Choice based Credit Semester System and Grading has been introduced for the Curriculum in affiliated colleges in the University with effect from 2009 admission onwards and the regulation for the same implemented vide paper cited 1 above.

As per paper read as (2) above, the Board of Studies has resolved to approve the scheme and Syllabus of B Sc Programme in Botany under Choice based Credit Semester System.

As per paper read as (3) and (4) above, the Faculty of Science at its meeting held on 05.05.2009 endorsed the minutes of Board of Studies and the Academic Council held on 14.05.2009 approved the same.

Sanction has therefore been accorded to implement the scheme and syllabus of B.Sc programme in Botany under Choice based Credit Semester System in the University with effect from 2009 admission onwards.

Orders are issued accordingly. Scheme and Syllabus appended.
UNIVERSITY OF CALICUT

(Abstract)

B.Sc programme in Botany – under Choice based Credit Semester System –
Modification in the scheme and syllabi of the theory and practical courses – with
effect from 2009 admission – approved – implemented - Orders issued.

---------------------------------------------------------------------------------------------------

GENERAL AND ACADEMIC BRANCH – I ‘J’ SECTION


---------------------------------------------------------------------------------------------------

Read:  1.   U.O. of even No. dated 25-06-2009
    2.   Minutes of the meeting of the Board of Studies in Botany
         (UG) held on 12-08-2009.

ORDER

As per paper read as 1st above, the Scheme & syllabus of B.Sc
programme in Botany under Choice based Credit Semester System was
implemented.

The Board of Studies in Botany (UG), vide paper read as 2nd
recommended certain modifications in the scheme and syllabi of theory
and practical courses of the B.Sc. programme in Botany with effect from
2009 admission.

The Vice-Chancellor in view of exigency, exercising the powers of the
Academic Council, approved the minutes subject to ratification by the
Academic council.

Sanction has therefore been accorded for implementing the
modifications in the scheme and syllabi of the theory and practical
courses of B.Sc programme in Botany with effect from 2009 admission.

University Order read as paper I stands modified to this extent

Orders are issued accordingly. Modification appended.

Sd/-

DEPUTY REGISTRAR (G&A I)

For REGISTRAR.

To

The Principal of affiliated Arts & Science Colleges
offering B.Sc Botany programme.

Copy to:    C.E, EX, DR (PG), Tabulation Section, Enquiry,
System Administrator (with a request to
upload in University website),
G&A-I F., ‘G’ Sn., G&A-II & III Branches,
Information centres.

Forwarded/By Order
Sd/-

SECTION OFFICER
APPENDIX

1. **Alteration – Core Course – 1**

   - Module – I  Science and Scientific Studies
   - Module – II  Experimentation in Science
   - Module - III Methods in Biological Science
   - Module – IV  Statistical Methods

2. In Page No. 2 a clause regarding Practical Record is added.

3. In page No. 6 in the criteria for practical internal assessment weightage for practical test is adjusted to 5% (weightage 1) and for practical record is enhanced to 10% (weightage 2).

4. In page No. 6 Internal assessment grade, weightage for practical test is adjusted to 1 and weightage for Record in adjusted to 2.

5. In page No.9 in the course structure, work load and credit distribution chart the following changes were made.

   a. Semester III Core course III (BO3-BO3) General and Bioinformatics , Theory hrs./ Semester is adjusted to 54 instead of 36 and Hours/week is modified to 3 instead 2.
   
   b. Semester V - Open course (Choice I, II & III) hrs/Semester for theory is adjusted to 36 instead of 54 and hrs/week is adjusted to 2 instead of 3. Decided to include Practical (36 hrs/Semester and 2 hrs/week) for open course I
   
   c. Semester VI.

   Core Course Elective Practical hrs/semester is adjusted to 36 instead of 18 and hrs/week is raised to 2 instead of 1.

**Changes in the Title of Papers.**

1) Core Course II
   - Micro technique & Horticulture

2) Core Course VIII
   - Environmental Science, Phyto geography and Evolution.
University of Calicut

RESTRICTED CURRICULUM FOR B.Sc.
PROGRAMME IN BOTANY

Scheme of Examination, Syllabus and Model Question Papers
(Effective from 2009 Admission onwards)
INTRODUCTION

Undergraduate education in Kerala requires major transformations, a transformation from rigid to flexible, from a set pattern to choice based structure, from exclusive summative evaluation to continuous assessment from teacher-centred to student-centred approach, from year system to semester system, from talk and chalk to activity based education. The transformation has to commence, by overcoming the constraints, as it is the need of the society and need of the hour.

The introduction of semesterisation and grading at undergraduate level is a drastic change in the history of formal education in Kerala. As per the directions of KSHEC the Board of Studies in Botany, University of Calicut has conducted a five-day workshop to frame the curricula and syllabus for the new system. A total of 40 teachers and 11 Resource Persons participated in the the five day workshop held at the Seminar Complex, University of Calicut from 16.2.2009 to 20.2.2009.

The curriculum, syllabus, evaluation pattern and model question papers were framed during the workshop and the Board of Studies in Botany (UG) recommended to implement the same with effect from 2009 admission onwards.

B.Sc. Degree Programme in Botany

Restructured Curriculum – an overview

i. Six Semesters

ii. Choice Based Credit System

iii. Open course (freedom for students to choose one open course each in the Vth and the VIth Semester) i.e., each department offers one open course for their main stream students and another open course for other stream students of the same institution

iv. Duration of 1 semester = 18 weeks (i.e., 18 x 5 = 90 days

Total contact hrs: 90 x 5 = 450

1 Programme = 30 courses

1 course = 4 hrs. /week = 1 full paper = 4 credits
i.e., 1 Programme = 30 x 4 = 120 credits

B.Sc. Botany Programme – structure

1. Common Course (First & second Language)
   i. 6 courses x 4 credits = Total 24 credits
   ii. 4 courses x 4 credits = Total 16 credits

2. Complementary (Subsidiary)
   I. 4 courses x 3 credits = Total 12 credits
   II. 4 courses x 3 credits = Total 12 credits

3. Core courses (Main)
   12 course x 4 credits = Total 48 credits

4. Open courses
   i. Main stream 1 course x 4 credits = Total 4 credit
   ii. Other streams 1 course x 4 credits = Total 4 credits

   Total 120 credits

   1. Common course 10 = 38 credits
   2. Core course 12 = 48 credits
   3. Complementary I 4 = 12 credits
   4. Complementary II 4 = 12 credits
   5. Open course 2 = 6 credits
   6. Project, study tour, field trip = 4 credits

   Total 30 = 120 credits

The common and complementary courses will be completed by the end of fourth semester. In the fifth semester students have the freedom to choose one open course from other stream and in the sixth semester, they can choose another open course offered by the parent department.
The assessment of students involves 75% weightage for External Evaluation and 25% for Internal Evaluation. Examination for theory courses will be held at the end of each semester and the practical examination for for first four semesters will be held at the end of fourth semester and those of fifth and sixth semester will be held at the end of sixth semester. In addition to the theory and practicals, each student has to submit the report of a project work done during the fifth and sixth semesters for valuation.

**Award of weightage**

Grading - Five point scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Grade points</th>
<th>Grade Point Average Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>3.5 to 4</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>2.5 to 3.49</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>1.5 to 2.49</td>
</tr>
<tr>
<td>D</td>
<td>1</td>
<td>0.5 to 1.49</td>
</tr>
<tr>
<td>E</td>
<td>0</td>
<td>Less than 0.5</td>
</tr>
</tbody>
</table>

**Details of Core Course in B.Sc. Botany Programme**

Theory and practicals of the core courses are extended in all the six semesters. Details are shown in the chart.

**Core Course**

Total number of core courses = 10

One core course will be taught in the first four semesters and three core courses will be taught in the Vth and the VIth semester. Practicals corresponding to each course will be conducted during the respective semesters.

- Core Course I
- Core Course II
- Core Course III
- Practical I – 4 credits
- External Examination at the end of IVth semester
- Core Course IV
Practical II  8 Credits  
Practical III  8 Credits  Examination at the end of the 6th semester  
Practical - Open course  
Each student should submit a report of the project work duly signed by the supervising teacher and certified by the Head of the Department, done during the 5th and 6th semester.

SCHEME OF EVALUATION

The performance of a student in the programme will be assessed in terms of grades. Evaluation is conducted through (I) Continuous Internal Assessment and (II) End-Semester External Examination. Internal assessment carries 25% weightage and External examination carries 75% weightage. The total weightage of a course is 30 (Weightage for internal assessment is 5 and for external evaluation 25 for both theory and practical. See table - II).

1. Continuous Internal Evaluation  = 25%; Weightage: 5

Internal Assessment is a continuous process. It will be done by the faculty members of the department where the candidate is pursuing the study. The weightage is based on the student's attendance, performance in class tests, termly examinations, seminars, group discussions and submission of assignments, records and project reports. Students will be graded on a five-point scale which provides sufficient space for differentiation and categorization.

A. Criteria for Internal Assessment of Theory

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Parameter</th>
<th>% of Internal Assessment</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>Attendance</td>
<td>5%</td>
<td>1</td>
</tr>
<tr>
<td>(b)</td>
<td>Class tests (2 Nos.)</td>
<td>10%</td>
<td>2</td>
</tr>
<tr>
<td>(c)</td>
<td>Seminar</td>
<td>5%</td>
<td>1</td>
</tr>
<tr>
<td>(d)</td>
<td>Assignment</td>
<td>5%</td>
<td>1</td>
</tr>
</tbody>
</table>
(a) Attendance

<table>
<thead>
<tr>
<th>Attendance</th>
<th>%</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>90% and above</td>
<td>5%</td>
<td>A Grade</td>
</tr>
<tr>
<td>80% to 89%</td>
<td>4%</td>
<td>B Grade</td>
</tr>
<tr>
<td>75% to 79%</td>
<td>3%</td>
<td>C Grade</td>
</tr>
</tbody>
</table>

But a student with below 75% attendance cannot appear for the examination.

(b) Class Tests

Two class tests must be conducted during each semester for each course; each test carries 5% of the internal assessment. Questions of the class test can be objective type, short answer, short essay or long essay and graded on a five-point scale. For short essays and long essays the following pattern of grading is to be followed.

<table>
<thead>
<tr>
<th>Nature of Answer</th>
<th>Grade</th>
<th>Grade point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>Very good</td>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>Good</td>
<td>C</td>
<td>2</td>
</tr>
<tr>
<td>Average</td>
<td>D</td>
<td>1</td>
</tr>
<tr>
<td>Poor</td>
<td>E</td>
<td>0</td>
</tr>
</tbody>
</table>

(c) Seminar

It is to be graded based on the timely presentation, way of presentation, matter content, etc. Taking into account all these factors students can be graded on the five-point scale as given in (b) above.

(d) Assignment

It is to be graded based on timely submission, content, etc. on the five-point scale as given in (b) above.

B. Criteria for internal assessment of Practical

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Parameter</th>
<th>% of Internal Assessment</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>Attendance</td>
<td>5%</td>
<td>1</td>
</tr>
</tbody>
</table>
(a) **Attendance**: Same as given for theory (a) above

(b) **Punctuality, performance in lab, etc.**: Grade the students in the five-point scale as given for theory (b) above.

(c) **Class tests**: Two class tests must be conducted for a practical course during a semester, each with 5% of internal assessment.

