aberrations- Euploidy – (Haploidy, Autopolyploidy, Allopolyploidy) and Aneuploidy- (Monosomy, Trisomy, Nullisomy)

Change in structure : Deletion, Duplication, Inversions and Translocations.

Module - 3

3 hrs

Mutation - definition, importance and types of mutations- Spontaneous and induced mutations. Mutagens- Physical(non-ionizing and ionizing radiations) and Chemical mutagens-Classification based on mode of action- (base analogues, alkylating agents, deaminating agents, acridine dyes, hydroxylating agents (brief description only); Chromosomal and point mutations. Molecular mechanism of mutation – Frame shift mutations, Transition, Transversion and Substitution

MOLECULAR BIOLOGY

18 hrs

Module - 4

Nucleic acids- DNA and RNA. Important features of Watson and Crick model of DNA, alternate forms of DNA –(A & Z), Structure and function of different types of RNA- tRNA, mRNA, and rRNA; Replication of DNA - Meselson-Stahl experiment - details of semiconservative replication of DNA , DNA repair (direct repair only)

Gene expression - concept of gene-definitions - the central dogma –reverse transcription; details of transcription in prokaryotes and eukaryotes - mRNA processing.

Details of translation - genetic code features, Wobble Hypothesis; Control of gene expression – inducible and repressible system - Operon model- lac operon and trp operon; Genetic basis of cancer -oncogenes - tumor suppressor genes – metastasis.

REFERENCES

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SEMESTER –V

ENVIRONMENTAL STUDIES AND HUMAN RIGHTS

Course Code : BO5CRT08
Teaching hours : 4 Hrs/ week (Hrs / Sem 72)
Credits : 3

**CORE
THEORY -8**

Objectives

- Acquaint the students with the significance of Environmental Science.
- Make the students aware about the extent of the total biodiversity and their conservation and the depletion of natural resources.
- Help the students to design novel mechanism for the sustainable utilization of natural resources.
- To understand the structure and function of the Ecosystems.
- Enable the students to understand various kinds of pollution in the environment, their impacts on the ecosystem and their control measures.
- Make the students aware about various environmental laws in India and the role of various movements in the protection of Nature and natural resources.
- Make the students aware of human rights.

ENVIRONMENTAL STUDIES 72 hrs

Module - 1 22 hrs

Environmental studies – definition, relevance, scope.

Eco systems- Structure and function- ecosystem components – abiotic – atmosphere, climate, soil, water; biotic- producers, consumers, decomposers.

Productivity- primary and secondary-gross and net productivity – homeostasis in the ecosystem; Concept of energy in ecosystems - Energy flow, food chain, food web, trophic levels, trophic structure and ecological pyramids – number, biomass, energy.

Nutrient cycles – biogeochemical cycles of C, N and S.

Population-size, density, natality, mortality, age, rate of natural increase, growth form and carrying capacity, population interactions between species- neutralism, competition, parasitism, predation, commensalism, mutualism; Community concept – biotic community, species diversity, species richness, dominance, growth forms and structure,

trophic structure, ecotone, edge effect, ecological indicators; Species, individual and ecosystem- habitat, ecological niche, micro-climate; Keystone species, Umbrella species
Ecosystem development - Ecological succession- Hydrosere, Xerosere, Climax community. Adaptations of plants to environment- Xerophytes, Hydrophytes, Epiphytes. Halophytes.

Module - 2

20 hrs

Environmental issues – global warming, greenhouse effect, ozone layer depletion. Climate change- causes and impact. Carbon sequestration; Environmental pollution-introduction, definition; Biomagnification. Air pollution – air pollutants, types, sources, effect of air pollution on plants and humans, control measures ; Water pollution-water pollutants, types, sources, impact – eutrophication, control measures, Quality standards –DO, BOD. Soil Pollution – causes, sources. Solid wastes – types – biodegradable, non-biodegradable, municipal wastes, agrochemicals, management of solid wastes, composting. EIA (brief account only)

Module - 3

24 hrs

Biodiversity- definition, Endemism - types, factors – RET - hot spots, hot spots in India, Western Ghats as hot spot. IUCN threat categories, Red data book; Wetlands and their importance; Biodiversity loss - causes and rate of biodiversity loss – extinction, causes - Alien Invasive plants, examples, impact on native biodiversity; Conservation, methods, *in-situ*, *ex-situ* -protected areas in Kerala- Botanic gardens, Sacred groves, Ramsar sites, Mangrove sites.

Joint Forest Management - people's participation in biodiversity conservation,

Eco-Development Committees - sustainable utilization of forests.

Ecotourism - Definition, relevance and scope. Ecotourism centers in Kerala. Positive and negative impacts of Ecotourism.

Global conservation efforts - Rio Earth Summit, Agenda 21, Kyoto protocol, COP 15 (15th Conference of the Parties under the UN Framework Convention on Climate Change) and its contribution - Paris protocol, major objectives; Conservation strategies and efforts in India and Kerala; Organizations, movements and contributors of Environmental studies and conservation - Organizations –WWF, Chipko, NEERI.

Contributors - Salim Ali, Sunder Lal Bahuguna, Madhav Gadgil, Anil Agarwal, Medha Patkar, Vandana Siva, Kalen Pokkudan [Brief account only].

Environmental Legislation and Laws - Environment (protection) Act 1986, Air (protection and control of pollution) Act, 1981, Water (protection and control of pollution) Act, 1974, Wildlife (protection) Act, 1972, Forest (conservation) Act, 1980, Biological Diversity Act 2002 [Brief account only].

Module - 4

6 hrs

Human Rights – Concept, Origin and Definitions – Types of Human Rights – UNO and UDHR – Human Rights and Indian Constitution –Contemporary Human Rights Issues – Women Rights – Child Rights – Rights of Minorities and Dalit's – HIV/AIDS – National and State Human Rights Commission.

REFERENCES

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SEMESTER – V

OPEN COURSE

AGRIBASED MICROENTERPRISES

Course Code : BO5OPT01

Teaching hours : 4 Hrs/ week (Hrs / Sem 72)

Credits : 3

**OPEN
COURSE**

Objectives

- To get a basic information about the entrepreneurial opportunities in Plant Sciences.
- To get an idea about sustainable agriculture and Organic Farming.
- Inculcate an enthusiasm and awareness about ornamental gardening, nursery management and mushroom cultivation.

Module - 1

16 hrs

Organic farming and composting techniques-Organic manures and fertilizers. Composition of fertilizers – NPK content of various fertilizers. Common organic manures – bone meal, cow dung, poultry waste, oil cakes, organic mixtures and compost. Preparation of compost –aerobic and anaerobic- advantages of both; vermicompost – preparation, vermiwash. Biofertilizers – definition, types – *Trichoderma*, *Rhizobium*, PGPR. Biopesticides, Biological control. Sustainable agriculture.

Module - 2

28 hrs

- a. Horticulture and Nursery management.-Soil components. Preparation of potting mixture. Common Garden tools and implements. Methods of plant propagation – by seeds – advantages and disadvantages. Vegetative propagation – advantages and disadvantages. Natural methods of vegetative propagation. Artificial methods – cutting, grafting, budding and layering. Use of growth regulators for rooting. Micropropagation by tissue culture – advantages and disadvantages. Gardening – Types of garden – ornamental, indoor garden, kitchen garden, vegetable garden for marketing. Rockery and artificial ponds. Ornamental garden designing – garden components – flower beds, borders, hedges, edges, drives and paths, garden adornments. Lawn - preparation by seeds, by transplanting seedling and by turfing. Annuals, Biennials, Shrubs, Trees, Cycads and Palms. Bonsai preparation. Pruning of plants. Types of Nurseries – Management aspects and Maintenance. Plant growth structures – advantages of green house, polyshed, fernery and orchidarium. Packaging of fruits, vegetables, nursery products and flowers.
- b. Plant tissue culture and micropropagation-Protoplast- basic structure and function of plant cell; concept of totipotency- differentiation and dedifferentiation. Infra structure of a tissue culture laboratory; Solid and liquid media- composition and preparation. Sterilization- dry, wet and filter sterilization. Explant- inoculation and incubation techniques. Callus induction- organogenesis and embryogenesis. Transplanting, hardening, package and transportation of tissue cultured plantlets

Module - 3

12 hrs

Food spoilage and preservation techniques.- Causes of spoilage. Preservation techniques – asepsis, removal of microorganisms, anaerobic conditions and special methods – by drying, by heat treatment, by low temperature storage and by chemicals (Food Additives). Preparation of wine, vinegar, pickle and dairy products (Milk peda, Ice cream and Paneer)

Module - 4

16 hrs

Mushroom cultivation and Spawn production.- Significance of Mushrooms, General outline of life cycle. Types of mushrooms - button mushroom, oyster mushroom and milky mushroom, poisonous mushroom – methods of identification. Spawn – isolation and preparation. Cultivation of oyster mushrooms – using paddy straw and saw dust by

polybag. Farm design and control of pests and diseases. Value added products from mushroom – pickles, candies, dried mushrooms.

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SEMESTER – VI

PLANT PHYSIOLOGY AND BIOCHEMISTRY

Course Code : BO6CRT09
Teaching hours : 4 Hrs/ week (Hrs / Sem 72)
Credits : 3

**CORE
THEORY -9**

Objectives

- Acquire the basic knowledge needed for proper understanding of plant functioning.
- Familiarize with the basic skills and techniques related to Plant Physiology
- Understand the role, structure and importance of the bio molecules associated with Plant life.

PLANT PHYSIOLOGY 48 hrs

Module - I 12 hrs

Plant water relations- Diffusion, imbibition, osmosis, OP, DPD, TP, WP; water potential – concepts and components (pressure potential, gravity potential, osmotic potential and matric potential), Absorption of water – active and passive, pathway of water movement – apoplastic and symplastic pathway; Ascent of sap – cohesion-tension theory; transpiration – types, mechanism, theories (Starch-sugar, Proton-K⁺ ion exchange), significance, Antitranspirants, Guttation.

Plant solute relation- Mineral Nutrition – role of major and minor elements in plant nutrition, deficiency symptoms of major elements, mineral uptake – Passive (Ion exchange) and Active (Carrier concepts).

Module - 2 24 hrs

- a.** Photosynthesis- history, photosynthetic pigments, photo excitation – fluorescence, phosphorescence, Absorption spectrum and Action spectrum ,Red drop and Emerson enhancement effect; photosystems – components and their organization (the four complexes of thylakoid membrane); cyclic and non-cyclic photophosphorylation; carbon assimilation pathways – C₃, C₄, CAM; Photorespiration (brief study only); factors affecting photosynthesis, Blackmans law of limiting factors.

Curriculum and Syllabus 2017 Admission onwards

Translocation of Solutes-Pathway of phloem transport, mechanism (Pressure flow), Phloem loading and unloading.

- b. Respiration-Anaerobic and aerobic; Glycolysis, Krebs' cycle, mitochondrial electron transport system – components, oxidative phosphorylation, ATPase, chemiosmotic hypothesis; RQ, Significance and factors affecting respiration.

Module - 3

12 hrs

- a. Growth and Development-plant hormone – their physiological effect and practical applications - auxins, gibberellins, cytokinins, ABA and ethylene. Abscission and senescence [Brief account only].
- b. Plant movements - tropic movements - geotropism and phototropism, nastic movements - sesimonastic and nyctinastic movements
- c. Physiology of flowering – phytochrome, photoperiodism, vernalization
- d. Stress Physiology: Concepts of plant responses to Abiotic stresses (water, salt, temperature), Biotic stress (pathogens).

BIOCHEMISTRY

24 hrs

Module - 4

Physical and chemical properties of water, acid and bases; pH - definition, significance, measurement, pH indicators; buffers, applications.

Carbohydrates-structure and functions of mono (glucose and fructose), di(maltose and sucrose) and polysaccharides(starch and cellulose).

Proteins - peptide bond, amino acids – basic categories, structural levels of proteins (primary, secondary, tertiary, eg. Insulin and Quarternary eg. Haemoglobin).

Lipids - General features and their roles, fatty acid types and structure (saturated and unsaturated), classification –simple (fats and oils) compound, derived lipids, structure and functions; β -Oxidation.