(d) **Record** is to be assessed taking into account the following points: – timely presentation, neatness and contents and is to be graded on the five-point scale as given for theory (b) above. Students shall submit separate practical records duly certified by the HOD for each practical examination. The student who fails to submit the practical record will not be permitted to attend the practical examination.
### Internal Assessment Grade – Theory: Weightage = 5

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Grade</th>
<th>Grade Point</th>
<th>Weightage</th>
<th>Weighted Grade Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Class test</td>
<td>(1)</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2)</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Assignment</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>5</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Internal Assessment Grade – Practical: Weightage = 5

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Grade</th>
<th>Grade Point</th>
<th>Weightage</th>
<th>Weighted Grade Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Punctuality, Performance, etc.</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Class test</td>
<td>(1)</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2)</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Record</td>
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<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>5</strong></td>
<td></td>
</tr>
</tbody>
</table>

(c) **Project, Study tour, Viva: Weightage: 5**

<table>
<thead>
<tr>
<th>Item</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>3</td>
</tr>
<tr>
<td>Study tour</td>
<td>1</td>
</tr>
<tr>
<td>Viva Voce</td>
<td>1</td>
</tr>
</tbody>
</table>

| Total     | 5         |

A student shall be assessed for the above three requirements according to the five point scale. Follow the criterion for theory (b) above.
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Grade</th>
<th>Grade Point</th>
<th>Weightage</th>
<th>Weighted Grade Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Study tour</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Viva-Voce</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>5</strong></td>
<td></td>
</tr>
<tr>
<td>Semester</td>
<td>Paper Code</td>
<td>Title of Paper</td>
<td>Hours/ Semester</td>
<td>Hours/ Week</td>
</tr>
<tr>
<td>----------</td>
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<td>----------------</td>
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</tr>
<tr>
<td>S-I</td>
<td>BO1B 01</td>
<td>CORE COURSE I. METHODOLOGY AND PERSPECTIVES OF SCIENCE</td>
<td>36 hrs</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>BO1B 01 (P)</td>
<td>CORE COURSE. PRACTICAL -I</td>
<td>36 hrs</td>
<td>2</td>
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<tr>
<td></td>
<td>BO1C 01</td>
<td>2nd COMPLEMENTARY COURSE (Angiosperm Anatomy, Micro technique)</td>
<td>36 hrs</td>
<td>2</td>
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<tr>
<td></td>
<td>BO1C 01 (P1)</td>
<td>COMPLEMENTARY COURSE PRACTICAL - I</td>
<td>36 hrs</td>
<td>2</td>
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<tr>
<td>S-II</td>
<td>BO2B 02</td>
<td>CORE COURSE II. MICROTECHNIQUE AND HORTICULTURE</td>
<td>36 hrs</td>
<td>2</td>
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<tr>
<td></td>
<td>BO2B 02 (P)</td>
<td>CORE COURSE. PRACTICAL -II</td>
<td>36 hrs</td>
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<tr>
<td></td>
<td>BO2C 02</td>
<td>2nd COMPLEMENTARY COURSE (Plant Physiology &amp; Ecology)</td>
<td>36 hrs</td>
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<tr>
<td></td>
<td>BO2C 02 (P2)</td>
<td>COMPLEMENTARY COURSE PRACTICAL - II</td>
<td>36 hrs</td>
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<tr>
<td>S-III</td>
<td>BO3B 03</td>
<td>CORE COURSE III. GENERAL AND BIOINFOMATICS</td>
<td>54 hrs</td>
<td>3</td>
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<td></td>
<td>BO3B 03 (P)</td>
<td>CORE COURSE. PRACTICAL -III</td>
<td>36 hrs</td>
<td>2</td>
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<tr>
<td></td>
<td>BO3 C 03</td>
<td>2nd COMPLEMENTARY COURSE (Cryptogams, Gymnosperms, Plant Pathology &amp; Genetics)</td>
<td>54 hrs</td>
<td>3</td>
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<tr>
<td>S-IV</td>
<td>BO4B 04</td>
<td>CORE COURSE IV MICROBIOLOGY, MYCOLOGY, PHYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY</td>
<td>54 hrs</td>
<td>3</td>
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<tr>
<td></td>
<td>BO4B 04 (P)</td>
<td>CORE COURSE. PRACTICAL -IV</td>
<td>36 hrs</td>
<td>2</td>
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<tr>
<td></td>
<td>BO4B 04 (P 1-4)</td>
<td>PRACTICAL PAPER - I - EXTERNAL</td>
<td>36 HRS</td>
<td>2</td>
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<tr>
<td></td>
<td>BO4C 04</td>
<td>2nd COMPLEMENTARY COURSE (Morphology, Systematic Botany, Economic Botany, Pharmacognosy, Plant Breeding &amp; Horticulture)</td>
<td>54 hrs</td>
<td>3</td>
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<tr>
<td></td>
<td>BO4C 04 (P)</td>
<td>COMPLEMENTARY COURSE PRACTICAL IV - EXTERNAL</td>
<td>36 HRS</td>
<td>2</td>
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<tr>
<td>Semester</td>
<td>Paper Code</td>
<td>Title of Paper</td>
<td>Hours/Semester</td>
<td>Hours/Week</td>
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<tr>
<td>----------</td>
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</tr>
<tr>
<td>S-V</td>
<td>BO5B 05</td>
<td>CORE COURSE V ANGIOSPERM MORPHOLOGY, PLANT ANATOMY, REPRODUCTIVE BOTANY &amp; PALYNOLOGY</td>
<td>81 hrs</td>
<td>4½</td>
</tr>
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<td></td>
<td>BO5B 05 (P)</td>
<td>CORE COURSE PRACTICAL -V</td>
<td>36 hrs</td>
<td>2</td>
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<tr>
<td></td>
<td>BO5B 06</td>
<td>CORE COURSE VI BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS &amp; PALAEOBOTANY</td>
<td>81 hrs</td>
<td>4½</td>
</tr>
<tr>
<td></td>
<td>BO5B 06 (P)</td>
<td>CORE COURSE PRACTICAL -VI</td>
<td>36 hrs</td>
<td>2</td>
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<tr>
<td></td>
<td>BO5B 07</td>
<td>CORE COURSE VII SYSTEMATIC BOTANY, ECONOMIC BOTANY &amp; ETHNO BOTANY</td>
<td>81 hrs</td>
<td>4½</td>
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<tr>
<td></td>
<td>BO5B 07 (P)</td>
<td>CORE COURSE PRACTICAL VII</td>
<td>36 hrs</td>
<td>2</td>
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<tr>
<td></td>
<td>BO5D 01</td>
<td>OPEN COURSE I - CHOICE I HORTICULTURE AND NURSERY MANAGEMENT (For other Streams)</td>
<td>36 hrs</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open course practical</td>
<td>36 hrs</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>BO5D 02</td>
<td>OPEN COURSE I - CHOICE II BIOFERTILIZER TECHNOLOGY AND ORGANIC FARMING (For other Streams)</td>
<td>36 hrs</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open course practical</td>
<td>36 hrs</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>BO5D 03</td>
<td>OPEN COURSE I - CHOICE III PLANT TISSUE CULTURE (For other Streams)</td>
<td>36 hrs</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open course practical</td>
<td>36 hrs</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project Work / Field visit / Study Tour</td>
<td>27</td>
<td>1½</td>
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<tr>
<td>S - VI</td>
<td>BO6B 08</td>
<td>CORE COURSE VIII ENVIRONMENTAL SCIENCE, PHYTOGEOGRAPHY AND EVOLUTION</td>
<td>81 hrs</td>
<td>4½</td>
</tr>
<tr>
<td></td>
<td>BO6B 08 (P)</td>
<td>CORE COURSE PRACTICAL VIII</td>
<td>36 hrs</td>
<td>2</td>
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<tr>
<td></td>
<td>BO6B 09</td>
<td>CORE COURSE IX PLANT PHYSIOLOGY, METABOLISM &amp; BIOCHEMISTRY</td>
<td>81 hrs</td>
<td>4½</td>
</tr>
<tr>
<td></td>
<td>BO6B09 (P)</td>
<td>CORE COURSE PRACTICAL IX</td>
<td>36 hrs</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>BO6B10</td>
<td>CORE COURSE X CELL BIOLOGY GENETICS AND PLANTBREEDING</td>
<td>81 hrs</td>
<td>4½</td>
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<tr>
<td>Semester</td>
<td>Paper Code</td>
<td>Title of Paper</td>
<td>Hours/ Semester</td>
<td>Hours/ Week</td>
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</tr>
<tr>
<td></td>
<td>BO6B10 (P)</td>
<td>CORE COURSE. PRACTICAL X</td>
<td>36 hrs</td>
<td>2</td>
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<td>CORE COURSE ELECTIVE - CHOICE I BIOTECHNOLOGY &amp; RESEARCH METHODOLOGY (for Main Stream)</td>
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<td>BO6B12(Pr)</td>
<td>Project Work / Field visit / Study Tour</td>
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<td>BO6B13(P)</td>
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<td>BO6B14(P)</td>
<td>PRACTICAL PAPER III - EXTERNAL</td>
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SEMESTER -I  
CORE COURSE I - METHODOLOGY AND PERSPECTIVES OF SCIENCE  
Total 72 hrs., Theory - 36 hrs, Practical - 36 hrs  
4 hours / week  

THEORY :- 36 Hours  

Module – I: Science and scientific studies  
What is science? What is not science?  
Science as a human activity, Scientific temper, Empiricism, Vocabulary of science, Science disciplines; Revolutions in science, Science and technology.  
Types of knowledge:- Practical, Theoretical and Scientific knowledge, Information. (6 hrs.)  

Module – II: Experimentation in science  
Design of an experiment; Experimentation:- Selection of controls, Observational requirements, Instrumental requirements.  
Types of experiments:- Experiment to test a hypothesis, to measure a variable or to gather data by preliminary and explorative experiments.  
Observations:- Direct and indirect observations, Controlled and uncontrolled observations, Human and machine observations.  
Data collection and representations:- Graphs, Tables, Histograms and Pie diagrams (both manual and using computer).  
Interpretation and deduction of data, Significance of statistical tools in data interpretation, Errors and inaccuracies.  
Necessity of units and dimensions; Repeatability and replication of experiments.  
Documentation of experiments, Record keeping. (9 hrs.)  

Module – III: Methods in Biological Science  
Solutions:- Types of solutions. Represention of concentrations: Molarity, Normality, Percentage and ppm.  
Acids and bases:- Buffers and pH, Measurement of pH. Preparation and applications of buffers in biological studies.  
Photometry:- Colorimetry and Spectrophotometry, Principle, Working and uses.  
Autoradiography:- Principle, mechanism, and significance  
Centrifugation:- Principle, types of centrifuges and their applications
Chromatography: - Principle, types:- Adsorption chromatography, Partition chromatography, Ion exchange chromatography, Molecular sieving. (12 hrs.)

Module -IV: Statistical methods
Measures of central tendency:- Mean, Median and Mode
Measures of dispersion:- Range, Mean Deviation, Variance, Standard Deviation, Coefficient of variation.
Correlation and regression (brief account).
Probability Distribution:- Binomial Distribution, Normal Distribution and Poisson distribution
Test of hypothesis:- Null hypothesis, Alternate hypothesis Chi-square test and t-test (9 hrs.)

PRACTICALS - 36 Hours
1. Preparation of solutions of known concentrations using pure samples and stock solutions
2. Preparation of buffers (phosphate/acetate buffer)
4. Paper chromatographic separation of aminoacids
5. Demonstration of the working of different kinds of centrifuges
6. Preparation of standard graph and determination of the concentration using colorimetry.
7. Work out the problems related to mean, median, mode, standard deviation, probability, Chi-square test, t-test and correlation.
8. Familiarise the technique of data representation (tables, bar-diagram, histogram, pie-diagram and frequency curve (manual and using computer).
References:

19. Mark V. Selverman :-A Universe of atoms, An atom in the universe

SEMESTER I

MODEL QUESTION PAPER I
PART A

(Answer all the questions)

1. One molar solution contains
   1) 1 g/litre       2) 1 g. mole/litre       3) 100g/litre
   4) 1 g mole dissolved in one litre.

2. In electrophoresis, separation is based on
   1) Charge       2) polarity       3) charge and Polarity       4) atomic weight

3. In calorimetry, the principle involved is
   1) Beer and lambert’s law       2) Beer’s law
   3) Lambert’s law       4) none of these

4. Pathway of carbon in photosynthesis, carbon reduction was confined using
   1) C$^{14}$       2) O$^{18}$       3) $^{131}$       4) N$^{15}$

5. In spectro photometry, the principle involved is
   1) Beer’s law       2) Lambert’s law
   3) Beer and Lambert’s law       4) None of these

6. Separation in molecular sieving chromatography is based on
   1) size       2) charge       3) polarity       4) all the three

7. Arrange in order
   1) Collection of data       2) Presentation of data
   3) Analysis       4) Interpretation

8. Median is a
   1) measure of dispersion       2) mid value
   3) frequently       4) positional average

9. We calculate standard deviation of a population for understanding.
   1) standard of variables       2) central Tendency
   3) spread of variability       4) variance

10. Larger value of standard deviation indicates
1) variation among the population is negligible
2) variation among the population is large
3) no similarity in the population
4) variables are closely related.