Enzymes-Nomenclature, mechanism and regulation of enzyme action, enzyme kinetics (Michaelis- Menten) factors affecting enzyme action.

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SEMESTER – VI

ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

Course Code : BO6CRT10

Teaching hours : 4 Hrs/ week (Hrs / Sem 72)

Credits : 3

**CORE
THEORY -10**

Objectives

- Acquaint with the aims, objectives and significance of Taxonomy.
- Identify the common species of plants growing in Kerala and their systematic position.
- Acquaint with the basic technique in the preparation of Herbarium.
- Familiarizing with the plants having immense economic importance.

MORPHOLOGY

15 hrs

Module - 1

Leaf Morphology - Types, venation, phyllotaxy, Morphology of flower- Flower as modified shoot-detailed structure of flowers-floral parts-their arrangement, relative position, symmetry, aestivation and placentation types-cohesion and adhesion- Floral Diagram and Floral Formula. Inflorescence - Racemose types - Simple Raceme, Corymb, Umbel, Spike, Spadix, Head and Catkin, Cymose types - Simple Cyme, Monochasial - Scorpioid and Helicoid, Dichasial and Polychasial, Special type- Cyathium, Hypanthodium, Verticillaster, Thyrsus.

Fruits-classification - Simple, Fleshy-(Drupe, Berry, Pepo, Hesperidium), Dry Dehiscent (Legume, Follicle, Capsule), Indehiscent-(Caryopsis, Cypsella, Nut), Aggregate, Multiple - (Sorosis, Syconus) with examples.

SYSTEMATIC BOTANY

49 hrs

Module - 2

7 hrs

Aim, Scope and Significance of Taxonomy, Types of Classification- Artificial (Brief account only), Natural – Bentham and Hookers (Detailed account) and Phylogenetic (Brief account only). Angiosperm Phylogeny Group system (Introduction only); Plant nomenclature - binomial, ICBN/ICN - Principles-Rule of priority and author citation.

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Interdisciplinary approach in Taxonomy- Cytotaxonomy and Chemotaxonomy, Embryology in relation to taxonomy:

Herbarium technique - Preparation of herbarium, their preservation. Important herbaria, Botanical Gardens and BSI.

Module- 3

42 hrs

Detailed study of families-Study the following families of Bentham and Hooker's System with special reference to their morphological and floral characters. Special attention should be given to common and economically important plants within the families, Annonaceae, Nymphaeaceae, Malvaceae, Rutaceae, Meliaceae, Anacardiaceae, Leguminosae (Mimosaceae, Caesalpiniaceae and Fabaceae), Combretaceae, Myrtaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Asclepiadaceae, Sapotaceae, Solanaceae, Convolvulaceae, Scrophulariaceae, Acanthaceae, Verbenaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Liliaceae, Arecaceae, Poaceae.

ECONOMIC BOTANY AND ETHNOBOTANY

8 hrs

Module- 4

Study of the following groups of plants based on their uses with special reference to the botanical name, family and morphology of the useful part - Cereals - Rice, Wheat ; Millets- Ragi ; Pulses- Green gram, Bengal gram, Black gram; Sugar yielding plants – Sugarcane; Fruits- Apple, Pineapple, Orange, Mango and Banana ; Vegetables- Bittergourd, Ladies finger, Carrot and Cabbage; Tuber crops- Tapioca; Beverages- Tea, Coffee ; Oil yielding plants- Ground nut, Coconut, Gingelly; Spices – Cardamom, Pepper, Cloves, Ginger ; Timber yielding plants- Teak wood and Jack wood ; Fibre yielding plants- Coir, Jute, Cotton ; Rubber yielding plants- Para rubber ; Gums and Resins- White dammar, Gum Arabic, Asafoetida ; Insecticide yielding Plants- Neem.

Ethnobotany - Introduction, scope and significance; Study of the following plants used in daily life by tribals and village folks for Food, Shelter and Medicine , Food – *Artocarpus hirsutus*, *Corypha*, *Phoenix sylvestris* ; Shelter - *Bambusa*, *Ochlandra* and *Calamus* ; Medicine – *Curcuma longa*, *Trichopus zeylanicus* and *Alpinia galanga*.

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SEMESTER –VI

BIOTECHNOLOGY AND BIOINFORMATICS

Course Code : BO6CRT11

Teaching hours : 3 Hrs/ week (Hrs / Sem 54)

Credits : 3

CORE
THEORY -11

Objectives

- Understand the current developments in the field of Biotechnology and Bioinformatics
- Equip to carry out Plant tissue culture
- Introduce the vast repositories of biological data knowledge
- Equip to access and analyze the data available in the databases.

BIOTECHNOLOGY

36 hrs

Module – 1

18 hrs

Concept of Cellular totipotency, landmarks in Biotechnology. Plant tissue culture – Principles and techniques - *in vitro* differentiation– de-differentiation and re-differentiation, callus induction, organogenesis and somatic embryogenesis; basic components of tissue culture media, inorganic nutrients, carbon source, vitamins, organic supplements, plant hormones, gelling agents, pH of medium, general methodology of medium preparation with special reference to MS medium ; sterilization of equipments, glassware, medium and explants; working of hot air oven, autoclave and laminar air flow chamber. Micropropagation- different methods – axillary bud proliferation, meristem and shoot tip culture, direct and indirect organogenesis, somatic embryogenesis; hardening, transplantation and field evaluation, advantages and disadvantages of micropropagation; somaclonal variations; production and application of haploids through tissue culture, Protoplast culture - isolation, culture methods, fusion techniques, somatic hybrids, cybrids, cryopreservation of plant cells.

Module - 2

18 hrs

Recombinant DNA construction- Gene cloning strategies - cloning vectors – plasmids - pBR322 and pUC series, bacteriophage based vector- M13; DNA based vector; Agrobacterium Ti plasmid based vectors; Restriction endonucleases and ligases – ligation techniques; transformation and selection of transformants using antibiotic

resistances markers; Southern blotting; PCR .Different methods of gene transfer – Chemically stimulated DNA uptake by protoplasts, transduction, electroporation, microinjection, microprojectiles, Agrobacterium mediated gene transfer. Gene library, gene banks.

Applications of Biotechnology in Medicine – Production of human insulin, human growth hormone and vaccines, gene therapy, monoclonal antibodies.

Forensics – DNA fingerprinting.

Agriculture – Genetically modified crops – Bt crops, Golden rice, Flavr Savr tomato, virus and herbicide resistant crops, edible vaccines.

Environment – Bioremediation – use of genetically engineered bacteria – super bug.

Industry – Horticulture and Floriculture Industry, production of vitamins, amino acids, organic acids and alcohols.

BIOINFORMATICS

18 hrs

Module – 3

9 hrs

An Introduction to Bioinformatics, objectives and applications of Bioinformatics. Biological data bases, primary and secondary databases, composite database - nucleic acid sequence databases – NCBI-GenBank, ENA, DDBJ; Protein databases-SWISS-PROT, PDB ; Genome sequencing – whole genome shotgun approach and map based approach, major findings of the following genome projects – Human, *Arabidopsis thaliana*, *Drosophila*; bibliographic database : PubMed

Module – 4

9 hrs

Pair wise sequence alignment; global alignment- Use of LALIGN; local alignment- Use of BLAST; multiple sequence alignment – Clustal X, molecular phylogeny and phylogenetic trees; Molecular structure viewers- RasMol and Jmol basic commands.

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SEMESTER –VI

PLANT BREEDING, HORTICULTURE AND PLANT PATHOLOGY

Course Code : BO6CRT12

Teaching hours : 3 Hrs/ week (Hrs / Sem 54)

Credits : 3

**CORE
THEORY - 12**

Objectives

- Understand the methods of crop improvement
- Understand the importance of Horticulture in human welfare
- Understand the various plant diseases and their impact on agriculture.
- Familiarize with the various measures adopted to control plant diseases.

PLANT BREEDING

18 hrs

Module – 1

Introduction and objectives of Plant Breeding.

Plant introduction - Procedure of plant introduction - quarantine regulations, acclimatization, agencies of plant introduction in India, major achievements.

Selection- mass, pure-line, clonal - achievements.

Hybridization - Procedure, Types - inter-varietal, inter-specific and inter-generic hybridization with examples, heterosis in plant breeding, inbreeding depression, genetics of heterosis and inbreeding depression, Handling segregating generations- pedigree method, bulk method, back cross method.

Male sterility in plant breeding; Use of apomixis in plant breeding; Mutation breeding and polyploidy breeding - methods and application.

Genetic engineering in crop improvement (Brief account only). Plant breeding centers in India.

HORTICULTURE

18 hrs

Module – 2

10 hrs

Introduction to Horticulture - Definition, history, classification of Horticultural plants, disciplines of Horticulture – Pomiculture, Olericulture, Floriculture, Arboriculture.

Garden implements. Irrigation methods- surface, sub, drip and spray irrigations, mist chambers; advantages and disadvantages. Brief account on propagation of horticultural plants by seeds- Seed viability, seed dormancy, seed testing and certification, seed bed preparation, seedling transplanting, hardening of seedling; advantages and disadvantages of seed propagation. Vegetative propagation - natural and artificial, artificial methods - cutting, layering, grafting and budding, micro propagation; advantages and disadvantages of Vegetative propagation.

Module – 3

8 hrs

Gardening - Types of garden. Brief account on - ornamental garden, indoor garden, kitchen garden, aquatic garden, vertical garden, medicinal garden, terrace garden, terrarium; famous gardens of India. Garden designing - garden components- lawns, shrubs and trees, borders, topiary, hedges, edges, walks, drives - Garden adornments ; Introduction to Landscape architecture- design, home landscape and parks. Physical control of plant growth- training and pruning. Bonsai -selection of plant for bonsai, bonsai containers and method of bonsai formation. Method of cultivation – rose, orchids, Lawn. Plant growing structures – green house, orchidarium, conservatory ; Potting mixture – components-sand ,soil, organic matter; vermiculite, perlite, peat, coarse sand, Charcoal, brick pieces, coconut fiber.

PLANT PATHOLOGY

18 hrs

Module – 4

History of plant pathology, Classification of plant diseases on the basis of causative organism and symptoms, Host - parasite interaction, Defence mechanism in host, Mechanism of infection, transmission and dissemination of diseases. Control of plant diseases – Prophylaxis-quarantine measures, seed certification; Therapeutic – physical therapy, chemotherapy; Biological control. Study of following diseases with emphasis on symptoms, disease cycle and control- Bunchy top of Banana, Bacterial blight of Paddy, Root wilt of Coconut, Abnormal leaf fall of Rubber, Leaf mosaic disease of Tapioca,

Quick wilt of Pepper. Fungicides - Bordeaux mixture, Neem decoction. (Brief account only).

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SEMESTER –VI

AGRIBUSINESS

Course Code : BO6CBT01
Teaching hours : 3 Hrs/ week (Hrs / Sem 54)
Credits : 3

**Choice Based
Course**

Objectives

- Inculcate and impart an idea about the entrepreneurial opportunities in the field of Plant Science.
- Give an idea about the need of sustainable development and organic farming.
- Harness the opportunities and potentials in the fields of Ecotourism, Processing technology and Food science.

Module - 1

3 hrs

ENTREPRENEURSHIP

Entrepreneur – Concept, Types, Basic qualities. Role of Kerala State Industrial Development Corporation (KSIDC), Micro Small Medium Enterprises (MSME), Khadi and Village Industries Board (KVIB), Self Help Groups, Kudumbasree and Neighbourhood groups on Entrepreneurship Promotion.

Module - 2

30 hrs

FARMING TECHNIQUES

a. Organic Farming and Composting Techniques.

Common organic manures – Bone meal, cow dung, poultry waste, oil cakes, organic mixtures and compost. Preparation of compost – aerobic and anaerobic- advantages and limitations. Vermicompost – preparation - Vermiwash – preparation; Biofertilizers – Definition and preparation of different types – Trichoderma, Rhizobium, PGPR, PSB, Mycorrhiza. Application of Biofertilizers. Biopesticides - Neem decoction. Biological control of diseases and pests, Organic traps.

b. Cultivation of Vegetables, Fruits and Medicinal Plants.

Types – Home gardening, Terrace gardening, Market gardening and Truck gardening. Packing and Transporting of Vegetables.

Organic farming of fruit crops – Packing and Transporting of fruits.

Induction of flowering and weed control.

Cultivation of Medicinal and Aromatic plants.

c. Floriculture

Problems and prospects of Floriculture in Kerala.

Scope of growing Anthurium, Orchids and Jasmine in Kerala.

Common cut flowers – Rose, Gerbera, Gladiolus, Aster, *Chrysanthemum*, Daisys, Carnation, Golden rod, Anthurium, Orchids, Liliun and Limolium.

Common leaves used in flower arrangement – *Cyprus*, *Podocarpus*, *Asparagus*, Palms, Cycads, Ferns and *Eucalyptus*.

Applications

Flower Arrangement.

Types - Western, Eastern (Japanese/ Ikebana) and Modern.

Wases, Flower Holders and Floral Foam.

Wase life of flowers and leaves.

After care of flower arrangements – Bouquets.

Packing and Maintenance of flowers and leaves.

Module - 3

16 hrs

a. VALUE ADDED FOOD PRODUCTS

Preparation and Preservation Techniques. Causes of Spoilage of Food. Principles of preservation – asepsis, removal of microorganisms, anaerobic situation and special methods – drying, thermal processing – pasteurization, sterilization and canning – low temperature, use of chemical preservatives and food additives. Preparation of wine, vinegar, pickles, jam, jelly, syrups, sauce, dry fruits, dairy products – (cheese, butter, yoghurt, paneer), candies, chocolates, payasam, kondattum.

b. PROCESSING TECHNIQUES.

Processing of latex – Centrifuged latex products and galvanized rubber products.

Processing, storage and marketing of Cocoa, Coconut (Copra ,Coir and Tender

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coconut), Rice (par boiled, raw rice and rice flour), Pepper, Cardamom, Ginger, Arrowroot, Tapioca, Cashew, Mango, Jack fruit, Guava, Grapes, Lemon, Papaya, Musa, Garcinia. Basic principles of preparation of Lehyam and Decoction.

Module - 4

5 hrs

GARDEN DESIGNING.

Landscaping

Use of different garden components.

Lawn preparation by seeds, seedling and turfing.

Maintenance of garden by Irrigation, Pruning, Repotting.

Diseases and Pests control.

REFERENCES

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SEMESTER –VI
PLANT GENETIC RESOURCES

Course Code : BO6CBT02
Teaching hours : 3 Hrs/ week (Hrs / Sem 54)
Credits : 3

Choice Based
Course

Objectives:

- To understand the diversity of crop plants.
- To understand their conservation strategies.
- To familiarise underutilized plants and their importance.

Module - 1

8 hrs

Introduction - History of crop plants, Centers of origin - Vavilovian concept - primary and secondary centers. Exploration and collection of genetic resources - importance of wild relatives of crop plants and their role in crop improvement.

Module - 2

28 hrs

Plant genetic resources – Land races – Obsolete varieties – varieties in cultivation – Breeding lines – Wild forms and wild relatives. Endemism and biodiversity hot spots. Important Crop plants of Kerala : Binomial ,family and uses of the following food crops : Cereals – Rice ; Tuber crops - Tapioca; Vegetables - Elephant foot yam, Cow pea, Bitter gourd; Spices- Ginger, Black pepper, Nutmeg, Cardamom; Medicinal plants - Vasaka, Aloe; Plantation crops – Rubber, Coffee, Cashew, Coconut, Tea; Fruits - Banana, Pineapple, Mango.

Underexploited and underutilized plants - future food crops : Uses of the following edible plants – Vegetables - *Averrhoa bilimbi* (Bilimbi, Chemmeenpuli, Irumbampuli), *Averrhoa carambola* (Carambola apple, Chathurappuli), *Canavalia gladiata* (Sword bean, Valpayar), *Dioscorea esculenta* (Cherukizhangu, Nanakizhangu), *Flacourtia montana* (Kattuloovika).

Ipomoea turbinate (Nithya Vazhuthana); *Psophocarpus tetragonolobus* (Winged bean, Chathurapayar), *Sauropus androgynus* (Velicheera, Chikurmanis, Sauropus), Fruits - *Artocarpus heterophyllus* (Jack, Plavu, Chakka), *Artocarpus hirsutus* (Anjili, Ayani,

Wild Jack), *Aporosa cardiosperma* (Vetti), *Spondias pinnata* (Ambazham, Hog plum), *Syzygium cumini* (Njara, Njaval, Black plum),

Module - 3

6 hrs

Major threats to plant genetic resources: Genetic erosion - human interference - over exploitation of resources - deforestation - alien invasive plants – natural calamities.

Module - 4

12 hrs

Conservation of plant genetic resources: *In situ* - Biosphere reserves, National parks and Wildlife sanctuaries. *Ex situ* - Seed banks, Field gene banks; Tissue culture storage and Cryopreservation – DNA banks. Conservation of endangered plants - IUCN - role and activities. Documentation of endangered and threatened plants - Red data book. Role of Governmental and non-governmental organizations in plant genetic resource management; Governmental organizations - Regional – JNTBGRI and KFRI; National - BSI and NBPGR; International – IPGRI (IBPGR) and ICRISAT; Non-Governmental Organizations - WWF and MNHS.

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SEMESTER –VI
PHYTOCHEMISTRY

Course Code : BO6CBT03
Teaching hours : 3 Hrs/ week (Hrs / Sem 54)
Credits : 3

Choice Based
Course

Objectives:

- To familiarize the common separation techniques used in Phytochemistry.
- To get a knowledge of the important phytochemicals present in medicinal and aromatic plants.
- To understand the common medicinal and aromatic plants and their uses.

Module - 1 **2 hrs**

Introduction to Phytochemistry: Primary and Secondary metabolites in plants.

Module - 2 **12 hrs**

Extraction of phytochemicals: Extraction and characterisation techniques: cold extraction, hot extraction - soxhlet-clevenger apparatus; Solvents - petroleum ether, chloroform, ethanol, water. Separation techniques – Column chromatography, TLC, HPLC. Characterization techniques - GC/MS, HPTLC, UV Spectra, IR Spectra.

Module - 3 **10 hrs**

Effect of phytochemicals: Study of the drug plants and their active principles - Properties, functions and pharmacological uses of Alkaloids, Terpenoids, Phenolics and Flavonoids.

Module - 4 **30 hrs**

Study of the following plants with special reference to the binomial, family, parts used, medicinal and aromatic properties and uses : *Acorus calamus*, *Adhatoda vasica*, *Aerva lanata*, *Aegle marmelos*, *Allium sativum*, *Aloe vera*, *Asparagus racemosus*, *Azadirachta indica*, *Bacopa monnerii*, *Boerhaavia diffusa*, *Carica papaya*, *Curcuma longa*, *Eclipta alba*, *Leucas aspera*, *Ocimum sanctum*, *Phyllanthus niruri*, *Punica granatum*, *Sida acuta*, *Tinospora cordifolia*, *Tylophora indica*, *Withania somnifera* and *Zingiber officinale*. Aromatic plants : *Cananga odorata*, *Cinnamomum zeylanicum*, *Cymbopogon*

sps., *Eucalyptus* spp., *Mentha piperita*, *Ocimum basilicum*, *Rosa* spp., *Santalum album*, *Syzygium aromaticum* and *Vetiveria zizanoides*.

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SEMESTER V & VI PRACTICAL
BO5CRP05 & BO6CRP09
RESEARCH METHODOLOGY, BIOPHYSICS, BIOSTATISTICS
&
PLANT PHYSIOLOGY AND BIOCHEMISTRY

Credits : 2

72 Hrs

SEMESTER V : PRACTICAL

36 hrs

1. Prepare CuSO₄. H₂O solution of different molarity using a stock solution
2. Determination of the area of different types of leaves using graph paper
3. Gather information and pictures on a given topic using the internet. Make a list of the sites visited for the purpose
4. Prepare a worksheet using a set of data collected and find out the SUM, MEAN using EXCEL
5. Prepare suitable tables/ charts/graphs based on the data using EXCEL
6. Prepare a PowerPoint presentation based on the 1& 2 exercises.
7. Measurement of pH using pH meter
8. Determination of the concentration of a sample solution using Colorimeter/ Spectrophotometer
9. Collect numerical data and find out the central tendencies and Standard deviation and prepare different types of graph mentioned in the syllabus using EXCEL

SEMESTER VI : PRACTICAL

36 hrs

Core Experiments.

1. Determination of osmotic pressure of plant cell sap by Plasmolytic method.
2. Compare the stomatal indices of Hydrophytes, Xerophytes and Mesophytes.
3. Separation of plant pigments by paper chromatography.
4. Measurement of photosynthesis by Wilmott's Bubbler/any suitable method.
5. Estimation of plant pigments by Colorimeter.

Demonstration experiments.

6. Demonstration of Osmosis using plant membrane

7. Demonstration of tissue tension.
8. Relation between transpiration and absorption.
9. Necessity of chlorophyll, light and CO₂ in photosynthesis.
10. Evolution of Oxygen during photosynthesis.
11. Simple Respiroscope
12. Respirometer and measurement of R.Q.
13. Fermentation.
14. Measurement of transpiration rate using Ganong's Potometer..

Biochemistry

1. General test for carbohydrates- Molisch's test, Benedicts's test, Fehling's test.
2. Colour test for starch – Iodine test.
3. Colour tests for proteins in solution. Biuret test, Million's test, Ninhydrin test.
4. Detect the presence of any two major organic compounds in the given food stuff/material viz. reducing /non-reducing sugar/fat /proteins/starch/ sucrose.

SEMESTER V & VI PRACTICAL

BO5CRP06 & BO6CRP10

GENETICS, EVOLUTION

&

ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

Credits : 2

Practical hours : 72 Hrs

SEMESTER V: PRACTICAL

36 hrs

Genetics

1. Work out problems in:
 - a. Monohybrid, dihybrid and test crosses.
 - b. All types of modified Mendelian ratios mentioned in the syllabus.

SEMESTER VI: PRACTICAL

36 hrs

1. Identify the following inflorescence and fruits-
 - (a) Inflorescence - Simple raceme, Spike, Corymb, Head, Simple Cyme, Cyathium and Hypanthodium
 - (b) Fruits – Simple - Fleshy- Berry, Drupe, Pepo, Hesperidium. Dry-Indehiscent –Nut; Dehiscent- Legume, Capsule (loculicidal). Aggregate
2. Identify the families mentioned in the syllabus by noting their vegetative and floral characters.
3. Students must describe the floral parts, draw the L.S., floral diagram and write the floral formula of at least one member from each family.
4. Study the finished products of plants mentioned in Economic Botany with special reference to the botanical name, family and morphology of useful part.
5. Prepare herbarium of 25 plants with field notes.
6. Conduct field work for a minimum of 3 to 5 days under the guidance of a teacher and submit report.
7. Identify and describe the ethnobotanical uses of the items mentioned in the syllabus.

SEMESTER V & VI PRACTICAL
BO5CRP07 & BO6CRP11
CELL, MOLECULAR BIOLOGY
&
BIOTECHNOLOGY AND BIOINFORMATICS

Credits : 2

Practical hours : 72 Hrs

SEMESTER V: PRACTICAL

36 hrs

1. Make acetocarmine squash preparation of Onion root tip to identify mitotic stages.
2. Identify and study photographs and diagrams of cell division anomalies like lagging chromosomes, chromatin bridge, aneuploidy, polyploidy. Study the chromosomal patterns/ Karyotype in auto-, allo-, and aneuploids
3. Work out elementary problems based on DNA structure and replication. (10 Nos.)

SEMESTER VI: PRACTICAL

36 hrs

1. Preparation of nutrient medium – Murashige and Skoog medium (Demonstration only).
2. Immobilization of whole cells or tissues in Sodium alginate.
3. Isolation of DNA from plant tissue
4. Study of genetic engineering tools and techniques using photographs / diagram (PCR, Agarose gel electrophoresis unit, UV transilluminator, pBR 322, SDS)
5. Familiarizing GEN BANK, DDBJ, ENA, SWISS-PROT and PDB databases
6. Analysis of structural features of proteins using protein data bank and RasMol
7. Local alignment of sequences using BLAST
8. Retrieving a few research papers related to Genetic engineering from Pub Med.