11. Ogive is a
   1) frequency polygon  2) relative Frequency map
   3) frequency curve  4) cumulative frequency curve

12. Number of treatments and replications are same and they are represented in all rows and columns.
   1) may be Latin Square design  2) will be randomized Block design
   3) will be Latin Square design  4) will not be latin square design

13. C.D. value means
   1) Critical Difference  2) Critical data  3) Critical value  4) None of these

14. The number of observations on the investigating topic is
   1) Law  2) Hypothesis  3) Data  4) Control

15. A sampling method that avoids conscious and unconscious bias in an experiment
   (1)Periodic sampling  2)Random sampling  3)Stratified sampling  4)Nonstratified sampling

16. An experimental baseline against which any effect of the treatment are compared
   1) Variable  2) Control  3) Data  4) Sample

17. A generalized statement of the topic of investigation
   1) Theory  2) Aim  3) Objective  4) Hypothesis

18. A question where answers are not prescribed
   1) Closed question  2) Open question
   3) ensible question  4) Questionare

19. Variation in the data either due to chance or to nontreatment variable
   1) Human error  2) Sampling error  3) Theoretical error  4) meiosis

20. p value at which a null hypothesis is is not rejected
   1) 0.05  2) 0.01  3) 1.001  4) 0.06

5x1 = 5 weightage

Part B
22. Write short note on molecular sievings.
23. What are the advantages of arithmetic mean over median.
24. Significance of sampling in a population.
25. Significance of range in measuring the variability.
26. What are the different types of experiments?
27. What is meant by null hypothesis?
28. What is plagiarism? 

6 x 1 = 6 weightage

Part C

29. Explain the preparation of one molar solution.
30. What is the principle involved in colorimetry.
31. Explain the pattern of distribution in human skin colour.
32. What is the significance of random number table.
33. What is experimental design? Enumerate the steps involved in designing an experiment.
34. How observations are made? 

3 x 2 = 6 weightage
Part D

(Answer any two of the following)

35. Explain the uses of radioactive isotopes in Biological research.

36. Give an account of the different types of knowledge.

37. How will you come to the conclusion in your experiment observed values are singular to your expected values  

\[2 \times 4 = 8 \text{ weightage}\]
SEMESTER II
CORE COURSE- II: MICROTECHNIQUE AND HORTICULTURE
Total – 72 Hrs. Theory – 36 Hrs., Practicals- 36 Hrs.

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<th>Practicals</th>
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<tr>
<td>1) Microtechnique</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>2) Horticulture</td>
<td>21</td>
<td>24</td>
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<tr>
<td>Total</td>
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</table>

4 hrs /week

MICROTECHNIQUE  (Theory-15 hrs.)

MODULE- 1: Microscopy
Principles of microscopy – Dual lens system: eyepiece lens and objective lenses.
Magnification, Resolving power, numerical aperture.
Mechanical components: base, pillar, stage, sub stage, body tube, focusing knobs, nose pieces
Optical components: mirror, objectives, ocular lens, condenser.
Types of microscopes: Light microscope, Compound microscope, Phase contrast microscope, Fluorescent microscope, Electron microscope: Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM)
Camera lucida – Principle, working and use.
Micrometry – Stage micrometer, Ocular micrometer, Calibration and working.
Photomicrography  

MODULE- 11: Histochemical methods
General account of killing and fixing, Agents used for killing and fixing. Common fixatives – Formalin – Acetic – Alcohol, Carnoy’s fluids I & II, Chromic acid – Acetic acid – Formalin (CRAF)
**MODULE – III: Histological techniques**

Free hand sectioning; Microtome (Rotary and sledge) serial sectioning and its significance.


Infiltration – paraffin wax method, Embedding.


Mounting: Whole mount, maceration and smears  

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**Practicals**  (12 hrs.)

1. Parts of microscope and its operation.
2. Free hand sectioning of stem, leaves, Staining and mounting.
4. Camera lucida drawing and computation of magnification and actual size.
5. Demonstration of dehydration, infiltration, embedding and microtoming.

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**References**

HORTICULTURE (Theory 21 hours)

MODULE – IV: Fundamentals Of Horticulture

1. Introduction: Scope and significance, Branches of horticulture.

2. Soil: Components of soil, Types of soil, Soil analysis, Soil testing,

3. Fertilizers: Chemical, Organic, Biofertilizer, Composting systems: Non container, Container; Vermi composting.


5. Irrigation: Surface, Sprinkle, Drip and Gravity irrigation. (7 hrs.)

MODULE – V: Plant Propagation Methods

1. Seed propagation: Seed dormancy, Seed viability and longevity, Seed quality tests, Seed treatment, Essential condition for successful propagation Raising of seed beds, Transplanting techniques.

2. Vegetative propagation:
   (a) Cutting (stem, roots, leaves)
   (b) Grafting (approach, side tongue)
   (c) Budding (T-budding, patch)
   (d) Layering (simple trench, air).

3. Micropropagation: General account, multiple shooting, somatic embryogenesis, Advantages (7 hrs.)


(a) Indoor gardening: Principles, Selection of indoor plants, Care and maintenance of indoor plants, Bonsai: Principle, Creating the bonsai.

(b) Outdoor gardening: Landscaping: Goals, Types.

   (1) Cultivation and post harvest management of ornamental plants: Rose, Jasminum, Orchids and Anthurium.
(2) Cultivation and post harvest management of vegetables: Ladies finger, Bitter gourd, Chilli, Brinjal, Pea.


6. Mushroom cultivation – Oyster mushroom (7 hrs.)

Practicals (25 hrs)

1. Preparation of nursery bed and polybag filling.
2. Preparation of potting mixture – Potting, repotting.
3. Field work in cutting, grafting, budding, layering.
4. Identification of pest and diseases in campus.
5. Preparation and application of Neem kernel suspension, Tobacco decoction and Bordeaux mixture.
6. Familiarizing gardening tools and implements.
7. Training in topiary and pruning.
8. Preparation of vermicompost.
10. Establishment of vegetable garden.
11. Visit to nurseries and tissue culture laboratories and preparation of notes.
12. Basic training in Vegetable carving and flower arrangement.
13. Basic training in fruit preservation.
References

14. Dr. S. Nesamony, Oushadha Sasyangal (Medicinal plants), State Institute of Language, Kerala, Trivandum.
15. Dr. R. Prakash, Dr. K. Raj Mohan, Jaivakrishi (Organic farming), State Institute of Languages, Trivandum.

Subjectwise Distribution of Questions
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<th>Type of questions</th>
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<td>Short Answer</td>
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<td>Essay</td>
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PART A

(Answer all the questions)

1. In budding union is promoted by:
   a) activity of phloem  b) activity of xylem
   c) cambial activity    d) activity of epidermis
2. A rooting hormone
   a) Porfactors b) IAA c) ABA d) GA$_3$
3. Which among the following is a biofertilizer?
   a) urea  b) factomphose  c) cowdung  d) rice oil
4. Irrigation minimising rain
   a) surface  b) drip  c) spray  d) sprinkler
5. Mushroom cultivation is carried out using
   a) Spawn  b) Seeds  c) buds  d) bulbil
6. Propagule used in tissue culture
   1) Callus  2) Explant  3) Embryo  4) all the three
7. Which is an apruning tool
   1) Trowel  2) Hose  3) Rake  4) Shears
8. Branch of Horticulture that deals with the production of vegetables
   1) Floriculture  2) Pomology  3) Olericulture  4) Arboriculture
9. A plant that is propagated by root cutting.
   1) Jack fruit  2) Muraya  3) Hibiscus  4) Anthurium
10. The types of propagation advisable in Mango
    1) Seed propagation  2) Layering  3) Grafting  4) Cutting.
11. Which plant is suitable for making bonsai
    1) Conifers  2) Teak  3) Musa  4) Any annuals
12. Which is an edible fungi

28
1)  Peziza  2) Pleurotus  3) Toad stool  4) None of these

13.  60-65% course sand is present in
   1)  Loamy soil  2) Clayey soil  3) Sandy soil  4) None of these

14.  Value of one division of stage micrometer is
   1) one micron  2) ten microns  3) 100 microns  4) 0.001 mm

15.  Resolving power of a light microscope is
   (1)10nm  2)50nm  3)100nm  4)200nm

16.  Which among the following is a coal-tar dye
   1) Orcein  2) Hematoxylin  3) Cotton blue  4) Aceto carmine

17.  Rotary microtome is used for
   1) taking serial sections  2) sections of wood
   3) taking ultra thin sections  4) quick tissue analysis

18.  DPX is used for
   1) spreading the ribbon  2) affixing the sections
   3) mounting the material  4) permanent mounting

19.  Maceration helps to study
   1) individual cells  2) the whole tissues  3) mitosis  4) meiosis

20.  Which among the following is the component of killing and fluid – FAA.
   1) Formalin – Methanol – Acetone
   2) Acetic acid – Ethanol – Formic acid
   3) Formic acid – Acetic acid – Ethyl Alcohol
   4) Formaldehyde – Acetone – Alcohol

   5x1 = 5 weightage

Part B

(Answer any six of the following)

28.  

21. Name the species of earthworm used in vermicompost.

22. Define pomology

23. Name any two watering tools
24. What is the percentage composition of Loamy soil?
25. Name two legislative method of disease control
26. What is maceration?
27. Explain the role of ethyl alcohol in permanent slide preparation
28. Write a note on significance of staining.\[6 \times 1 = 6 \text{ weightage}\]

**Part C**

(*Answer any three of the following*)

29. Explain the preparation of one molar solution
30. What is the principle involved in colorimetry
31. Explain the pattern of distribution in human skin colour
32. What is the significance of random number table.
33. Calibration in microscopic measurement
34. Significance of killing and fixation fluids.\[3 \times 2 = 6 \text{ weightage}\]

**Part D**

(*Answer any two of the following*)

35. Define vegetative propagation. Explain the different methods in vegetative propagation with examples.
37. Describe the methods of irrigation\[2 \times 4 = 8 \text{ weightage}\]

**SEMESTER-III**

**CORE COURSE III. GENERAL AND BIOINFORMATICS**

Total 90 Hrs., Theory- 54Hrs., Practical 36 Hrs.

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<th>Practicals</th>
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<tr>
<td>1) General Informatics</td>
<td>36</td>
<td>18</td>
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GENERAL INFORMATICS (Theory 36 hrs.)

MODULE-I: OVER VIEW OF INFORMATION TECHNOLOGY

1. Definition, salient features, scope and tools in information technology.
2. Computers - evolution of computers and computer generations, classification (Brief account)
4. Software - system, programming and application software. Malicious software.
5. Networking- LAN and WAN; Intranet and Internet. Internet protocols-IP address, and Domain Name System, URL.

10 hrs

MODULE-II: KNOWLEDGE SKILL FOR HIGHER EDUCATION

1. Internet as a knowledge repository, data and metadata.
2. Searching the internet: Browsers, search engines, Meta search engines, Boolean searching.
3. IT in teaching, learning and research: Web page designing and web hoisting. Academic web sites, e-journals, Open access initiatives and open access publishing, education software, academic services - INFLIBNET, NICNET, BRNET.

9 hrs

Module – III: SOCIAL INFORMATICS

1. IT and society- issues and concerns. The digital divide, IT and development, the free software debate.
2. IT industry: new opportunities and new threats.
3. Social net work sites, orkut, facebook, myspace etc. emerging trends, benefits, potential for misuse and hazards.


6. e-wastes and green computing.

7. Impact of IT on language and culture. 9 hrs

**MODULE – IV: IT Application**

1. e-governance at national and state levels, overview of IT application in medicine, healthcare, business, commerce, industry, defence, law, crime detection, publishing, communication, resource management, weather forecasting, education, film and media. IT in service of disabled.

2. Futuristic IT - Artificial intelligence, virtual reality, bio-computing. 8 hrs
MODULE – V: BIOINFORMATICS

1. Definition and scope of Bioinformatics.

2. Introduction to genomics and proteomics.

3. Internet and Bioinformatics

4. Bioinformatics databases:
   - Nucleic acid databases – NCBI, EMBL, GENBANK.
   - Protein Databases – SwissProt, TrEMBL.

5. Tools of Bioinformatics
   - Pair wise sequence alignment – BLAST
   - Multiple sequencing alignment – Clustal W
   - Homology modeling of protein, structure prediction.