SEMESTER V & VI PRACTICAL

BO5CRP08 & BO6CRP12

ENVIRONMENTAL STUDIES

&

PLANT BREEDING, HORTICULTURE AND PLANT PATHOLOGY

Credits : 2

Practical hours : 72 Hrs

SEMESTER V: PRACTICAL

36 hrs

1. Estimation of CO₂ and Cl of water samples (Titremetry)
2. Determination of pH of soil and water.
3. Assessment of diversity, abundance and frequency of plant species by Quadrat method.
4. Identification of pollutant to respective pollution types using photographs.
5. Study of morphological and anatomical adaptations of plants to the environment (Xerophytes, Hydrophytes, Epiphytes, Halophytes).

SEMESTER VI: PRACTICAL

36 hrs

1. Emasculation and bagging
2. Estimation of pollen sterility.
3. Approach grafting, Budding ('T', patch), air layering.
4. Identification of different garden tools and their uses.
5. List out the garden components in the photograph.
6. Preparation of potting mixture.
7. Identify the diseases mentioned in the syllabus with respect to causative organisms and symptoms.
8. Learn the technique of preparing Bordeaux mixture.

**SYLLABUS FOR B. Sc. BOTANY
COMPLEMENTARY COURSE**

SEMESTER –1

CRYPTOGAMS, GYMNOSPERMS AND PLANT PATHOLOGY

Course Code : BO1CMT01

Teaching hours: 2 Hrs/ week (Hrs / Sem 36)

Credits : 2

Objectives

- Acquire fundamental knowledge in Plant Science and to make the student to understand that Botany is an integral part of the human life and developments.
- Understand the diversity of microbes and plants with respect to Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms.

CRYPTOGAMS

36 hrs

Module – 1

18 hrs

Algae - classification based on pigments, thallus and habitat diversity and life history of the following groups - Cyanophyceae - *Nostoc* ; Chlorophyceae - *Volvox*, *Cladophora*; Phaeophyceae – *Sargassum*; Rhodophyceae – *Polysiphonia* ; Economic importance of Algae.

Fungi - Classification, Main features and life history of the following groups- Phycomycetes – *Phytophthora*; Ascomycetes – *Peziza*; Basidiomycetes – *Puccinia*. Economic importance of Fungi Lichens - classification, general account and economic importance of Lichens ; morphology, anatomy, reproduction and life cycle of *Parmelia*.

Module – 2

7 hrs

Bryophytes, general account; morphology, anatomy, reproduction and life cycle of *Riccia* ; Pteridophytes, general account, morphology, anatomy, reproduction and life cycle of *Selaginella*.

GYMNOSPERMS

Module – 3

7 hrs

Gymnosperms, general account; morphology, anatomy, reproduction and life cycle of *Cycas*.

PLANT PATHOLOGY

Complementary
Theory I

Module – 4

4 hrs

Classification of plant diseases on the basis of causative organism and symptoms ; Study the following diseases with special emphasis on causative organism, symptoms and control measures – Nut fall of Arecanut, Bacterial blight of Paddy, Leaf mosaic of Tapioca

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8. Gangulee H.C. and Kar A. K. 1993. College Botany Vol. II, New Central Book Agency. Calcutta
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10. Mamatha Rao. 2009. Microbes and Non-flowering plants, Impact and Applications, Ane Books Pvt. Ltd. New Delhi
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- 15 Sharma P.D. 2003. Microbiology and Plant Pathology and Biotechnology, Rasthogi Publications. New Delhi
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SEMESTER –II PLANT PHYSIOLOGY

Course Code: BO2CMT02

Teaching hours: 2 Hrs/ week (Hrs / Sem 36)

Complementary Theory 2

Credits : 2

Objectives

- Make the students realize the importance of all physiological processes which take place in plants.
- Understand the mechanism of various physiological processes related to plant life.

PLANT PHYSIOLOGY

36 hrs

Module - 1

12 hrs

Plant water relations; Diffusion, Imbibition, Osmosis, DPD, water potential, Plasmolysis. Mechanism of water absorption – active and passive absorption. Apoplast and Symplast pathway. Ascent of sap -Root Pressure theory, Transpiration pull theory.

Transpiration- types, mechanism of stomatal transpiration (Starch - Sugar Hypothesis and Active K⁺ Transport Mechanism) significance and factors affecting transpiration, Antitranspirants, Guttation.

Mineral nutrition of plants - Role of micro and macro nutrients.

Module - 2

14 hrs

Photosynthesis-Photosynthetic pigments, Red drop and Emerson's enhancement effect, Two pigment systems, Cyclic and non cyclic photophosphorylation, Carbon fixation– C₃, C₄, Kranz anatomy and CAM Cycles, Factors affecting Photosynthesis. Photorespiration (brief study only)

Module - 3

2 hrs

Translocation of organic solutes; Path of translocation, Mechanism of translocation (Pressure Flow Hypothesis)

Module - 4

8 hrs

Seed dormancy, causes of seed dormancy, methods of breaking dormancy.

Germination of seeds – physiological changes.

Growth-Sigmoid curve, plant growth regulators – Auxins, Gibberellins, Cytokinins, Abscissic acid and Ethylene and their physiological role (brief study only).

Senescence and Abscission.

Photoperiodism and Vernalization.

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9. Sinha, A. K. 2004. Modern Plant Physiology. Narosa publishing House, New Delhi.
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SEMESTER I & II PRACTICAL
BO1CMP01 & BO2CMP02
CRYPTOGAMS, GYMNOSPERMS, PLANT PATHOLOGY
&
PLANT PHYSIOLOGY

Credits : 2

Practical hours : 72 Hrs

SEMESTER I : PRACTICAL

36 hrs

1. Identify Cryptogamic and Gymnosperm specimens and their parts prescribed in the syllabus, make micropreparations wherever necessary.
2. Identify plant diseases mentioned in the syllabus.

SEMESTER II : PRACTICAL

36 hrs

Core Experiments

1. Demonstration of Osmosis using Papaya petiole.
2. Separation of leaf pigments by Paper Chromatography.
3. Effect of Carbondioxide concentration on the rate of photosynthesis.

Demonstration experiments

1. Demonstration of Tissue Tension
2. Relationship between Transpiration and Absorption.
3. Measure the rate of transpiration by Ganong's potometer.
4. Evolution of oxygen during Photosynthesis.
5. Demonstrate the Effect of Light Intensity on the rate of photosynthesis.
6. Light screen experiment.

SEMESTER – 3

ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

Course Code: BO3CMT03

Teaching hours: 3 Hrs/ week (Hrs / Sem 54)

Complementary Theory - 3

Credits : 3

Objectives

- Acquaint the student with the objectives and components of Taxonomy.
- Help the student to understand the Systems of Classification of Angiosperms.
- Help the student to identify the common angiosperm species of Kerala.
- Familiarize the student with plants of immense economic importance

Angiosperm Morphology and Taxonomy **36 hrs**

Module – 1 **12 hrs**

Leaf – simple, compound, venation and phyllotaxy ; Flower as a modified shoot, structure of flower - floral parts, their arrangement, relative position, cohesion and adhesion of floral parts, symmetry of flowers, types of aestivation and placentation, floral diagram and floral formula.

Inflorescence - Racemose types - Simple Raceme, Corymb, Umbel, Spike, Spadix, Head and Catkin. Cymose types - Simple Cyme, Monochasial- Scorpioid and Helicoid, Dichasial and Polychasial, Special type - Cyathium, Hypanthodium.

Fruits - classification - Simple, Fleshy-(drupe berry, pepo, hesperidium), Dry-Dehiscent (Legume, Follicle, Capsule), Indehiscent - (Caryopsis, Cypsella, Nut), Aggregate, Multiple - (Sorosis, Syconus) with examples.

Module - 2 **8 hrs**

Importance of plant classification, types of classification, binomial nomenclature; ICBN, Bentham and Hooker's system of classification (detailed study); Cytotaxonomy and Chemotaxonomy (brief account only); Herbarium techniques; importance of herbarium.

Module - 3 **16 hrs**

Study of the following families of Bentham and Hookers system of classification with special reference to major identifying characters and economic importance:

Annonaceae, Malvaceae, Rutaceae, Leguminosae (Mimosaceae, Caesalpiniaceae and Fabaceae), Rubiaceae, Asteraceae, Apocynaceae, Lamiaceae, Euphorbiaceae, Arecaceae, Poaceae

ECONOMIC BOTANY

18 hrs

Module - 4

Classification of economic plants based on their uses. Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economic products and uses - Cereals - Paddy, Wheat ; Pulses - Green gram, Bengal gram ; Tuber crops - Tapioca; Spices - Pepper, Cardamom; Beverages - Tea, Coffee ; Oil yielding plants - Coconut, Groundnut ; Fibre yielding plants - Cotton, Coir; Timber yielding plants - Teak, Rose wood ; Latex yielding plants - Para rubber ; Bio pesticides - Neem, Tobacco ; Ornamental plants - Rose, Orchids, Anthurium. Study of the following medicinal plants with special reference to their binomial, family, morphology of useful parts and uses – *Adhatoda vasica*, *Aloe vera*, *Bacopa monnieri*, *Catharanthus roseus*, *Eclipta alba*, *Azadirachta indica*, *Ocimum sanctum*, *Phyllanthus amarus*, *Rauvolfia serpentina*, *Sida acuta*

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1. Eames, A. J. 1969. Morphology of Angiosperms. McGraw Hill, New York.
2. Hill, A.F. 1952. Economic Botany: A Text book of Useful Plants and Plant Products. Tata McGraw-Hill Publishing Company Limited, New Delhi.
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SEMESTER – 4

ANATOMY AND APPLIED BOTANY

Course Code: BO4CMT04

Teaching hours: 3 Hrs/ week (Hrs / Sem 54)

Complementary Theory - 4

Credits : 3

Objectives

- Understand different types of plant tissues.
- Understand the internal structure of different plant organs with reference to their functions.
- Understand the process of normal and anomalous secondary thickening in plants.
- Know the morphological and anatomical adaptations of plants growing in different habitats.
- Understand the techniques of crop improvement applications of botanical knowledge in the field of crop improvement for human prosperity.

PLANT ANATOMY

30 hrs

Module - 1

12 hrs

Gross structure of primary and secondary cell walls, Submicroscopic structure of cell wall (brief account only); simple and bordered pits, Structure and function of plasmodesmata.

Living and non-living inclusions. Tissues – meristematic and permanent, types of meristems; simple and complex tissues, secretory tissues (nectaries, hydathodes, mucilage ducts and lactiferous tissue); cambium-origin, structure, ray and fusiform initials; function and role in budding and grafting

Module – 2

9 hrs

Primary structure of stem and root in dicots and monocots; anatomy of monocot and dicot leaf; Normal secondary thickening in dicot stem and dicot root; growth rings, dendrochronology, heart wood and sap wood; tyloses; hard wood and sap wood; anomalous secondary thickening in *Bignonia*.

Module - 3

9 hrs

Ecological anatomy-Study of the morphological and anatomical adaptations of the following groups - Hydrophytes (*Nymphaea*/Hydrilla), Xerophytes (*Nerium*), Epiphytes (*Vanda*) and Halophytes (*Avicennia*/ *Rhizophora*).

APPLIED BOTANY

24 hrs

Module - 4

Plant breeding - Objectives, Methods of plant improvement - Plant introduction and acclimatization. Selection - mass selection; pureline selection and clonal selection; Hybridization- intervarietal, interspecific and intergeneric; procedure of hybridization ; Special methods of plant breeding - Mutation breeding and Polyploidy breeding Artificial vegetative propagation methods – propagation through cutting, layering (air & simple layering), budding (T and patch budding) and grafting (tongue and splice grafting)

Plant tissue culture – Principles and applications; sterilization, culture media, callus, organogenesis, somatic embryogenesis, artificial seeds, micropropagation –different steps.

REFERENCES

1. Christopher, E.P. 1958. Introductory Horticulture. McGraw Hill, New York.
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SEMESTER – III & IV PRACTICAL

BO3CMP03 & BO4CMP04

**ANGIOSPERM MORPHOLOGY, TAXONOMY, ECONOMIC BOTANY
&
ANATOMY AND APPLIED BOTANY**

Credits : 2

Practical hours : 72 Hrs

SEMESTER III : PRACTICAL

36 hrs

1. Students should be able to identify the different types of inflorescence and fruits of typical plants belonging to the families prescribed in the syllabus.
2. Students should be able to identify typical local plants belonging to the families prescribed in the syllabus.
3. They should be able to describe the floral parts in technical terms and draw the L.S. of flower, construct the floral diagrams and write the floral formula of at least one flower from each family.
4. Study of the groups of plants mentioned in the Economic Botany syllabus with special reference to their botanical name, family, morphology of useful part, economic products and uses

SEMESTER IV : PRACTICAL

36 hrs

1. Types of tissues – simple and complex.
2. Primary structure of stem and root of dicots and monocots. (*Centella*, grass, *Ficus* *Musa*)
3. Structure of dicot stem and dicot root after secondary thickening (Stem - *Vernonia*, root - *Tinospora*, Papaya)
4. Anomalous secondary thickening in *Bignonia*.
5. Anatomical adaptations of Hydrophytes (*Nymphaea* petiole), Xerophytes (*Nerium* leaf), Epiphytes (Velamen root of *Vanda*), Halophytes (Pneumatophore and vivipary of *Avicennia* or *Rhizophora*).
6. Emasculation of *Clerodendron* or *Caesalpinia* flower buds.
7. ‘T’ budding, approach grafting, air layering.

MODEL QUESTION PAPERS THEORY

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER I

CLASSIFICATION OF ORGANISMS AND PHYCOLOGY

Course Code: BO1CRT01

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What are Amylum stars?
2. Which algae are called Stone worts?
3. What are Akinetes?
4. Name the reserve food materials of Phaeophyceae.
5. What is Gaidukov Phenomenon?
6. What are Cap cells?
7. Define Coenobium
8. What is Algal bloom? (8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. Comment on SCP.
10. What is Palmella stage?
11. Comment on Plakea stage
12. What is Gongrosira stage?
13. Describe the thallus structure of Vaucheria.
14. Write notes on Tetrasporophyte.
15. Comment on cell division of Pinnularia.
16. Describe the primitive characters of Cyanobacteria.
17. Explain the cell structure of Chlamydomonas.
18. What are cryptoblasts? (6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Distinguish between Angiosperms and Gymnosperms.
20. Comment on Algal Pigments.
21. Give an illustrated account of sex organs in Chara.
22. Explain the conjugation in Spirogyra.
23. Describe the male conceptacle of Sargassum.
24. Give an account of Algal culture.

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Describe Eichler's system of classification.
26. Explain the life cycle of Polysiphonia.
27. Describe the life cycle of Oedogonium.
28. Discuss the economic importance of Algae.

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER II

MICROBIOLOGY, MYCOLOGY AND LICHENOLOGY

Course Code: BO2CRT02

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What is Peritrichous Bacteria?
2. What are Pili?
3. Name a Retro Virus
4. What is SCP?
5. Name a Coprophilous Fungus
6. Which fungus is known as dead man's finger?
7. Define Mycorrhiza
8. What is Soredium?

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. Write notes on Archaeobacteria
10. How bacteria are classified based on flagellar arrangement ?
11. What are biofertilisers?
12. Comment on antibiotics
13. Describe the structure of Xylaria stroma
14. Explain heteroecious habit with an example
15. Give an illustrated account of structure of yeast
16. Explain dolipore septum
17. What are VAM fungi?
18. Write short notes on economic importance of lichens.

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Explain the ultra structure of a bacterial cell with the help of diagram
20. Describe the shapes and arrangement of bacterial cells
21. Explain the structure of TMV
22. Explain the structure of Peziza apothecium
23. With the help of labelled diagram describe the structure of Agaricus gill
24. Describe the cultivation of Oyster mushroom

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Explain the mechanisms of genetic recombination in Bacteria
26. Give an account of the lytic and lysogenic life cycles in bacteriophages
27. Describe the life cycle of Puccinia
28. Discuss the economic importance of fungi

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER III

BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS AND PALEOBOTANY

Course Code: BO3CRT03

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What are nurse cells ?
2. What is peristome ?
3. Name a resurrection plant.
4. Give an example of a tree fern
5. Name an edible species of Cycas
6. What is rhizophore ?
7. Name a gymnosperm with vessels
8. What are fossils?

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. Distinguish between tuberculated and smooth walled rhizoids
10. What are elaters ?
11. What is gemma cup ?
12. What is a ligule ?
13. Comment on synangium
14. Describe the structure of sporangium in Equisetum
15. Explain the structure of microsporophyll in Cycas
16. What are Bars of Sanio ?
17. Differentiate manoxylic and pycnoxylic wood
18. Mention the contributions of Birbal Sahni

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Explain the sporophyte of *Funaria*
20. Heterospory leads to seed habit. Discuss
21. Comment on the economic importance of Pteridophytes
22. Explain the structure of *Cycas* ovule with a diagram.
23. Comment on the angiosperm characters of *Gnetum*
24. Explain the different types of fossils (4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Explain the economic importance of Bryophytes
 26. Give an illustrated account of stellar evolution in Pteridophytes
 27. Explain the life cycle of *Pinus*
 28. Explain the general characters of Gymnosperms
- (2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER IV

ANATOMY, REPRODUCTIVE BOTANY AND MICROTECHNIQUE

Course Code: BO4CRT04

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What is Cystolith ?
2. Define Apposition
3. What are Bulliform cells ?
4. What are laticifers?
5. Define polyembryony
6. Define protandry
7. What is FAA ?
8. What is a fixative ? (8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. What is plasmodesmata? Mention its function
10. Distinguish between simple and bordered pits
11. What is promeristem? Give an example
12. Differentiate ring porous and diffuse porous wood
13. Explain the role of cambium in wound healing
14. What is double fertilization ?
15. Write short notes on dehiscence of anther
16. What is apomixis ?
17. Write short notes on dehydrating agents
18. Distinguish between smear and squash preparations (6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Explain the submicroscopic structure of cell wall
20. Comment on secretory tissues
21. Explain the theories regarding shoot organization
22. Describe the types and functions of tapetum
23. What are the adaptations in entomophilous flowers?
24. Give an account of stains used in microtechnique (4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Comment on ergastic substances of the cell
26. Explain the anomalous secondary growth in *Dracaena*
27. Give an account of meristems
28. Describe the embryo sac development in angiosperms (2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER V

RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

Course Code: BO5CRT05

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. Define hypothesis
2. Give the name of two research journals
3. What is e-mail ?
4. What are search engines ?
5. What is numerical aperture ?
6. Expand PAGE
7. What is histogram ?
8. Define standard deviation

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. What is INSDOC services ?
10. What do you mean by laboratory hygiene ?
11. What is INFLIBNET ?
12. What is presentation soft ware ?
13. Write an array formula for any function in MS EXCEL
14. Distinguish between dry and oil immersion objectives
15. State Beer-Lambert's law
16. Comment on soxhlet extractor
17. Write notes on student's t - test
18. What is pie diagram ?

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. How will you prepare a research paper ?
20. Explain the parts of a Computer
21. Discuss the steps involved in the preparation of a Power point presentation
22. Give an account of TLC
23. How will you determine the pH of a given solution using pH meter ?
24. Give an account of Sampling methods

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Discuss the use of IT in teaching and learning
26. Describe the steps in scientific method
27. Explain the principle, working and applications of an electron microscope
28. Describe the Measures of Central Tendency

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER V

GENETICS AND EVOLUTION

Course Code: BO5CRT06

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. Define allele
2. What is pleiotropism ?
3. What is Barr body?
4. What is Royal disease?
5. What is genetic drift?
6. Define gene pool
7. What is use and disuse theory?
8. Define speciation

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. Explain incomplete dominance with an example
10. Write notes on pseudoalleles
11. What is crossing over ?
12. Distinguish between interference and coincidence
13. Distinguish between autosomes and allosomes
14. What is sex linkage ?
15. Explain Hardy-Weinberg principle
16. Distinguish between Progressive and Retrogressive evolution
17. Explain Germplasm theory
18. Write a short note on Neodarwinism

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Give an account of multiple alleles.
20. Explain two point test cross.
21. Give an account of extranuclear inheritance in Paramecium.
22. Describe sex determination in higher plants.
23. Explain the role of reproductive isolation in Speciation.
24. Discuss the role of polyploidy in evolution.

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Describe Epistasis with suitable examples.
26. Describe the inheritance of kernel colour in wheat.
27. Describe the sex chromosomal abnormalities in man.
28. Give an account of Darwinism.

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER V

CELL AND MOLECULAR BIOLOGY

Course Code: BO5CRT07

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. Who proposed Unit membrane model of plasma membrane?
2. What are suicidal bags?
3. What are Acrocentric chromosome ?
4. What is idiogram ?
5. Define point mutation
6. Name a physical mutagen
7. What is Chargaff's rule ?
8. Define transcription.

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. Distinguish between extrinsic and intrinsic proteins
10. What are microbodies?
11. Give an account of ultra structure of nucleolus.
12. Differentiate between rough and smooth endoplasmic reticulum.
13. What are B chromosomes?
14. What is synaptonemal complex?
15. What is Robertsonian Translocation?
16. Write short notes on chemical mutagens
17. Differentiate A and Z types of DNA
18. Write short notes on tumor suppressor genes

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Describe the Fluid mosaic model of plasma membrane
20. Give an illustrated account of ultra structure of a chloroplast
21. Describe the Nucleosome model of chromatin organization
22. Write short notes on Lamp brush chromosomes
23. Describe the structure of tRNA
24. Describe lac operon

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Describe the morphology, ultrastructure and functions of Mitochondria
26. Give an illustrated account of Mitosis and Meiosis
27. Give an account of special types of chromosomes
28. Explain the mechanism of protein synthesis in eukaryotes

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER VI

ENVIRONMENTAL STUDIES AND HUMAN RIGHTS

Course Code: BO5CRT08

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. Define Homeostasis
2. What is Edge effect ?
3. Expand EIA
4. What is biomagnification ?
5. Define Endemism
6. What is red data book ?
7. Expand NEERI
8. What is UDHR ?

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. What are ecological indicators ? Give an example
10. Discuss the role of decomposers in an Ecosystem
11. What is a keystone species ?
12. What is Green house effect ?
13. Comment on Eutrophication
14. Distinguish between biodegradable and non biodegradable solid wastes
15. Comment on Hot Spots in India
16. Mention the important Botanical gardens of India
17. Comment on AIDS.
18. Write short notes on the rights of Minorities.

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Describe the steps in decomposition
20. Explain ecological succession on Hydrosere
21. Comment on solid waste management
22. Write short notes on JFM
23. Comment on Environmental organizations
24. What are the causes and impacts of Climatic change ?

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Comment on the morphological and anatomical adaptations of Xerophytes
26. What are Air pollutants ? Give an account of the types , effect and control measures of Air pollution
27. Describe the methods of conservation of Biodiversity
28. Define Ecotourism. Explain the positive and negative impacts of Ecotourism.

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER V (OPEN COURSE)

AGRIBASED MICROENTERPRISES

Course Code: BO5OPT01

Time: Three hours

Maximum marks: 80

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What is Vermiwash ?
2. Expand PGPR
3. Define Totipotency
4. What is topiary ?
5. Define callus
6. What are annuals ?
7. What is asepsis ?
8. Define pasteurization
9. What is spawn ?
10. Name an edible mushroom. (10×1=10 Marks)

Section B (Short Answer Questions)

Answer any **eight** questions. Each question carries **2** marks

11. What are biopesticides ?
12. Write short notes on biological control.
13. Comment on the importance of pruning in plants.
14. Give an account of different types of culture media.
15. What is hardening ?
16. Write the composition of potting mixture.
17. Comment on chemical preservatives.
18. What is Botulism?
19. What is filtration ?
20. Give an account of poisonous mushrooms.

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- 21. What is basidium?
- 22. Give an account of value added products of mushrooms. (8×2=16 Marks)

Section C (Short Essay Questions)

Answer any **six** questions. Each question carries **4** marks

- 23. Describe the various composting techniques
- 24. Describe garden tools and implements and comment on the uses.
- 25. Give an account of the infrastructure of tissue culture laboratory.
- 26. Comment on the preparation of wine.
- 27. What are the causes of food spoilage?
- 28. Give a general account of the life cycle of a Mushroom.
- 29. What is Bonsai? Explain the principle and methods of preparation of Bonsai.
- 30. Explain the different types of Irrigation methods.