Practicals: (18 hrs)

1. Visit to Nucleic acid and protein databases in the internet.

2. BLAST analysis using DNA sequences and BLAST tool form NCBI site

References

1. Technology in Action, Pearson
2. V.Rajaraman, Introduction to Information Technology, Prentice Hall
3. Alexis Leon & Mathews Leon, Computers Today, Leon Vikas, Rs. 180
4. Greg Perry, SAMS Teach Yourself Open Office.org, SAMS,
5. Alexis & Mathews Leon, Fundamental of Information Technology, Leon Vikas
6. George Beekam, Eugene Rathwohl, Computer Confluence, Pearson Education,
7. Barbara Wilson, Information Technology: The Basis, Thomson Learning
the analysis of genes and proteins, Wiley Interscience , New York.


12. Attwood DJ and Arry Smith Introduction to Bioinformatics; Pearson education


Web Resources

1. www.fgcu.edu/support/office2000
2. www.openoffice.org Open Office Official web site
3. www.microsoft.com/office MS Office web site
4. www.lgta.org Office on-line lessons
5. www.learnthenet.com Web Primer
6. www.computer.org/history/timeline
7. www.computerhistory.org
10. www.dell.com Dell Computers
11. www.intel.com Intel
12. www.ibm.com IBM
13. www.keralaitmission.org Kerala Govt IT Dept
14. www.technopark.org
I. Objective questions - answer all

1. INFLIBNET is used in

2. Which of the following is a program for IT for masses in Kerala?
   a. SPARK       b. Akshaya       c. IDEAS       d. AASTHI

3. Which of the following is a nucleic acid sequence database?
   a. Swiss-Prot       b. PDB 4       c. GenBank       d. TrEMBL

4. 1 Kilobyte is equal to
   a. 1024 bytes       b. 1204 bytes       c. 2104 bytes       d. 1402 bytes

5. The most used Internet search engine is

6. Primary memory is
   a. RAM       b. CD ROM       c. Hard Disk       d. Mother Board

7. Which of the following is not a processor?
   a. Celeron       b. Pentium 4       c. AMD Athelon       d. Wipro

8. Which of the following is not an e-Governance project in Kerala
   a. e-Krishi       b. e-District       c. e-Pay       d. e-Procurement

9. Which operating system is used in majority of the personal computers all over the world?
   a. Macintosh       b. Linux Redhat       c. MS Windows       d. Apple

10. The entire array of encoded proteins in an organism is
    a. Genome       b. Proteome       c. Transcriptome       d. Primers

11. Program that compares an amino acid query sequence against a protein sequence database
    a. BLASTb, BLASTp       c. BLASTn       d. BLAST x

12. I-T@School in Kerala uses which of the following software?
    a. softexam       b. softstudy       c. softschool       d. softeducation

13. NCBI is in
a. Maryland  b. Canada  c. Japan  d. UK

14. The tertiary structure of proteins are stabilized by disulphide bonds between
   a. Lysine residues   b. Cysteine residues  c. Hystidine residues
   d. Glycine residues

15. Protein - protein interactions are detected by
   a. DNA microarrays  b. Protein arrays  c. Lipofection
   d. Transfection

16. Building blocks of a protein database is

17. WEEE is
   a. Wired Electrical and Electronic Equipment  b. Waste Electrical and
      Electronic Equipment  c. Wired Electrochemical and Electronic Equipment
   d. Waste Electrochemical and Electronic Equipment

18. Program used to label green computing

19. Which of the following is a programme for IT for masses in Kerala
   a. SPARK  b. IDEAS  c. AASTHI  d. AKSHAYA

20. Which of the following is a free operating system?
   a. LINUX VISTA Basic  b. WINDOWS xp  c. WINDOWS VISTA
       Premium  d. WINDOWS

II. Short Answer questions - Answer any 6 questions
21. What is Bluetooth technology?
22. What are the hazards of e-wastes?
23. Explain the concept of tele-medicine.
24. What is green computing?
25. IPR
26. Differentiate copy-right from patenting.
27. BLAST
28. NCBI
III. Short Essay - Answer any four

29. Whether IT is advantageous or disadvantageous in education? Substantiate.

30. Name any two Indian Cyber Laws. Explain its merits and demerits.

31. Differentiate between LAN, WAN and internet.

32. What is the influence of IT on regional language Malayalam?

33. What is homology modeling? How it is useful in structure prediction? 34. Differentiate genomics and proteomics. Add a note on their applications

IV. Essay questions - Answer any two

35. What is e-Governance? Discuss anyone state e-Governance initiative. Discuss advantages and disadvantages of e-Governance.

36. What are databases? Explain the different types of biological databases with suitable examples.

37. Enumerate the different applications of bioinformatics.
SEMESTER IV

CORE COURSE IV-MICROBIOLOGY, MYCOLOGY, PHYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY

Total – 90 Hrs. Theory – 54 Hrs., Practicals- 36 Hrs.

<table>
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<tr>
<th>Distribution of Hours</th>
<th>Theory</th>
<th>Practicals</th>
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<tbody>
<tr>
<td>1) Microbiology</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>2) Mycology &amp; Lichenology</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>3) Phycology</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>4) Plant Pathology</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54</strong></td>
<td><strong>36</strong></td>
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</table>

MODULE - I: Microbiology

Theory- 12 Hrs

1. Classification of prokaryotes, Bergey’s classification.
2. Bacteria:- Ultrastructure of bacteria with stress to cell wall and flagella. Bacterial growth, Nutrition, Reproduction, Economic importance of bacteria
3. Viruses:- Classification, architecture and multiplication of bateriophages and TMV. Brief account of retroviruses, HIV, Viriods, Prions.
5. Industrial microbiology:- Alcohol, Acids, Milk products and Single cell proteins
6. Bacterial pure culture techniques – Spread plate, Streak plate and Pour plate method.

Practicals

9 Hrs.

1. Simple staining – crystal violet
2. Gram staining – Curd, root nodules
3. Culture and isolation of bacteria using nutrient agar medium
References


MODULE – II: Mycology & Lichenology (Theory-12 Hrs.)

1. Introduction – General characters and phylogeny
2. A general outline on classification – Ainsworth and Bisby (1983)
3. Mastigomycota: General characteristics, occurrence, reproduction, and life cycle – Type: Pythium, Albugo
4. Zygomycota: General characters, occurrence, reproduction, and life cycle – Type: Mucor

Practicals (9 hrs.)

1. Micropreparation – Cotton blue Lactophenol – Slides of the above mentioned types.
2. Isolation and culturing of Fungi

References


Lichenology
Introduction

Type of Interaction between the components symbiosis – mutualism.

Growth forms – Crustose (Paint like), filamentous (hair-like), foliose (leafy), fruticose (branched) leprose (powdery), squamulose (consisting of scale like structures), Gelatinous (algal partner produce a polysaccharide that absorb and retain water).

Taxonomy and Classification based on fungal partner

Reproduction and Dispersal – Fragmentation, isidia, soridia, cephaloidea, cephalo

Sexual Reproduction – Typical of fungal partner, producing spores.

Ecophysiological advantages of lichen -

- Endure extreme condition of temp., drought, exposure to space
- Poikilohydric – Tolerate irregular, extreme, extended periods of severe desiccations.
- Epiphyte – adaptations
- Sensitivity to pollutants
- Chemical degradation and physical disruption of mineral surfaces
- Unprotected survival in the vacuum of space even after 2 weeks.

Economic Uses: Dyes, Cosmetics and perfumes, Medicinal uses- (in nanomedicine (Usnea longissima), treatment of cancer, Homoeopathy). Toxicology, Lichens as food, Biremediation, Ecological indicators, Pollution indicators, Lichen in Soil formation and pioneers of Xerosere.

Practicals

1. Morphology and anatomical features of lichen- Usnea

2. Identification of different growth froms of Lichen

References


MODULE – III: Phycology

1. Classification of Algae. (Fritsch, 1935) with modifications after (Whittaker, 1969) basis for classification

2. General Features: Occurrence, cell morphology, range of thallus structure, reproduction and life cycles.


4. Xanthophyceae: General characteristics, occurrence, range of thallus structure, reproduction, interrelationships. Type - *Vaucheria*.

5. Bacillariophyceae (Diatoms) General characteristics, occurrence, thallus structure, cell structure, cell division, sexual reproduction, auxospores, classification, interrelationships. Type - *Pinnularia*.

6. Phaeophyceae: General characteristics, occurrence, range of thallus structure, anatomy, cell structure, flagella, reproduction, alternation of generations, interrelationships. Type - *Sargassum*.

7. Rhodophyceae: General characteristics, occurrence, range of thallus structure, cell structure, reproduction, life cycle, phylogeny and interrelationships. Type - *Polysiphonia*.

9. Economic Importance

Algae as food, fodder, green manure, bio-fuels, pollution indicators, research tools, medicinal uses of algae,

Commercial Products - carrageenin, agar-agar, alginates, diatomaceous earth.

Harmful effects – Water bloom, entrophication, neurotoxins, parasitic algae.

**Practicals**

1. Identification of two Algae from Algal mixture (Microscopic algae) including *Volvox, Oedogonium, Spirogyra, Vaucheria* and *Polysiphonia*.

2. Identify the vegetative and reproductive structures of the types studied.
3. Algal culture of the types mentioned in the syllabus- demonstration.

**Submission**

Five algal herbarium sheets must be submitted.

**References**

   Bishen Sing Mahendra Pal Sing.
   Cambridge.
   Books India. (pp. 376-377. Composition of media used for algal culture.

**MODULE - IV: Plant Pathology**

(Theory 12 hrs.)

1. Introduction – Concepts of plant disease, pathogen, causative agents, symptoms
2. Mechanism of disease resistance (morphological, physiological anatomical, biochemical
   and genetic), Physiology of parasitism (fungaltoxin), modelling and disease forecasting.
3. Symptoms of diseases: spots, blights, wilts, rots, galls, canker, gummosis, necrosis,
   chlorosis, smut, rust, damping off.
4. Control measures: Prophylatic methods, Chemical, biological and genetic methods,
   quarantine measures.
5. Brief study of Plant diseases in South India (Name of disease, pathogen, symptom and
   control measures need to be studied.)
   Nematode infection on Banana.
Practicals  

(9 hrs.)

Identification of the disease, pathogen, symptoms and control measures of the following:

1. Citrus canker
2. Mahali disease
3. Tapioca mosaic disease
4. Blast of Paddy
5. Abnormal leaf fall of Rubber

Submission

Preparation of 5 herbarium sheets of Pathology – specimens studied (2 marks)

References


Rangaswami, G. 1999. Disease of Crop plants of India Prentice Hall of India Pvt. Ltd.

## Subjectwise Distribution of Questions

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PART A

(Answer all the questions)

1. A virion is a
   a) Infectious nucleic acid b) Infectious virus particle c) a virus parasitic on bacteria d) a virus parasitic on algae.