(6×4=24 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **15** marks

- 31. Give an account of organic manures and fertilizers.
- 32. Describe the methods of vegetative propagation.
- 33. Describe various food preservation techniques.
- 34. Give an account of cultivation of Oyster mushroom.

(2×15=30 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER VI

PLANT PHYSIOLOGY AND BIOCHEMISTRY

Course Code: BO6CRT09

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What is DPD ?
2. What are antitranspirants ?
3. What is red drop ?
4. Define RQ
5. What is ABA ?
6. Name a growth inhibitory hormone
7. What is buffer ?
8. What are monosaccharides ?

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. Differentiate apoplastic and symplastic pathways
10. Mention the significance of transpiration in plants
11. Mention the deficiency symptoms of Potassium
12. Explain phloem loading and unloading
13. Mention the significance of carotenoid pigments
14. Differentiate Fluorescence and Phosphorescence
15. Define Vernalization. Mention its significance
16. Comment on Abscission
17. Differentiate between Coenzyme and Prosthetic group
18. Comment on the biological functions of lipids

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Differentiate Active and Passive absorption.
20. Explain K^+ ion exchange theory.
21. Differentiate cyclic and non cyclic photophosphorylation.
22. Describe Munch Mass flow hypothesis.
23. Explain the mechanisms of enzyme action.
24. Describe tropic movements in plants.

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Give a comparative account of C₃ and C₄ Cycle with schematic diagrams.
26. Give an illustrated account of photorespiration.
27. Briefly describe oxidative photophosphorylation.
28. Comment on phytohormones.

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER VI

ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

Course Code: BO6CRT10

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. Define aestivation.
2. What is gynandrophore?
3. Expand ICBN.
4. What is vasculam?
5. Explain syngenesious anther.
6. What is obdiplostemonous condition ?
7. Name two fibre yielding plants.
8. Give the binomial of Para rubber.

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. Explain simple cyme with an example.
10. What is an aggregate fruit ? Give an example.
11. Comment on BSI.
12. What is Cytotaxonomy ?
13. Explain ruminant endosperm.
14. Describe the inflorescence in Asteraceae.
15. Define Pollinium.
16. Write the binomial, family and morphology of useful part of white dammar.
17. Describe papilionaceous corolla.
18. Define Gynostegium.

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Explain different types of placentation.
20. Give an account of Herbarium technique.
21. Describe the primitive features of the family Annonaceae.
22. Comment on economic importance of the family Leguminosae.
23. Describe the androecium of Cucurbitaceae.
24. Give an account of Spices and Condiments.

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Describe the different types of fruits with examples.
26. Comment on Bentham and Hooker's Classification. Mention the merits and demerits
27. Explain the important floral characters of the family Apocynaceae.
28. Describe the scope and importance of Ethnobotany.

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER VI

BIOTECHNOLOGY AND BIOINFORMATICS

Course Code: BO6CRT11

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. Define totipotency
2. What is callus ?
3. Define meristem culture
4. What is electroporation ?
5. Define plasmid
6. What is PCR ?
7. Expand NCBI
8. What is RasMol ?

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. What is hardening ?
10. Explain somaclonal variation
11. What are cybrids ?
12. Write short notes on Restriction endonucleases
13. Give an account of Bt crops
14. Write short notes on edible vaccines
15. What is SWISS – PROT ?
16. What are GenBanks ?
17. Comment on the use of BLAST
18. What is bioremediation ?

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. What are the advantages and disadvantages of micropropagation ?
20. Describe the production of haploids
21. Explain DNA finger printing
22. Describe Agrobacterium mediated gene transfer
23. Give an account of Genome sequencing
24. Give an account of multiple sequence alignment

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Describe the method of plant tissue culture technique
26. Describe the applications of Biotechnology in medicine
27. Give an account of cloning vectors
28. Comment on Human Genome Project

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER VI

PLANT BREEDING, HORTICULTURE AND PLANT PATHOLOGY

Course Code: BO6CRT12

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. Define Acclimatisation
 2. What is NBPGR ?
 3. What is Olericulture ?
 4. What is Hardening ?
 5. What is Pruning ?
 6. What is Topiary ?
 7. Name the causative organism of bacterial blight of paddy
 8. Define Etiology
- (8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. What is Quarantine ?
 10. Explain interspecific hybridization with an example
 11. What is inbreeding depression ?
 12. Comment on fungal toxins
 13. What is seed certification ?
 14. What is vertical garden ?
 15. What is a mist chamber ? Mention its advantages
 16. What is Landscape Architecture ?
 17. Mention the advantages of seed propagation
 18. What is whip grafting ?
- (6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Explain the genetic basis of Heterosis
20. Describe clonal selection
21. What is Bonsai? Explain the principle and methods of preparation of Bonsai
22. Describe the various types of irrigation methods
23. Explain the types of plant propagating structures
24. Give an account of the measures adopted to control plant diseases

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Describe the procedure of Hybridization and mention its role in crop improvement
26. Give an illustrated account of different types of Artificial Vegetative Propagation methods
27. Comment on various Garden components used in Garden designing
28. Describe the causative organism, symptom and control measures of Bacterial Blight of Paddy.

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER VI

AGRIBUSINESS

Course Code: BO6CBT01

Time: Three hours

Maximum marks: 80

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What are Micro Enterprises ?
2. What is vermiwash ?
3. Name a flower inducing hormone
4. What is Ikebana ?
5. What is Asepsis ?
6. Define pasteurization.
7. Name a chemical preservative.
8. Give the names of two grasses used in lawn preparation.
9. Name two plants that can be used in cut flower industry
10. Give the scientific name of Arrow root.

(10×1=10 Marks)

Section B (Short Answer Questions)

Answer any **eight** questions. Each question carries **2** marks

11. What is the role of Kudumbasree project ?
12. What is bone meal ?
13. What is truck gardening ?
14. What is the importance of Trichoderma ?
15. Write short notes on Organic traps
16. What is canning ?
17. What are food additives ?
18. Give an account of the preparation of Paneer

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19. What is the importance of pruning ?
20. What is landscaping ?
21. Name any two common leaves used in flower arrangement.
22. Give the name of any two galvanized rubber products.

(8×2=16 Marks)

Section C (Short Essay Questions)

Answer any **six** questions. Each question carries **4** marks

23. List out the role of Khadi and Village Industries Board
24. Comment on biofertilizers
25. Give an account of medicinal and aromatic plants
26. Describe the preparation of Vinegar
27. Explain the basic principles in the preparation of Lehyam and Decoction
28. Give an account of different Garden components
29. Describe the preparation of Kondattaum.
30. Comment on common cut flowers used in Floriculture.
31. Explain the different methods in lawn preparation.

(6×4=24 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **15** marks

32. Comment on common organic manures
33. Describe different types of flower arrangements
34. Describe the various food preservation techniques
35. Explain the processing, storage and marketing of Coconut

(2×15=30 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER VI

PLANT GENETIC RESOURCES

Course Code: BO6CBT02

Time: Three hours

Maximum marks: 80

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. Who proposed the concept of Centres of Origin ?
2. What are Endemic plants ?
3. What is deforestation ?.
4. Give the binomial of two medicinal plants.
5. Expand JNTBGRI
6. Write the binomial and morphology of useful part of Bilimbi .
7. What are seed banks?
8. Give the binomial of Black Plum.
9. Expand IUCN.
10. What are threatened plants?

(10×1=10Marks)

Section B (Short Answer Questions)

Answer any **eight** questions. Each question carries **2** marks

11. What is the role of IBPGR ?
12. What are invasive species ?
13. Write the binomial and family of two spices you have studied.
14. What is the role of wild relatives in crop improvement ?
15. What is Red Data Book ?
16. Give the binomial, family and morphology of useful part of Cherukizhangu.
17. What is cryopreservation ?
18. Give an account of the medicinal properties of Gloriosa.

19. Mention the role of KFRI .
20. What are Endangered plants ? Give an example.
21. Briefly explain genetic erosion.
22. Mention the uses of Carambola apple.

(8×2=16 Marks)

Section C (Short Essay Questions)

Answer any **six** questions. Each question carries **4** marks

23. List out the role and activities of IUCN.
24. Comment on Plantation crops.
25. Describe the major threats to Plant Genetic resources
26. Give an account the important spices.
27. Explain Centers of Origin of cultivated crop plants.
28. Give an account of National Parks and Sanctuaries.
29. Explain the importance of tuber crops..
30. Give an account of plantation crops.
31. Comment on hot spots.

(6×4= 24 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **15** marks

32. Describe the role of organizations in Plant Genetic resource management.
33. Give an account of important crop plants of Kerala.
34. Explain the methods of conservation of Plant Genetic resources.
35. Give an account of Underutilized plants.

(2×15=30 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY PROGRAMME (CBCS)

SEMESTER VI

PHYTOCHEMISTRY

Course Code: BO6CBT03

Time: Three hours

Maximum marks: 80

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What are Volatile oils ?
2. Name a secondary metabolite.
3. What are Phytochemicals ?
4. Give the binomial of Mint.
5. Name a super solvent.
6. Write the binomial of two aromatic plants.
7. What are Quinines?
8. Expand HPTLC.
9. What are primary metabolites?
10. Mention one confirmatory test for terpenoids.

(10×1=10 Marks)

Section B (Short Answer Questions)

Answer any **eight** questions. Each question carries **2** mark

11. What are the properties of Phenolics ?
12. What are uses of *Acorus calamus* ?
13. Write the binomial and family of two medicinal plants you have studied.
14. What is the importance of Flavonoids ?
15. What is the principle of Column Chromatography?
16. Give the binomial, family and morphology of useful part of Vasaka.
17. Explain the use of chloroform as a solvent.
18. Give an account of Hot extraction.
19. What are Terpenoids?
20. What are medicinal properties of *Aerva lanata* ?
21. Give two tests for alkaloids.

22. Mention two uses *Acorus*.

(8×2=16 Marks)

Section C (Short Essay Questions)

Answer any **six** questions. Each question carries **4** marks

23. List out the importance of secondary metabolites.

24. Comment on Clevenger apparatus.

25. Comment on solvents.

26. Give an account of Extraction methods.

27. Explain the medicinal uses of *Eclipta alba*.

28. Name four chemical constituents present in the oil of *Vetiveria*.

29. Mention the properties of phenolics.

30. Explain the pharmacological uses of flavonoids.

31. Comment on the importance of *Curcuma*.

(6×4=24 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **15** marks

32. Comment on Characterization techniques of Phytochemicals.

33. Write the binomial and explain the medicinal uses of six plants.

34. Explain the properties, functions and pharmacological uses of Alkaloids.

35. Give the binomial and explain the uses of six aromatic plants.

(2×15=30 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY COMPLEMENTARY COURSE (CBCS)

SEMESTER I

CRYPTOGAMS, GYMNOSPERMS AND PLANT PATHOLOGY

Course Code: BO1CMT01

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What is coenobium ?
2. Name a parasitic alga
3. What is oogamy ?
4. Name a coprophilous fungus
5. What is circinate vernation ?
6. Why bryophytes are called as the amphibians of the plant kingdom?
7. What is corolloid root?
8. Name the causative organism of bacterial blight of paddy

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. What is Heterocyst? Mention its functions.
10. What is Plakea Stage ?
11. What are Soredia ?
12. What is heterothallism? Give an example.
13. Differentiate between macrandrous and nannandrous species of *Oedogonium*.
14. Distinguish between uredospores and telutospores.
15. Differentiate between scales and rhizoids of *Riccia*.
16. What is resurrection plant? Give an example.
17. What is manoxylic wood ? Give an example.
18. What are the symptoms of leaf mosaic of tapioca ?

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. With a labelled diagram, describe the apothecium of *Peziza*.
20. Explain the post fertilization changes in *Polysiphonia*.
21. Comment on algal pigments.
22. Give an illustrated account of structure of *Selaginella* stem.
23. Explain the male cone of *Cycas*.
24. Name the pathogen, symptoms and control measures of nut fall of Arecanut.