2. Which algae are almost exclusively marine
   a) brown algae b) blue green algae c) desmids d) green algae.

3. Lichen grown on the trees are called
   a) saxicoles b) corticoles c) lithophytes d) psammophytes.

4. Red rust of tea is caused by
   a) Fungus b) virus c) algae d) mycoplasma

5. Male sex organ in Chara
   a) antheridium b) spermatium c) nucule d) globule

6. Cyanophyceae is separated from algae because it is
   a) eukaryotic b) unicellular c) prokyotic d) filamentous

7. Floridean Starch is the energy reservoir of
   a) Chlorophyta b) Xanthophyta c) Phaeophyta d) Rhodophyta.

8. Asexual reproductive structure in Lichen is
   a) apothecium b) soridia c) gonidia d) conidia.

9. A fungal toxin
   a) Ergotamine b) Histamine, c) Cysteine, d) Glutamine

10. Infective protein particle
    a) Virus b) Viroid c) Prion d) Intron

11. A live viral vaccine
    a) Petruissis, b) Typhoid, c) Poliomyelitis, d) Tetanus.

12. Which of the following is not used for biological control
    a) Pseudomonas b) Peziza c) Bacillus d) Trichoderma

13. A retro virus
    a) HIV b) TMV c) T2 Phage d) None of the above

14. Which microorganism produces the gum Dextran
    a) Volvox b) Diatms c) Chara d) Oedogonium
a) Nostoc  b) Xanthomonas  c) Aspergillus  d) Penicillium

19. Which bacterium obtain energy from the following reaction
\[ \text{NO}_2 + \frac{1}{2} \text{O}_2 \rightarrow \text{NO}_3 + \text{energy} \]
   a) Nitrobacter  b) Nitrosomonas  c) Azotobacter  d) Rhizobium

5x1 = 5 weightage

Part B
(Answer any six of the following)

20. Archaebacteria and its significance
21. Define Plakea
22. What is Nannandrium
23. Define facultative saprophyte
24. Write notes on symbiosis with an example
25. What is heteroecious fungus
26. Distinguish between smut and rust
27. Write notes on Rhizosphere

6 x 1 = 6 weightage

Part C
(Answer any three of the following)

28. Relationships between green algae and green plants.
29. Enumerate the economic importance of Fungi
30. Briefly explain physiology of parasitism
31. Explain the reproduction in Volvox
32. Briefly explain industrial uses of microbes
33. Describe the gene transfer methods in bacteria

3x2 = 6 weightage

Part D
(Answer any two of the following)

34. Briefly explain the life cycle of a facultative saprophyte with special emphasis on damping off of seedling
35. Explain the different life cycle you have studied in algae with examples.
36. Describe the structure and reproduction of Bacteriophage. 2 x 4 = 8 weightage
PART A
(Answer all the questions)

1. Agar-agar is obtained from
   a) Sargassum  b) Nostoc  c) Gelidium  d) Ectocarpus
2. A bacteriophage with single stranded DNA
   a) \(\phi\) x 174  b) Small pox virus  c) \(T_2\)-bacteriophage  d) Polyoma virus
3. Citrus cankles is caused by
   a) Bacillus  b) Xanthomonas  c) Pyricularia  d) Streptococcus
4. A parasitic alga
   a) Cephaleurus  b) Polysiphonia  c) Volvox  d) Spirogyra
5. Type of colony present in Volvox
   Palmelloid  b) Dendroid  c) Cornobium  d) Filamentous
6. Amylum star is found in
   a) Chara  b) Nostoc  c) Volvox  d) Vancheria
7. Spauring is related to
   a) Mushroom cultivation  b) Sporulation in Ascomycota  c) Sporulation of Agaricus
   d) Sporulation in Mucor
8. Fruticose Lichens comes under the growth form
   a) Powdery  b) Scaly  c) Foliose  d) Branched
9. Orcein is obtained from
   a) Parmelia  b) Usnea  c) Rochella  d) Cladenia
10. Crue disease is caused by
    a) Prion  b) Viriod  c) Virus  d) Bacteria
11. A neurotoxin produced from fungus
    a) Amylopeptin  b) Amaritin  c) Chitin  d) Pectin
12. Blast of paddie is caused by
    a) Xanthomonas  b) Rhizoctonia  c) Pythium  d) Pyricularia
13. Sexual reproduction is not observed in
    a) Ascomycota  b) Phycymycota  c) Basidiomycota  d) Deuteromycotina
14. Dikaryotic mycelium is not found in
    a) Peziza  b) Pythium  c) Agaricus  d) Puccinia.
15. Which algae have this type of life cycle plant
    \(\text{meiosis}\)  \(\text{fusion}\)
    \(\frac{(2n)}{\text{gameter (n)}}\)  \(\text{zygote (2n)}\)
    a) Volvox  b) Oedogonium  c) Sargassum  d) Spirogyra
16. Mannitol and Laminasin are the storage products of
    a) Red algae  b) Brown algae  c) Blue green algae  d) Golden brown algae
17. Which groups of fungi are called ‘club fungi’
    a) Ascomycetes  b) Basidiomycetes  c) Deuteromycetes  d) Phycomycetes
18. A Viroid is a
    a) A virus which infects nucleic acid
b) A virus which infects bacteria

c) A virus with nucleic acid and protein coat

d) A naked infectious nucleic acid

19. Who is the author of ‘Manual of Determinative Bacteriology’
   a) Winogradsky  b) Beijerinck  c) Bergey  d) Alexopoulos

20. An enzyme system capable of hydrolyzing bacterial cell wall
   a) Lysosome  b) Microsome  c) Lysozyme  d) Ribosome

Part B
(Answer any six of the following)

21. Define arus
22. Differentiate between isogamy and oogamy
23. Write note on siphonaceous thallus
24. What is isidium
25. Fungal toxins and its …. 
26. Write note on quarantine measures.
27. Write notes on SCP.
28. What is mycoplasma. Name a disease caused by it.

Part C
(Answer any three of the following)

29. Write a brief account of role of microbes in industry
30. Give a brief account of Gram staining
31. Enumerate the medicinal uses of algae
32. Briefly explain the post fertilization changes in Polysiphonia
33. Briefly explain the mechanism of disease resistance.
34. Brief note on sexual reproduction in Pythium 

Part D
(Answer any two of the following)

35. Life cycle of a fungus causing black must of wheat
36. Thallus evolution in Chlorophyta with special reference to the types you have studied.
37. Microbes in soil and their role
**SEMESTER V**

**CORE COURSE V - ANGIOSPERM MORPHOLOGY, PLANT ANATOMY**

REPRODUCTIVE BOTANY & PALYNOLGY

Total – 117 Hrs. Theory – 81 Hrs., Practicals- 36 Hrs.

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<tr>
<th>Distribution of Hours</th>
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<td>1) Angiosperm morphology</td>
<td>18</td>
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<td>2) Plant Anatomy</td>
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<td>3) Reproductive Botany &amp; Palynology</td>
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<td><strong>Total</strong></td>
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**MODULE- I: Angiosperm Morphology**

**Theory 18 –Hrs.**

I Morphological description of a flowering plant- Plant Habit  
A. Root: Types - Tap root, fibrous root; Modifications - Definition with examples - Storage, aerial, pneumatophores, buttress  
B. Stem: Habit - Acaulescent, Caulescent, Cespitose Prostrate, Repent, Decumbent, Arborescent, Suffrutescent (Definition with examples only); Modification - Underground, Aerial, Subaerial with examples  
C. Leaves: Lamina, petiole, leaf tip, leaf base, stipule, pulvinus; Phyllotaxy; types - simple and compound; shapes of lamina; leaf tip; leaf base; leaf margin; leaf surface features: hairiness - tomentose, glabrous, scabrous, strigose, hispid.

II Inflorescence: racemose, cymose and specialised (cyathium, hypanthodium, coenanthium verticillaster, thrysus)

III Flower: Flower as a modified shoot - detailed structure of flowers - floral parts -their arrangement, relative position, cohesion and adhesion - symmetry of flowers - floral diagram and floral formulae.

IV Fruits - Types, classification with examples; Seed structure - dicot and monocot - albuminous and exalbuminous, aril, caruncle; Dispersal of fruits and seeds - types and adaptations.

**Practicals**

9 Hours

1. Students have to identify the types mentioned in the syllabus and are need not be drawn in the record.
2. Students have to submit a minimum of 10 different types of specimens belonging to any one of the following categories (dry/wet)- root, stem, leaf, inflorescence, flower, fruits and seeds.

3. Students shall work out any flower belong to the families included in the taxonomy syllabus.

References


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**Module – II: Plant Anatomy**

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<th>Section</th>
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<th>Hours</th>
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<td>1.</td>
<td>Introduction: Brief history and significance</td>
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<td>2.</td>
<td>Plant cell- Structure, types with regard to size and shape</td>
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<td>A. Cell wall - Primary - Wall layers. Secondary - Thickening, Pits - simple, boardered, half boardered - Plasomdesmata, their structure and function.</td>
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<td>Fine structure - Orientation of micellae, sub-micellae, microfibrils &amp; cellulosic chains.</td>
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<td>B. Growth of cell wall - Apposition, Intususception</td>
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<td>C. Extra cell wall materials - lignin, cutin, suberin callose, wax.</td>
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<td>D. Cell wall properties.</td>
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<td>Non-living inclusions with special emphasis on economic importance:-</td>
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<td>a. Reserve food materials - carbohydrates, proteins, fats &amp; oils</td>
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<td>i. Carbohydrates - sugars &amp; starch</td>
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<td>Starch grains -structure, different types with examples</td>
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<td>ii. Proteins - Aleurone grains with examples</td>
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<td>iii. Fats &amp; oils examples.</td>
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<td>b. Secretory materials</td>
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c Waste materials - Nitrogenous – alkaloids, Non-nitrogenous - glucosides, gums, resins, tannins

Mineral crystals - Calcium oxalate - prismatic, Drusses raphides

Calcium carbonate - cystoliths with examples 1½ hrs.

4. Tissues :- Definition -Types


i. Theories on apical organisation - Apical cell theory, Histogen theory, Tunica - corpus theory

ii. Organisation of shoot apex and differentiation of tissues- (protoderm, procambium and ground meristem should be mentioned).

iii Kopper-Kappe theory- organization of root apex in dicots- common types with three sets of initials- in monocots – Maize type with four sets of initials 5 hrs.

b Mature tissues- definition classification- simple complex and secretory

i. Simple tissues – parenchyma, collenchyma, sclerenchyma, - fibres and sclereids- structure occurrence and function. 3 hrs.

ii Complex tissues - Definition - Xylem & Phloem structure, origin and function

Phylogeny, tracheary elements & Sieve elements 2 hrs.

iii. Secretory tissues - glands, glandular hairs, nectaries, hydathodes, schizogenous and lysigenous ducts, resinducts, mucilage ducts, kinoveins, laticifers - articulated and non-articulated - with examples. 2½ hrs.
**MODULE – III:**

I. Vascular bundles - Origin and types - conjoint, collateral, bi-collateral, open closed, radial, concentric - amphicribal and amphivasal.  
   **2 hrs.**

II. Primary vegetative body of the plant -

   Dicot root - (aerial -Ficus, Tinospora)

   Dicot stem - Normal (Centella) and bi-collateral (Cephalandra, Cucurbita)

   Monocot stem - (Grass, Asparagus)

   Dicot leaf - (Ixora, Hibiscus)

   Monocot leaf - (Grass, Crinum)

   Stomata - Dicot, Monocot, Classification (Metcalf & Chalk)  
   **5½ hrs.**

III. Root - stem transition  
   **1½ hrs.**

IV. Nodal anatomy - unilacunar, trilacunar and multi lacunar types - leaf trace - leaf gaps - branch trace - branch gaps  
   **1½ hrs.**

V. Secondary body of the plant

   a. Normal secondary growth in Dicot stem & (Vernonia, Eupatorium, Moringa) Dicot root (Ficus, Tinospora)

   Formation of vascular cambial ring - structure and activity of cambium - storied and non-storied, fusiform and ray initials.

   Formation of secondary wood, secondary phloem, vascular rays, growth ring, heart wood, sapwood.  
   **6 hrs.**

   b. Extra stelar Secondary thickening in stem and root - Periderm formation.

      Structure - phellogen, phellem, phelloderm, bark, lenticels - structure & function.  
      **1 hrs**

VI. Anomalous secondary growth - general account with special reference to the anomaly in Dicot stem - Boerhaavia, Bignonia, Dracaena.  
   **5 hrs.**

VI. Applied Plant Anatomy: Anatomy related to Taxonomy  
   **1 hr.**

Practicals  
   **18 Hrs.**

   Students are expected to

   1. Study the primary plant structure of stem, root and leaf (Dicots and Monocots)
2. Study the secondary plant structure of Dicot stem and root after secondary thickening
3. Study the anomalous secondary thickening -Boerhaavia, Bignonia and Dracaena
4. Identify at sight different cell types – tissues and vascular bundles (all types).

References

MODULE – IV: Reproductive Botany

1. Typical Angiosperm Flower – morphology of floral organs
2. Anther - Structure, Dehiscence, Microsporogenesis – types; male gametogenesis
   2 hrs.
3. Ovule - Structure, types, Megasporogenesis, female gametogenesis: monosporic, bisporic and tetrasporic. Structure of typical embryosac, Polygonum, Allium and Adoxa type
   2 hrs.
4. Fertilization - Pollen tube entry – types, syngamy, and triple fusion, Double fertilization,
5. Endosperm formation - Types - Free nuclear, cellular and helobial; endosperm haustoria – Crotalaria type
   1½ hrs.
6. Embryo - Structure and development of Dicot embryo- Capsella type and Mococot embryo - Sagittaria (structure only)
   1½ hrs.
7. Apomixis- definition and kinds; Polyembryony - causes, types and significance  
   \[ \text{1½ hrs.} \]

8. Germination of seed - Epigeal and Hypogeal type

9. Experimental Embryology: \textit{In vitro} culture of embryo, anther, pollen, ovary and ovule  
   (Brief description only)

10. Role of embryology in Taxonomy  
    \[ \text{2½ hrs.} \]

\textbf{Practicals}  
\[ \text{4½ Hours} \]

Students should identify-

1. Anther (young and mature), Types of ovules
2. Dicot and monocot embryo of Angiosperms
3. Demonstration of embryo mounting eg:- Tridax, Crotalaria

\textbf{References}


\textbf{MODULE – V: - Palynology}  
\[ \text{Theory -7 Hrs.} \]

1. Palynology- Introduction, significance & scope
2. Pollen morphology – Acetolysis, Pollen wall features - fine structure, pollen kit substance; Pollinium.  
   \[ \text{2 hrs.} \]
3. Pollination - different types, mechanisms and contrivances
4. Pollen viability and pollen storage  
   \[ \text{2½ hrs.} \]
5. Applied palynology: Aero - palynology, Pollen allergy; Role of pollen morphology in Taxonomy  
   \[ \text{2½ hrs.} \]
Practicals

4½ Hrs.

1. Study the pollen morphology of *Hibiscus, Datura*, and pollinia of *Cryptostegia* and *Calotropis* by acetolytic method

2. Viability test for pollen
   1. *in vitro* germination using sugar solution. (cavity slide method)
   2. Tetrazolium test
   3. Acetocarmine test (Acetocarmine & Glycerine 1:1)

References:


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PART A

(Answer all the questions)

1. Tap root modification found in
   a) Asparagus   b) Carrot    c) Potato    d) Tapioca

2. Jig leaves are
   a) Glabrous    b) Glaucus   c) Scabrous  d) Tomentose

3. Inflorescence of Sun flower
   a) Spike      b) Spadix    c) Corymb   d) Capitulum

4. The fruit of Paddy
   a) Cypsella   b) Caryopsis c) Achene    d) Nut

5. Anther wall layer with fibrous thickening
   a) Epidermis   b) Endothecium c) Endothelium d) tapetum

6. Roughness of grass leaf is due to the presence of
   a) Cutin      b) Suberin   c) Tannin    d) Silica

7. Vascular cambium is a
   a) Lateral meristem b) Intercalary meristem
   c) Apical meristem  d) Rib Meristem

8. Pollinium is present in
   a) Calotropis   b) Catheranthus c) Ricinus   d) Tamarindus

9. Stem habit of Tridax is
   a) Procumbent  b) Excurrent c) Decumbent d) Prostrate

10. Growth of cells wall is accomplished by
    a) Cell division b) Apposition c) Addition d) Duplication

11. Principal component of exine is
    a) Pollinin    b) Suberin   c) Lignin    d) Sporopollenin
12. Erect ovule is termed
   a) Orthotropous  b) Anatropous  c) Campylotropus  d) Circinotropous

13. Cell was discovered by
   a) Schwann  b) Schleiden  c) Robert Brown  d) Robert Hook

14. Living mechanical tissue
   a) Aerenchyma  b) Collenchyma  c) Sclerenchyma  d) Parenchyma

15. Mesogamy is the process of entry of pollen tube through
   a) Micropyle  b) Chalaza  c) Integument  d) Funicle

16. Closed vascular bundle is present in
   a) Dicot stem  b) Monocot root  c) Dicot root  d) Monocot stem

17. Sagittaria is an example for
   a) Dicot embryo  b) Dicot seed  c) Monocot embryo  d) Monocot seed

18. Cork Cambium is
   a) Phellogen  b) Phellem  c) Phelloderm  d) Periderm

19. Included phloem occur in
   a) Boerhaavia  b) Piperc  c) Amaranthus  d) Bignonia

20. Polyembryony occur in
   a) Pinus  b) Ficus  c) Amaranthus  d) Phyllanthus

**5x1 = 5 weightage**

**Part B**

(Answer any six of the following)

21. Differentiate between simple and compound leaves

22. Comment on Endodermis

23. What is triple fusion?

24. What is pollen kit? Mention its function.

25. Give the structure of a typical monocot embryo

26. What is Caruncle? Give an example

27. What is the importance of wood anatomy?

28. What are lenticels? Mention their functions.

**6x1 = 6 weightage**

**Part C**

(Answer any three of the following)

29. What is placentation? Classify them.

30. Give a detailed account of isobilateral leaf with the help of labelled sketch.
31. Given an account on structure and development of Dicot embryo.
32. Comment on the role of Palynology in Taxonomy
33. Describe briefly the special types of inflorescence.
34. Explain the extra stelar secondary growth in root & stem  \(3 \times 2 = 6\) weightage

**Part D**

*(Answer any two of the following)*

35. With the help of labelled diagrams, describe the anomalous secondary growth in Bignonia.
36. Given an account on experimental embryology
37. Write an essay on root-stem transition with suitable diagrams.

\(2 \times 4 = 8\) weightage
PART A

(Answer all the questions)

1. Whorled phyllotaxy is present in
   a) Hibiscus  b) Calotropis  c) Nerium  d) Leucas

2. Quiescent centre is found in
   a) Leaf apex  b) Shoot apex  c) Root apex  d) Internode

3. Groups of pollen grains which are loosely jointed among themselves
   a) Tetrad  b) Diad  c) Pollinium  d) Massulae

4. Type of ovule in which the funiculus is very long and surrounds the ovule.
   a) Orthotropous  b) Circinotropous  c) Anatropus  d) Amphitropous

5. Casparian strips occur in
   a) Epidermis  b) Endodermis  c) Hypodermis  d) None of these

6. Jack fruit is developed from
   a) Monocarpous pistil  b) Apocarpous pistil  c) Syncarpous Pistil  d) Infloresence

7. Living nonnucleated plant cell
   a) Sieve cell  b) Companion cell  c) Sieve tube  d) Sieve plate

8. Lever mechanism is seen in
   a) Hibiscus  b) Leucas  c) Acacia  d) Salvia

9. Cotyledon of Monocot seed is known as
   a) Labellum  b) Scutellum  c) Vexillum  d) Phellem

10. Proponent of Kopper-Kappe theory
    a) Nageli  b) Hanstein  c) Schimidt  d) Schuepp

11. Chrysanthemum is an example for
    a) Stolon  b) Runner  c) Sucker  d) Offset

12. Calcium carbonate crystals are found as
13. Monothecous anthers are found in
   a) Ixora   b) Datura   c) Hibiscus   d) Annona

14. Monocot plant showing anomalous secondary growth
   a) Gloriosa   b) Cocos   c) Oryza   d) Dracaena

15. Primary endosperm nucleus is
   a) Haploid   b) Diploid   c) Triploid   d) Polyploid

16. Pneumatophores are present in
   a) Pandanus   b) Ficus   c) Cycas   d) Avicennia

17. Type of stomata in Ixora
   a) Anomocytic   b) Anisocytic   c) Diacytic   d) Paracytic

18. Tetrasporic type of embryosac is present in
   a) Polygonum   b) Adoxa   c) Allium   d) Oenothera

19. Placentation found in Hibiscus
   a) Basal   b) Marginal   c) Axiled   d) Parietal

20. Root cap is derived from
   a) Dermatogen   b) Phellogen   c) Calyptrogen   d) Periblem

5x1 = 5 weightage

Part B

(Answer any six of the following)

21. Explain aerial root modification

22. What are tyloses? Mention their function

23. What is double fertilization?

24. Describe the structure of anther wall.

25. What is coenanthium? Give an example.

26. Draw and label the structure of typical monocot stem

27. Explain the free nuclear type of endosperm formation

28. What are annual rings? 6x1 = 5 weightage

Part C

(Answer any three of the following)

29. Comment on 'Flower is a modified shoot'.

30. What is meristem? Classify them based on position, origin and function.

62
31. Describe the monosporic type of embryosac development with suitable diagrams.

32. Describe the ultrastructure of pollen wall.

33. Briefly explain the types of fruits.

34. With suitable labelled diagrams, describe the primary structure of a dicot stem.

\[ 3 \times 2 = 6 \text{ weightage} \]

Part D

(Apply any two of the following)

35. With suitable labelled diagrams, describe the ultrastructure of cell wall.

36. Given an account of micropropagation with the help of labelled diagrams.

37. Describe the normal secondary growth in dicot root with suitable diagrams.

\[ 2 \times 4 = 8 \text{ weightage} \]
CORE COURSE VI - BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS & PALAEOBOTANY

Total – 117 Hrs. Theory – 81 Hrs., Practicals- 36 Hrs.

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**MODULE – 1: Bryology**

1. Introduction, general characters and classification by Proskauer, 1957  
   **2 hrs.**
2. Study of distribution, structure (external and internal), reproduction, life cycle and affinities of following types (Developmental details are not required)
   - **Riccia (Hepaticopsida)**
   - **Anthoceros (Anthocerotopsida)**
   - **Funaria (Bryopsida)**
   
   **4 x 3 = 12 hrs.**
3. Evolution of gametophyte and sporophyte among Bryophytes  
   **1½ hrs.**
4. Economic importance of Bryophytes  
   **1 hr.**
5. Contribution of Indian Bryologists  
   **1 hr.**
6. Fossil Bryophytes  
   **½ hr.**

**Practicals**  
**9 hrs.**

- **Riccia** – habit, internal structure of thallus, V.S. of thallus through antheridium, archegonium and sporophyte.
- **Anthoceros**- habit, internal structure of thallus. V.S. of thallus through antheridium, archegonium and sporophyte.
- **Funaria**- habit, structure of antheridial cluster, archegonial cluster, L.S. of sporophyte.

**References**


MODULE- II: Theory-18 Hrs.
1. Introduction, general characters and classification (PichiSermolli, 1977 & Smith et al., 2004 – brief outline only)  
   3 hrs.
2. Study of distribution, structure (external and internal), reproduction, life cycle and affinities of following types
   (Developmental details are not required)
   - Psilotum (Psilopsida) 4 hrs.
   - Selaginella (Lycopsida) 4½ hrs.
   - Equisetum (Sphenopsida) 4½ hrs.

Practicals 9 hrs.
Psilotum- habit, T.S. of stem, C.S. of synangium
Selaginella – habit, T.S. of stem, T.S. of rhizophore, L.S. of Strobilus
Equisetum- habit, T.S. of stem, L.S. of Strobilus

MODULE – III: Theory-18 Hrs, Practicals- 9 Hrs.
1. Distribution, structure (external and internal), reproduction, life cycle and affinities of the following types
   (Developmental details are not required)
   - Pteris & Marsilea (Pteropsida) 9 hrs.
2. Apogamy and apospory in Pteridophytes; Stelar evolution in Pteridophytes
   Heterospory and seed habit; Affinities of Pteridophytes; Economic importance of Pteridophytes with special reference to biofertilizers: Contribution of Indian Pteridologists (9 hrs.)

Practicals
Pteris- Habit, T.S. of petiole and T.S. of sporophyll
Marsilea - habit, T.S. of rhizome. T.S. of petiole, sporocarp, sectional view of sporocarp

References

MODULE – IV: Gymnosperms

1. Introduction:- General characters Classification (Sporne, 1965)
2. Distribution, structure (external and internal), reproduction, life cycle and affinities of following plants (Developmental details are not required): Cycas, Pinus, Gnetum
3. Evolutionary trends in Gymnosperms; affinities of Gymnosperms with Pteridophytes and Angiosperms; Economic importance of Gymnosperms.

Practicals

2. Pinus- branch of unlimited growth, spur shoot, T.S. of stem and needle, male cone and female cone, L.S. of male cone and female cone, seed. 6 hrs

References

**MODULE-V: Palaeobotany**

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<td>2. Fossil formation and types of fossils</td>
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<td>3. Geological time scale- sequence of plants in geological time</td>
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<td>4. Fossil Pteridophytes-Rhynia, Lepidodendron, Lepidocarpon, Calamites</td>
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<td>5. Fossil gymnosperms- Williamsonia</td>
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<td>6. Importance of Birbal Sahni Institute (brief)</td>
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<td>7. Brief mention of fossil deposits in India</td>
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<td>8. Indian Palaeobotanists</td>
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**Practicals**

Fossil Pteridophytes-Rhynia stem, Lepidodendron, Lepidocarpon and Calamites
Fossil gymnosperms- Williamsonia
References
Ltd., Delhi.
London.
York.
Steward A.C.,1935, Fossil Plants Vol. I to IV.