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Describe the economic importance of Algae.
26. Describe the life cycle of *Puccinia*.
27. Give an account of general characters of Bryophytes.
28. Explain the life cycle of *Cycas*.

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY COMPLEMENTARY COURSE (CBCS)

SEMESTER II

PLANT PHYSIOLOGY

Course Code: BO2CMT02

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What is D.P.D ?
2. Define guttation.
3. What is red drop ?
4. What are quantasomes ?
5. Define absorption spectrum.
6. What is sink ?
7. Name a gaseous phytohormone.
8. What is seed dormancy ?

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. Differentiate active and passive absorption.
10. Distinguish between macro and micro nutrients.
11. What are antitranspirants ?
12. What is Kranz anatomy ?
13. What is Emerson's Enhancement Effect?
14. Differentiate between Action spectrum and Absorption spectrum.
15. Give an account of Phloem loading and unloading.
16. What is sigmoid curve ?
17. What is vernalization ?
18. What is senescence ?

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Briefly describe Transpiration pull theory.
20. Describe Crassulacean Acid Metabolism.
21. Give an account on Cyclic and Non – cyclic photophosphorylation.
22. Explain Munch Mass flow Hypothesis.
23. Comment on Photoperiodism.
24. Explain the physiology of fruit ripening.

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Explain the types, mechanism and factors influencing transpiration.
26. Explain Calvin cycle.
27. Differentiate C₃ and C₄ cycle with the help of schematic diagrams.
28. Give an account of plant growth regulators.

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY COMPLEMENTARY COURSE (CBCS)

SEMESTER III

ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

Course Code: BO3CMT03

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What is phyllotaxy ?
2. Define aestivation
3. Define binomial nomenclature
4. What is vasculam ?
5. What is ruminant endosperm ?
6. What is obdiplostemonous condition ?
7. Give the binomial of para rubber
8. What are biopesticides ?

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. What are aggregate fruits? Give an example.
10. Distinguish between drupe and berry.
11. What is chemotaxonomy ?
12. Describe papilionaceous corolla.
13. What are pappus hairs ?
14. Comment on the androecium of Malvaceae.
15. Explain the corolla of Lamiaceae.
16. Mention any two alkaloids obtained from *Adhatoda*.
17. Give the binomial, family and morphology of useful part of a fibre yielding plant.
18. Write short notes on pulses.

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Explain the types of placentation.
20. Explain the steps in the preparation of Herbarium.
21. Comment on the advance characters of Poaceae.
22. List out the distinguishing characters of Euphorbiaceae.
23. Write short notes on Ornamental plants.
24. Comment on Spices and Condiments.

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Describe the different types of Inflorescence.
26. Compare the three sub families of Leguminosae.
27. Give an account of merits and demerits of Bentham and Hooker's Classification.
28. Mention the binomial, family, morphology of useful parts and uses of any six medicinal plants.

(2×12=24 Marks)

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. BOTANY COMPLEMENTARY COURSE (CBCS)

SEMESTER IV

ANATOMY AND APPLIED BOTANY

Course Code: BO4CMT04

Time: Three hours

Maximum marks: 60

Section A (Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark

1. What is plasmodesmata?
2. Define somatic embryogenesis.
3. What is promeristem?
4. What are tyloses?
5. Define Dendrochronology.
6. What are pneumatophores?
7. Define Acclimatization.
8. What is callus?

(8×1=8 Marks)

Section B (Short Answer Questions)

Answer any **six** questions. Each question carries **2** marks

9. What are bordered pits ? Give an example.
10. Give an account of Hydathodes.
11. Differentiate tracheids and vessels.
12. Differentiate between Heart wood and Sap wood.
13. What are Growth rings?
14. Differentiate between articulated and non - articulated laticifers.

Curriculum and Syllabus 2017 Admission onwards

15. What are the morphological adaptations seen in Epiphytes?
16. What is Vivipary?
17. What are chemical mutagens?
18. Comment on artificial seeds.

(6×2=12 Marks)

Section C (Short Essay Questions)

Answer any **four** questions. Each question carries **4** marks

19. Explain the structure and composition of plant cell wall.
20. Comment on the functions of Cambium.
21. Describe the secondary growth in Dicot root.
22. What are the morphological adaptations of hydrophytes?
23. Based on priority, describe the Objectives of Plant Breeding.
24. Give an account of Micropropagation.

(4×4=16 Marks)

Section D (Essay Questions)

Answer any **two** questions. Each question carries **12** marks

25. Give an account of Meristematic tissues.
26. Describe the anomalous secondary growth in *Bignonia*.
27. Describe the various morphological and anatomical adaptations in Xerophytes.
28. Describe the artificial vegetative propagation methods.

(2×12=24 Marks)

MODEL QUESTION PAPERS

PRACTICAL

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY
B.Sc. DEGREE (CBCS) BOTANY PROGRAMME
SEMESTER II - I & II (Combined) Core Practical (BO1CRP01 & BO2CRP02)
CLASSIFICATION OF ORGANISMS, PHYCOLOGY
&
MICROBIOLOGY, MYCOLOGY AND LICHENOLOGY

Time 3 hours

Maximum marks: 40

1. Grams stain the bacterial culture A1. Write down the procedure/flow chart Identify and leave the preparation for valuation 5

| | |
|----------------------|-----|
| Preparation | - 2 |
| Procedure/flow chart | - 2 |
| Identification | - 1 |

OR

Isolate the soil microbe from the sample A2 by dilution plate method

| | |
|----------------------|-----|
| Working | - 2 |
| Procedure/flow chart | - 3 |
2. Make suitable micro preparations of B & C. Identify giving key characters. Submit the preparations for valuation. (5×2 = 10)

| | |
|----------------|-----|
| Preparation | - 1 |
| Identification | - 1 |
| Key characters | - 2 |
| Diagram | - 1 |
3. Take suitable micro preparations of samples D & E to reveal the reproductive structures. Submit the preparations for valuation. (2×4= 8)

| | |
|----------------|-----|
| Preparation | - 1 |
| Identification | - 1 |
| Reasons | - 2 |
4. Name the living organisms and type of fermentations in material F. 2
5. Spot at sight G, H, I. (3×1 = 3)

| | |
|--------------|-------|
| Major group | - 0.5 |
| Generic name | - 0.5 |
6. Prepare a bed for Oyster mushroom (J) cultivation 2

| | | |
|------------------------------------|-----|---|
| Preparation | - 2 | |
| 7. Viva voce (based on practicals) | | 2 |
| 8. Record | | 8 |

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY
B.Sc. DEGREE (CBCS) BOTANY PROGRAMME
SEMESTER IV - III & IV (Combined) Core Practical (BO3CRP03 & BO4CRP04)
BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS, PALEOBOTANY
&
ANATOMY, REPRODUCTIVE BOTANY AND MICROTECHNIQUE

Time 3 hours

Maximum marks: 40

1. Make suitable micropreparations of A & B and identify giving reasons. **(2×5 = 10)**

| | | |
|------------------|-------|--|
| Preparation | - 1 | |
| Labelled Diagram | - 2 | |
| Identification | - 0.5 | |
| Key characters | - 1.5 | |
2. Take a T.S of the given material C, stain and mount in glycerine. Identify giving reasons (primary) **5**

| | | |
|-----------------------------|-----|--|
| Preparation | - 2 | |
| Identification with reasons | - 2 | |
| Diagram | - 1 | |
3. Take a T.S of the given material D, stain and mount in glycerine. Identify giving reasons (secondary/anomaly) **7**

| | | |
|----------------------------|-----|--|
| Preparation | - 2 | |
| Identification with reason | - 3 | |
| Diagram | - 2 | |
4. Identify the cell inclusion, E **1**
5. Spot at sight F, G, H **(1×3 = 3)**

| | | |
|----------------|-------|--|
| Generic name | - 0.5 | |
| Part displayed | - 0.5 | |
6. Identify the anther type/ embryo type, I. **1**
7. Find out the pollen viability, J by germination or staining method. **3**

| | | |
|-------------|-------|--|
| Preparation | - 1.5 | |
|-------------|-------|--|

Curriculum and Syllabus 2017 Admission onwards

| | | | | |
|----|---------------------------------|---|-----|----------|
| | Calculation and Result | - | 1.5 | |
| 8. | Viva voce (based on practicals) | | | 2 |
| 9. | Record | | | 8 |

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY
B.Sc. DEGREE (CBCS) BOTANY PROGRAMME
SEMESTER VI - V&VI (Combined) Core Practical (BO5CRP05 & BO6CRP09)
RESEARCH METHODOLOGY, BIOPHYSICS, BIOSTATISTICS
&
PLANT PHYSIOLOGY AND BIOCHEMISTRY

Time 3 hours

Maximum marks: 40

1. Conduct experiment A and bring out the result. **8**

| | | |
|------------------------|---|---|
| Requirements | - | 1 |
| Procedure | - | 1 |
| Setting the experiment | - | 3 |
| Labelled diagram | - | 1 |
| Result and inference | - | 2 |
2. Comment on the defects in experiment set up B. **3**

| | | |
|-------------|---|---|
| Aim | - | 1 |
| Procedure | - | 1 |
| Defects (2) | - | 1 |
3. Detect any one organic compound present in the sample C. **3**
4. By using the Molar stock of CuSO₄ prepare 10ml each of dilute solutions of CuSO₄ with the following concentrations. **4**
 - a.
 - b.
 - c.
 - d.

Calculate the volume of the stock solution to be taken and the volume of water to be added to achieve the required dilution. Draw a dilution table showing the details.

| | | |
|----------------------------------|---|---|
| Conduct of exercise | - | 2 |
| Calculation and dilution table - | | 2 |
5. Examine the compound leaf supplied and measure the lengths of the leaflets **5**
 - a. Group them into frequency classes according to their length
 - b. Calculate the mean and standard deviation of the data

Curriculum and Syllabus 2017 Admission onwards

- c. Prepare a histogram using EXCEL to represent the data. Make a print out and submit

| | | |
|--|---|---|
| Construction of the classes and scoring of frequency | - | 1 |
| Mean | - | 1 |
| Standard deviation. | - | 2 |
| Histogram | - | 1 |

6. Determine the concentration of the given solution of CuSO₄ using Colorimetry. Use the values supplied for the preparation of Standard graph. **4**

| | | |
|--------------------------------|---|---|
| Standard graph | - | 2 |
| Determination of concentration | - | 2 |

7. Determine the pH of the given solution using pH meter. **3**

| | | |
|--------------------------|---|---|
| Conduct of the exercise. | - | 2 |
| pH | - | 1 |

8. Viva voce (based on practicals)

2

9. Record **8**

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY
B.Sc. DEGREE (CBCS) BOTANY PROGRAMME
SEMESTER VI - V&VI (Combined) Core Practical (BO5CRP06 & BO6CRP10)
GENETICS, EVOLUTION

&

ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

Time 3 hours

Maximum marks : 40

1. Identify the specimen A to the respective family giving key characters at each steps.

5

| | |
|-------------------------|-----|
| Identification | - 1 |
| Characters up to series | - 1 |
| Family characters | - 3 |
2. Describe the flower B in technical terms. Draw the LS, construct the floral diagram and write the floral formula.

2

| | |
|----------------|-------|
| Description | - 0.5 |
| LS | - 0.5 |
| Floral Diagram | - 0.5 |
| Floral formula | - 0.5 |
3. Identify the inflorescence and fruit, C & D

(2×1 = 2)
4. Identify the herbarium specimens E1 & E2 by their binomial and family. **(2×1 = 2)**

| | |
|----------|-------|
| Binomial | - 0.5 |
| Family | - 0.5 |
5. Identify the product/part by binomial, family & morphology of the useful part of F & G.

(2×1.5 = 3)

| | |
|-------------------------------|-------|
| Binomial | - 0.5 |
| Family | - 0.5 |
| Morphology of the useful part | - 0.5 |
6. Submit 25 herbarium and a duly certified field book.

2
7. Write the binomial and ethno botanical use of the material H.

1
8. Work out the problems I & J.

(2×5= 10)

9. Match the karyotype with the phenotype in J and identify the genetic disorder and make comments on the karyotype and phenotype. 3
10. Viva voce (based on practicals) 2
11. Record 8

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc. DEGREE (CBCS) BOTANY PROGRAMME

SEMESTER VI - V&VI (Combined) Core Practical (BO5CRP07 & BO6CRP11)

CELL, MOLECULAR BIOLOGY

&

BIOTECHNOLOGY AND BIOINFORMATICS

Time 3 hours

Maximum marks: 40

1. Make Acetocarmine squash preparation of the root tips, A supplied and identify any two stages of Mitosis. 5
 - Preparation - 1
 - Identification - (2x1 = 2)
 - Labelled Diagrams. - (2x1 = 2)
2. Identify the stage of Meiosis in the figure/photograph B and comment on it. 3
 - Identification - 1
 - Comments - 2
3. Work out the problem C 3
4. Immobilize whole cells / plant tissue D, in alginate beads. 2
 - Procedure / working - 1
 - Results - 1
5. Extract the DNA from plant material E using suitable methods 4
 - Requirements - 1
 - Working - 2
 - Result - 1
6. Sterilize the given explant F and inoculate in to the medium supplied. 5
 - Steps followed - 2
 - Working - 3
7. Comment on G & H (2×2 = 4)
8. Using molecular visualization tool Ras Mol show the information of given protein I (Insulin/ Haemoglobin) 4

Curriculum and Syllabus 2017 Admission onwards

| | | | |
|-----|--|-----|----------|
| | Set up the colour of background | - 1 | |
| | Display H ₂ bond /Disulphide bond | - 1 | |
| | Display the labels specified (amino acids) | - 1 | |
| | Display the protein structure in model specified | - 1 | |
| 9. | Viva voce (based on practicals) | | 2 |
| 10. | Record | | 8 |

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY
B.Sc. DEGREE (CBCS) BOTANY PROGRAMME
SEMESTER VI - V&VI (Combined) Core Practical (BO5CRP08 & BO6CRP12)
ENVIRONMENTAL STUDIES
&
PLANT BREEDING, HORTICULTURE AND PLANT PATHOLOGY

Time 3 hours

Maximum marks : 40

1. Estimate the amount of (CO₂/Cl) in the given water sample A. **6**
Procedure - 2
Experiment - 3
Result - 1
2. Find out the Density/Abundance from the given data B **2**
3. Identify and write critical notes on the given pollutant C (photograph/material) **1**
4. Comment on the morphological adaptations of D. **2**
5. Make a micropreparation of the given material E and write the anatomical adaptations. **5**
Preparation - 1
Ecological group - 1
Diagram - 1
Adaptations - 2
6. Conduct emasculation/budding/grafting/layering on material F **3**
Conduct of exercise - 2
Diagram - 1
7. Identify the garden design G and garden tool H. Comment on them. **(2×2 =4)**
8. Comment on the anthropogenic influence on environment deterioration I. **1**
9. Prepare Bordeaux mixture, J and write the concentration of the ingredients **3**
Concentration of ingredients - 1
Preparation - 2
10. Identify the plant disease K. **3**
Name of the disease - 1
Causative organism - 1
Symptoms - 1

- | | |
|-------------------------------------|---|
| 11. Viva voce (based on practicals) | 2 |
| 12. Record | 8 |

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY
B.Sc BOTANY COMPLEMENTARY COURSE
SEMESTER II - I&II (Combined) Practical (BO1CMP01 & BO2CMP02)
CRYPTOGAMS, GYMNOSPERMS, PLANT PATHOLOGY
&
PLANT PHYSIOLOGY

Time : 3 Hours

Maximum Marks : 40

- | | |
|--|----------|
| 1. Make suitable micropreparations of A and B, stain and mount in glycerine. | (2×5=10) |
| Preparations | - 2 |
| Labelled diagram | - 1 |
| Identification | - 0.5 |
| Reasons | - 1.5 |
| 2. Identify the material C. | 3 |
| Identification | - 1 |
| Reasons | - 1 |
| Labelled diagram | - 1 |
| 3. Spot at sight D, E, F and G. | (4×1=4) |
| Generic name | - 0.5 |
| Part displayed | - 0.5 |
| 4. Write note on Pathological interest of H. | 3 |
| Name of the disease | - 1 |
| Causative organism | - 1 |
| Symptoms | - 1 |
| 5. Conduct the experiment I. | 7 |
| Requirements | - 1 |
| Aim | - 1 |
| Conduction of experiment | - 3 |
| Procedure | - 2 |

- | | | |
|----|--|---|
| 6. | Explain the working of the experiment J. | 3 |
| | Aim - 1 | |
| | Procedure - 2 | |
| 7. | Viva voce | 2 |
| 8. | Record | 8 |

ASSUMPTION COLLEGE AUTONOMOUS CHANGANACHERRY

B.Sc BOTANY COMPLEMENTARY COURSE

SEMESTER IV - III&IV (Combined) Practical (BO3CMP03 & BO4CMP04)

ANGIOSPERM MORPHOLOGY, TAXONOMY, ECONOMIC BOTANY

&

ANATOMY AND APPLIED BOTANY

Time: 3 Hours

Maximum Marks : 40

- | | | |
|----|---|-------------|
| 1. | Assign A to its family giving diagnostic characters. | 4 |
| | Name of the family - 1 | |
| | Diagnostic characters - 3 | |
| 2. | Draw L.S, construct floral diagram and write the floral formula of B. | 4 |
| | L.S of the flower - 2 | |
| | Floral Diagram - 1 | |
| | Floral formula - 1 | |
| 3. | Identify C and D | (2×1.5 = 3) |
| | Identification - 0.5 | |
| | Reasons - 1 | |
| 4. | Write the binomial, family and morphology of the useful parts of E and F. (2×2 = 4) | |
| | Binomial - 1 | |
| | Family - 0.5 | |
| | Morphology - 0.5 | |
| 5. | Make micropreparation and identify G | 8 |
| | Preparation - 3 | |
| | Identification with characters - 3 | |
| | Diagram - 2 | |
| 6. | Identify the given TS of the material H | 1 |
| 7. | Identify the cell inclusion I with reason | 1 |
| 8. | Assign J to the ecological group with reasons | 2 |

Curriculum and Syllabus 2017 Admission onwards

| | | | | |
|-----|--|---|-----|----------|
| | Ecological group | - | 0.5 | |
| | Reasons | - | 1.5 | |
| 9. | Carry out emasculation/budding/grafting/layering in K. | | | 3 |
| | Demonstration | - | 2 | |
| | Aim & procedure | - | 1 | |
| 10. | Viva voce | | | 2 |
| 11. | Record | | | 8 |

APPENDIX

APPENDIX

Annexure 1a - Model Mark Cum Grade Card (I Sem)

ASSUMPTION COLLEGE, AUTONOMOUS

(Affiliated to Mahatma Gandhi University)

Section:

Student ID:

Date:

MARK CUM GRADE CARD

Name of Candidate :

Name of College :

Permanent Register Number (PRN) :

Degree : Bachelor of Science

Programme : BSc. Botany

Stream : Model I

Name of Examination : First Semester Examination Month and Year

| Course Code | Course Title | Credits (C) | Marks | | | | | | Grade Awarded (G) | Grade Point (GP) | Credit Point (Cx GP) | Institution Average (IA) | Result |
|-------------|-------------------------|--------------|--------------|-----|-------------|-----|-----------------|-----|--------------------|------------------|----------------------|--------------------------|--------|
| | | | External | | Internal | | Total | | | | | | |
| | | | Awarded (E) | Max | Awarded (I) | Max | Awarded (E +I) | Max | | | | | |
| | Common Course I | | | | | | | | | | | | |
| | Common Course II | | | | | | | | | | | | |
| | Core Course | | | | | | | | | | | | |
| | Complementary Course I | | | | | | | | | | | | |
| | Complementary Course II | | | | | | | | | | | | |
| | TOTAL | | | | | | | | | | | | |
| | SGPA : | | | | | | | | | | | | |
| | SG : | | | | | | | | | | | | |

Annexure 1b - Model Mark Cum Grade Card (VI Sem)

ASSUMPTION COLLEGE, AUTONOMOUS

(Affiliated to Mahatma Gandhi University)

Section:

Student ID:

Date:

MARK CUM GRADE CARD

Name of Candidate :

Name of College :

Permanent Register Number (PRN) :

Degree : Bachelor of Science

Programme : BSc. Botany

Stream : Model I

Name of Examination : Sixth Semester Examination April 2014

| Course Code | Course Title | Credits (C) | Marks | | | | | | Grade Awarded (G) | Grade Point (GP) | Credit Point (CGP) | Institution Average (IA) | Result |
|-------------|--------------|----------------|-------------|-----|-------------|-----|-----------------|-----|-------------------|------------------|--------------------|--------------------------|--------|
| | | | External | | Internal | | Total | | | | | | |
| | | | Awarded (E) | Max | Awarded (I) | Max | Awarded (E + I) | Max | | | | | |
| | Core 9 | | | | | | | | | | | | |
| | Core 10 | | | | | | | | | | | | |
| | Core 11 | | | | | | | | | | | | |
| | Core 12 | | | | | | | | | | | | |
| | Choice Based | | | | | | | | | | | | |
| | Course | | | | | | | | | | | | |

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| | | | | | | | | | | | | | |
|--|--------------|--|--|--|--|--|--|--|--|--|--|--|--|
| | Project | | | | | | | | | | | | |
| | TOTAL | | | | | | | | | | | | |
| | SCPA : | | | | | | | | | | | | |
| | SG : | | | | | | | | | | | | |

| | Marks | | Credit | GPA | Grade | Month and Year | Result |
|-------------------------|---------|-----|--------|-----|-------|-------------------|--------|
| | Awarded | Max | | | | | |
| Semester I | | | | | | | |
| Semester II | | | | | | | |
| Semester III | | | | | | | |
| Semester IV | | | | | | | |
| Semester V | | | | | | | |
| Semester VI | | | | | | | |
| Common Course I | | | | | | | |
| Common Course II | | | | | | | |
| Complementary Course I | | | | | | | |
| Complementary Course II | | | | | | | |
| Core + Project | | | | | | | |
| Generic/Open Elective | | | | | | | |
| Overall Programme | | | | | | | |
| CGPA: | | | | | | | |

**Annexure 1c - Reverse side of the Mark cum Grade Card
(COMMON TO ALL SEMESTERS)**

Description of the Evaluation Process

Table 1

| % Marks | Grade | Grade Point |
|--------------------|-------------------|--------------------|
| 95 and above | O - Outstanding | 10 |
| 85 - <95 | A+ - Excellent | 9 |
| 75 - <85 | A - Very Good | 8 |
| 65 - <75 | B+ - Good | 7 |
| 55 - <65 | B - Above Average | 6 |
| 50 - <55 | C - Average | 5 |
| 40 - <50 | D - Pass | 4 |
| Below 40 or Absent | F - Failure | 0 |

Grade and Grade Point

The Evaluation of each Course comprises of Internal and External Components in the ratio 1:4 for all Courses.

Grades and Grade Points are given on a 10-point Scale based on the percentage of Total Marks (Internal + External) as given in Table 1

(Decimals are to be corrected to the next higher whole number)

Credit point and Credit point average Grades for the different Semesters and overall Programme are given based on the corresponding CPA, as shown in

Table 2

| CPA | Grade |
|---------------|-------------------|
| 9.5 and above | O - Outstanding |
| 8.5 - <9.5 | A+ - Excellent |
| 7.5 - <8.5 | A - Very Good |
| 6.5 - <7.5 | B+ - Good |
| 5.5 - <6.5 | B - Above Average |
| 5 - <5.5 | C - Average |
| 4 - <5 | D - Pass |
| <4 | F - Failure |

Credit point (**CP**) of a Course is calculated using the formula

$$CP = C \times GP, \text{ where } C = \text{Credit}; GP = \text{Grade Point}$$

Credit Point Average (**CPA**) of a Semester or Programme etc. is calculated using the formula

$$CPA = \frac{TCP}{TC}, \text{ where } TCP = \text{Total Credit Point};$$

TC = Total Credit

NOTE

A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 40% are required for a pass for a course. For a pass in a programme, a separate minimum of Grade D is required for all the individual courses. If a candidate secures F Grade for any one of the courses offered in a Semester/Programme only F Grade will be awarded for that Semester/Programme until she improves this to D Grade or above within the permitted period. Candidates who secure D Grade and above will be eligible for higher studies.