Subjectwise Distribution of Questions

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PART A

(Answer all the questions)

1. Which of the following comes under vascular cryptogams?
   a) Anthoceros  b) Pinus  c) Pteris  d) Funaria
2. Stele of Pteris Rhizome
   a) Actinostele  b) Protostele  c) Siphonostele  d) Dictyostele
3. Psedoelaters are present in
   a) Riccia  b) Anthoceros  c) Equisetum  d) Psilotum
4. The largest Antherozoid in the plant kingdom is seen in
   a) Gnetum  b) Pinus  c) Ephedra  d) Cycas
5. Stem of Cycas contains
   a) Heart wood  b) Porous wood  c) Pycnoxylic wood  d) Manoxylic wood
6. Mode of nutrition in Psilotum prothallus is
   a) autotrophic  b) parasitic  c) saprophytic  d) heterotrophic
7. In Funaria, the dispersal of spores from the sporophyte in regulated by
   a) annulus  b) calyptra  c) peristomial teeth  d) operculum
8. Famous Indian Palaentologist
   a) M.O.P. Iyengar  b) P.C. Vasishtac) Birbal Sahni  d) B.P. Pandey
9. Sporangium develops from a single initial cell is
   a) homosporangium  b) heterosporangium  c) eusporangium  d) leptosporangium
10. The coralloid root of cycas shows
    a) negative geotropism  b) symbiosis  c) N₂ fixation  d) all the above
11. Origin of Himalayan Mountain Ranges took place in
    a) mesozoic era  b) palaeozoic era  c) coenozoic era  d) proterozoic era
12. Funaria, the calyptra is derived from
a) antheridium  b) archegonium  c) columella  d) capsule

13. Anthoceros is commonly known as
   a) horn worts  b) liver worts  c) club moss  d) horse tail

14. Pteris is characterized by
   a) sporocarp with false indusium  b) sporocarp with true indusium
   c) coenosorus with false indusium  d) coenosorus with true indusium

15. The age of Rhynia
   a) Permian  b) Silurian  c) Devonian  d) Cambrian

16. Cavity formed by the disintegration of protoxylem elements in Equisetum
   a) Vallecular canal  b) Pith canal  c) Resin canal  d) Carinal canal

17. Diploxylic vascular bundles are found in
   a) Pteris  b) Selaginella  c) Funaria  d) Cycas

18. Polystelic stem is seen in
   a) Selaginella  b) Psilotum  c) Riccia  d) All these

19. Which of the following contains vessels in the xylem
   a) Cycas  b) Gnetum  c) Marsilea  d) Pinus

20. The nomenclature of fossil form genus for a stem is
   a) phyllum  b) dendron  c) xylon  d) carpopen

\[ 5x1 = 5 \text{ weightage} \]

**Part B**

*(Answer any six of the following)*

21. Stele in Marsilea rhizome

22. Ligule of selaginella

23. Medicinal importance of Bryophytes

24. Apospory

25. How lateral conduction takes place in Cycas leaflet?

26. Mesophyll tissue of pinus needle

27. Spore dispersal mechanism in Funaria

28. What is an amber?

\[ 6x1 = 6 \text{ weightage} \]

**Part C**

*(Answer any three of the following)*

29. Heterospory is an initial step towards seed habit. Discuss.
30. Write a note on the economic importance of Gymnosperms.
31. With necessary diagrams describe the stelar evolution in Pteridophytes.
32. Indian contribution to Palaeobotany
33. Discuss the affinities of bryophyte with algae and Pteridophytes.
34. Write an account on angiosperm characters in Gnetum

Part D

(Answer any two of the following)

35. With the help of a neat labelled diagrams discuss the similarities and differences of the Gymnosperm ovules you have studied and add a note on their evolutionary trend.
36. Describe the life cycle of Psilotum with suitable diagrams and comment on its primitive characters.
37. Discuss the evolution of sporophytes in Bryophyta with the help of suitable examples.

3x2 = 6 weightage

2 x 64 = 8 weightage
PART A

(Answer all the questions)

1. In Pinus seeds, wing develops from:
   a) outer layer of Integument   b) basal part of ovuliferous scale
   c) partly from (A) and (B)   d) seed scales

2. Carinal Canal is filled with
   a) mucilage   b) Cyanobacteria   c) water d) air

3. Sporophyte of Riccia is protected by
   a) indusium   b) calyptra   c) endothecium   d) amphithecum

4. Tongue shaped structure present in the young leaf of Selaginella is
   a) bract   b) perichaetium   c) ligule   d) perigonium

5. In cycar rachis, vascular bundles are arranged in which shape.
   a) II   b) φ   c) Ω   d) X

6. Germination of microspore before liberation from sporangium is called
   a) in vitro   b) in vivo   c) in situ   d) ex situ

7. Nurse cells are present in the sporophyte of
   a) Funaria   b) Anthoceros   c) Marchantia   d) Riccia

8. Elaters of Equisetum are formed from
   a) perispore   b) epispore   c) mesospore   d) endospore

9. Sorus is a group of
   a) strobilus   b) spores   c) sporangium   d) sporophyll

10. Age of Cycads
    a) Coenozoic   b) Palaeozoic   c) Mesozoic   d) Archaeozoic

11. Fruits are not formed in gymnosperms due to absence of
    a) fertilization   b) pollination   c) seeds   d) ovary
12. The peristome of moss consists of
   a) $16 + 16$ teeth b) $16 + 32$ teeth c) $16$ teeth only d) $32 + 32$ teeth

13. A Fossil Gymnosperm
   a) Rhynia b) Calamites c) Williamsonia d) Lepidodendron

14. Function of root hairs in Pinus is performed by
   a) lateral roots b) scales c) mycorrhiza d) epidermal hairs

15. Resinous excretion of fossil conifers
   a) gum b) coal balls c) amber d) pseudofossils

16. Pteris prothallus is
   a) heterotrophic b) heteromorphic c) homothallic d) heterothalic

17. The dehiscence of moss capsule takes place by the rupture of
   a) operculum b) peristome c) annulus d) calyptra

18. No. of cotyledons in Pinus seed
   a) many b) $3$ c) $2$ d) not found

19. Spore bearing organ of Marsilea is the
   a) sporophyte b) sporophore c) spermocarp d) sporocarp

20. Palaeontology refers to
   a) study of fossil animals b) study of pollen grains
c) study of fossils d) study of fossil plants

   $5 \times 1 = 5$ weightage

PART B

(Answer any six of the following)

21. What are resurrection plants? Give example.

22. Primitive characters of Riccia sporophyte.

23. Salient features of Lepidocarpon?

24. Give a note on amphiphloic siphonostele

25. Distinctive features of Anthoceros antheridium

26. What are the characteristic features of gametophyte of Pteris?

27. Give the peculiarities of Pinus megasporophyll.

28. What are the main functions of coralloid roots in Cycas

   $6 \times 1 = 6$ weightage

PART C
(Answer any three of the following)

28. Compare the elaters of Equisetum and Anthoceros.
29. Write an account on economic Importance of Bryophytes.
30. Describe the process of fossilization or [Objectives of Palaeobotany]
31. With the help of labelled diagram, describe the structure of Gnetum ovule.
32. Draw L.S. of Selaginella strobilus, label the parts and describe its structure.
33. Briefly explain the affinities of Pteridophytes with Bryophytes and Gymnosperms.

3x2 = 6 weightage

Part D

(Answer any two of the following)

34. The gametophyte of Anthoceros is very primitive, but its sporophyte is advanced discuss.
35. With neat labeled diagrams, describe the anatomical features of Equisetum and Marselia stem and add a note on its hydrological features.
36. Describe the reproduction in ‘Pinus’ with neat labeled diagrams.

2 x 4 = 8 weightage
SEMMESTER - V
CORE COURSE - VII: ANGIOSPERM SYSTEMATICS, ECONOMIC BOTANY
AND ETHNOBOTANY

Total - 117 hrs., Theory - 72 hrs, Practicals - 45 hrs.

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MODULE-I:

1. Introduction, objectives and importance of systematics  

2 hrs.

2. Concepts of biological classification – Pre-Darwinian, essentialism and empiricism; Post-Darwinian, concepts of evolution and phylogeny.  

5 hrs.


Annonaceae, Malvaceae, Rutaceae, Papilionaceae, Myrtaceae, Cucurbitaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Poaceae.  

14 hrs.

MODULE – II:

4. Taxonomic structure – Hierarchy; Concepts of taxa; Species – Biological, Phenetic and Phylogenetic; Genus; Family.  

7 hrs.

5. Taxonomic character – concept, primitive and advanced characters, sources, comparative morphology, vegetative, reproductive, Macro and micromorphology, modern trends in taxonomy, cytotaxonomy, chemotaxonomy, numerical taxonomy, molecular taxonomy and phylogenetics.  

7 hrs.


7 hrs.

MODULE – III:

21 hrs.
7. Plant nomenclature – Limitations of common name, ICBN, Principles(introduction only); Typification (holotype, isotype, syntype paratype and lectotype); Priority – merits and demerits; Effective and valid publication; Author citation. 7 hrs.

8. Plant identification – Keys- construction and applications. 7 hrs.

9. Taxonomic information resources – Herbarium- principles and practices; world herbaria; BSI; Indian herbaria; Botanic Gardens; Indexes; Journals; Monographs; Revisions; Floras; Online resources and Databases. 7 hrs.

Practicals 27 hrs.

1. Students shall learn the characters of families mentioned in the syllabus from demonstrations in the laboratory using one or more plants from each family, make suitable diagrams, describe them in technical terms and identify them upto species using any standard flora.

2. Students are expected to study the construction of taxonomic keys.

3. Students are expected to do field study @ 1hr/week and the observations must be recorded in the field note.

4. Each student shall submit a minimum of 15 properly identified herbarium specimens in the standard format (cultivars and ornamentals should be avoided)

Study Tour

Students are expected to undertake a study tour of not less than 10 days duration under the guidance of the teachers, for familiarizing the vegetation in the 5th semester. They are also expected to visit at least one research station and should submit a duly certified study tour report along with herbarium sheets and field notes for external evaluation.

References


NaiK, V.N. Taxonomy of Angiosperms. TATA McGraw Hill, New Delhi


Sharma, B.D. et al. (Eds.) Flora of India vol. I. Botanical Survey of India, Calcutta.


**MODULE – IV: Economic Botany**

Classification based on the economic use of the following plants. Study the binomial, Family, Morphology of useful part, products and uses.

1. Cereals and Millets – Rice, Wheat, Maize and Ragi
2. Pulses and legumes – Greengram, Bengalgram, Blackgram, Cowpea, Winged bean, Cluster bean, Soya and Pigeon pea.
3. Sugar – Sugar cane
5. Vegetables – Root – Carrot, Beet Root, Tapioca; Stem – Corm, Potato.
6. Fruits – Cucurbits- Bitter gourd, Cucumber, Snake gourd, Ridge gourd; Laiyes finger; Leaves – Cabbage, Amaranthus, Moringa, Boerhaavia.

10. Fibre – Coir, Cotton, Jute.


13. Latex – Rubber

14. Gums and Resins – Dammer, Gum Arabic, Asafoetida

15. Spices – Pepper, Ginger, Cardamom, Turmeric, Clove, Mace, Allspice, Cinnamon


17. Insecticides – Neem, Tobacco, Pyrethrum.

18. Essential oil – Sandal wood oil, Clove oil, Lemon grass, Patchouli oil, Peppermint oil.

19. Perfumery – Camphor, Rose, Lemon grass, Champak, Elingi, Cananga


Practicals

1. Students are expected to identify plants or plant products (raw or processed) studied in theory and to know the binomial, family and morphology of the useful parts of source plants (Submit a report preferably with photos)

2. Students shall submit 10 duly preserved specimens with certified index for practical examination.

3. Diagrams of items mentioned in the Economic Botany syllabus need be recorded

References


MODULE – V: Ethnobotany

1. Introduction, scope and significance

2. Major tribes of South India
3. Ethnobotanic significance of the following:

1. *Aegle marmalos*
2. *Ficus religiosa*
3. *Curcuma longa*
4. *Cynadon dactylon*
5. *Ocimum sanctum*
6. *Trichopus zeylanica*

References


Subjectwise Distribution of Questions

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PART A

(Answer all the questions)

1. Father of Modern Botany?
   a. Linnaeus  b. Theophrastus  c. Hooker  d. Aristotle

2. Standard size of herbarium
   a. 28.5x41.25  b. 25.25x35.25  c. 5.2 x 10.5  d. 50.5 x 75.5

3. *Carthamus tinctorius* (safflower) is
   a. an ornamental  b. a medicinal plant  c. a weed  d. an oil seed crop

4. Taxonomy based on secondary metabolites is
   a. Phenetic taxonomy  b. Experimental taxonomy  
   c. Cytotaxonomy  d. Chemotaxonomy

5. Binomials with identical generic and specific names
   a. Isonym  b. Homonym  c. Isonym  d. Synonym

6. Verticillaster inflorescence is found in

7. The abbreviation of OUT stands for
   a. Organisation of taxonomists of U.K.  b. Operational taxonomic unit
   c. Old taxonomic unit  d. Organisation of taxonomic unit

8. Taxonomic hierarchy of four different species belonging to two different
   genera of a family

9. Caryopsis is the fruit seen in the family
   a. Graminae  b. Asteraceae
   c. Labiatae  d. Apocynaceae
10. Colchicine is extracted from
   a. Gloriosa superba .       b. Colchicum autumnale
   c. Adathoda vasica       d. Vinca rosea

11. Which one is not a taxonomic resource

12. Tropicos is  

13. Which part of the rice plant yields oil
   a. Ste   b. Roots       c. Starchy grain d. Bran

14. Timber yielding plant
   a. Corchorus capsulains b. Gossypium herbaceum
   c. Catharanthus roseus d. Dalbergia latifolia

15. Coir is obtained from
   a. endocarp   b. mesocarp c. epicarp d. endosperm

16. Edible oil is obtained from
   a. Elaeis guinensis b. Linum usitatissimum
   c. Ricinus communis d. Jatropha curcas

17. The richest source of vitamin C is
   a. Capsicum frutescence b. Emblica officinalis
   c. Cirtus aurantifolia d. Carica papaya

18. Major source of sugar is India is

19. Name of a tribe in South India

20. An ethnobotanical plant
   a. Aegle marmelos b. Artocorpus integrifolia
   c. Gloriosa       d. Bombax
5x1 = 5 weightage

PART B

(Answer any six of the following)

21. What is Holotype?
22. What is a manual?
23. What is epigyny?
24. Write the salient features for Annonaceae
25. Mention the inflorescence of Asteraceae
26. Name the binomial of clone.
27. Name any two fibre yielding plant.

6x1 = 6 weightage

PART C

(Answer any three of the following)

29. Briefly describe taxonomic hierarchy
30. Briefly describe chemotaxonomy
31. Describe the diagnostic features of the family Lamiaceae
32. Mention the family, binomial and useful part of any three cereals.
33. Mention the family, binomial and useful part of gum Arabic, and Asafeotida.
34. Define ethnobotany. What is its significance. Give an example for successful exploitation of ethnobotany.

3x2 = 6 weightage

PART D

(Answer any two of the following)

35. Explain the hierarchical structure of Taxonomic units. What are the concept of species, genus and family.
36. What are identification keys? Give the method of preparing such keys.
37. Describe the various techniques involved in herbarium preparation.

2 x 4 = 8 weightage
PART A

(Answer all the questions)

1. Binomial nomenclature introduced by

2. In which of the following branches of taxonomy is equal weightage given to each of thousands of characters that a taxon exhibits?
   a. Chemotaxonomy  b. Alpha taxonomy  
   c. Classical taxonomy  d. Numerical taxonomy

3. Find out the correct type of stigma found in Apocynaceae?
   a. Bifid stigma  
   b. Capitate stigma  
   c. Hour-glass stigma  d. Spathulate stigma

4. Contribution of Hendrik Vanheede
   a. Flora of presidency  
   b. genera plantarium of Madras  
   c. Hortus indicus malabaricus  d. Species plantarum

5. Ruminate endosperm is seen in the family
   a. Apocynaceae  
   b. Annonaceae  
   c. Acanthaceae  d. Alismataceae

6. The correct sequence of taxonomic categories is
   a. Division-class-family-order-genus-species  
   b. Division - class-order family- genus- species  

7. The largest herbarium in the world is located at
   a. Geneva  
   b. Newyork  
   c. Berlin  d. Kew

8. Expand ICBN?
   a. International code for Botanical nomenclature  
   b. Indian Council of Botanical nomenclature  
   c. Indian code for Biological nomenclature
d. Indian code for Botanical nomenclature.

9. Vincristin is extracted from
   a. Catharanthus roseus  
   b. Ixora coccenia  
   c. Datura Stramonium  
   d. Nerium odoratum

10. In Asteraceae androecium is
    a. Monadelphia  
    b. Synandrous  
    c. Polyadelphia  
    d. Syngenesious

11. Similar individuals comprise
    a. Kingdom  
    b. Class  
    c. Family  
    d. Species

12. In Bentham and Hooker’s system Rutaceae belongs to the series
    a. Disciflorae  
    b. Thalamiflorae  
    c. Calyciflorae  
    d. Inferae

13. Asafoetida is obtained from which part of Ferula asafoetida.
    a. Stem bark  
    b. Leaf  
    c. Root  
    d. Fruit

14. Rose wood used for making furniture is obtained from
    a. Dalbergia  
    b. Shorea  
    c. Santalum album  
    d. Xylia xylocarpa

15. Botanical name of finger millet
    a. coix lacryma-jobi  
    b. Pismum sativum  
    c. Pennisetum Americana  
    d. Eleusine coracana

16. In certain parts of India muscular dystrophy is commonly found among the poor people because they eat cheap pulses from a plant.
    a. Phaseolus mungo  
    b. Pismum sativum  
    c. Lathyrus sativus  
    d. Cicer arietinum

17. Colchicine is extracted from
    a. Gloriosa superba  
    b. Colchicum autumnale  
    c. Adathoda vasica  
    d. Vinca rosea

18. Carthamus tinctorius (Saf flower) is
    a. an ornamental plant  
    b. a medicinal plant  
    c. Adathoda vasica  
    d. Vinca rosea

19. Jeevani is
    a. Name of an ethnomedicine  
    b. Carminative  
    c. a weed  
    d. an oil seed crop

20. Choose the correct Ethnobotanically important group of plants
    a. Artocorpus  
    b. Ficus  
    Mangifera  
    Aegle  
    Anacardium  
    Cynadon
c. Ocimum   d. Acorus
       Heliotropium   Mimosa
       Oxalis   Acacia

**5x1 = 5 weightage**

**PART B**

(Answer any six of the following)

21. What is syntype?
22. Name two journals of taxonomy?
23. Who coined the term taxonomy?
24. What is binominal nomenclature?
25. Datura stramonium belongs to which family?
26. Name two gum yielding plants.
27. Write the botanical name of a) Cotton b) mango
28. Name two plants used by tribes

**6x1 = 6 weightage**

**PART C**

(Answer any three of the following)

29. Distinguish between monograph and revision?
30. Briefly describe the biological species concept
31. What are the floral peculiarities of Papilionaceae
32. Mention the family, binomial and useful part of any three oil yielding plants.
33. What is pharmacognosy? Mention any two drug yielding plants?
34. Briefly describe South Indian Tribes.

**3x2 = 6 weightage**

**Part D**

(Answer any two of the following)

35. Trace the development of the concepts of Biological classification with examples for artificial, natural and phylogenetic system.
36. Explain the modern trends in Taxonomy with examples for application of modern concepts.
What is taxon? What are the different hierarchical ranks of taxa as accepted in ICBN?

2 x 4 = 8 weightage

SEMESTER - V
OPEN COURSE - I: CHOICE I: HORTICULTURE AND NURSERY MANAGEMENT

Total - 72 hrs., Theory - 36 hrs, Practicals - 36 hrs.

MODULE – I. 11 hrs.

1. Horticulture: Definition, history and development, scope and significance – Different branches of horticulture.

2. Vegetative and reproductive parts, life cycle of Angiosperm, Plant nomenclature.

3. External factors influencing propagation
   (a) Edaphic – soil, soil features, humus, soil pH and soil treatment.
   (b) Biotic – soil microbes.

4. Fertilizers – Chemical, organic, biofertilizer, vermi compost (Preparation) coir pith compost.

5. Pots & potting – earthen, fibre, polythene bags, potting mixture, potting, depotting, repotting.


7. Shade regulation.
MODULE – II.  


2. Vegetative propagation:
   (a) Cutting (stem, roots)
   (b) Grafting (approach, cleft)
   (c) Budding (T-budding, patch)
   (d) Layering (simple, air)

2. Seed propagation – Seed dormancy, seed treatment, essential condition for successful propagation – rising of seed beds, care of seedling, transplanting techniques.

3. Micropropagation / Tissue culture (on MS medium).
   Definition: Lab organisation, Media preparation, Sterilization, Mother plants, Explants, Hardening, Tissue culture technique in different crops, Significances. Applications of tissue culture.

MODULE – III.  

1. Nursery management- Definition, concept and principle.

2. Site selection, propagating structure – green house, poly house, moist chamber, net frame.

   (a) Indoor gardening – Selection of indoor plants, care and maintenance of indoor plants, Bonsai – Principle, Creating the bonsai.
   (b) Outdoor gardening.
      (1) Floriculture: Cultivation of Rose, Jasminum, Chrysanthemum, Orchids, Anthurium.
      (2) Ornamental plants: (Foliage shrubs, climbers, creepers, ferns, ornamental grasses, palms, conifers, cactus).
      (3) Medicinal plants: Ocimum, Coleus, Catheranthus, Adathoda, Rauwolfia, Mentha, Turmeric, Pepper.
      (4) Olericulture: Vegetable gardening of chillies, ladiesfinger, brinjal, pea.
      (5) Mushroom cultivation: Oyster Mushroom culture.

4. Protection of Horticultural plants: Definition, types, cultural, mechanical, physical, chemical, biological and legislative. Major pests of horticulture plants – pest management; disease and disease management

5. Pesticides; definition, classification, preparation and application.

MODULE-IV.  

3 hrs.
1. Harvesting and post harvest management: harvesting, handling, storing, fumigation, preservation and processing of horticultural produces.

2. Strategies to ensure market, participatory approach – significance.

**Practicals**

1. Preparation of nursery bed and polybag filling.

2. Preparation of potting mixture – Potting and repotting.

3. Field work in cutting, grafting, budding, layering.
   
   4. Identification of plant pests and diseases of in the campus.
   
   5. Identification and use of garden tools and implements.
   
   
   7. Topiary and pruning.
   
   8. Preparation of vermicompost.
   
   
   10. Establishment of vegetable garden.
   
   11. Visit of important nurseries and tissue culture laboratories and submission of report.
   
   12. Vegetable carvings – flower arranging of cut and dry flowers.
   
   13. Fruit preservation methods.

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Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India.

Premchand, Agriculture and Forest Pest and their Management, Oxford Publication.


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Bal, J.S., Fruit growing, Kalyani Publishers, Delhi.

Dr. S. Nesamony, Oushadha Sasyangal (Medicinal plants), State Institute of Language, Kerala, Trivandrum.

Dr. R. Prakash, Dr. K. Raj Mohan, Jaivakrishi (Organic farming), State Institute of Languages, Trivandrum.

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PART A

(Answer all the questions)

1. Angiosperms are:
   (a) Seed bearing plants  (b) Non-flowering plants
   (c) Gametophytic plants  (d) Fruitless plants.

2. The factor influencing soil condition is called:
   (a) Biotic factor  (b) Abiotic factor
   (c) Edaphic factor  (c) Climatic factor

3. The post harvesting operation is
   (a) Culturing  (b) Replanting
   (c) Grading  (d) Selectioning

4. The relative percentage of sand, silt and clay in a soil may be called as:
   (a) Soil structure  (b) Soil texture
   (c) Soil profile  (d) None of these.

5. Apples are commonly propagated by
   (a) Mound layering  (b) Compound layering
   (c) Chip layering  (d) Tissue culture

6. Pick the odd one out
   (a) Anthurium  (b) Carnation  (c) Dianthus  (d) Grapes

7. Sand is used in potting media in order to improve:
   (a) Infiltration  (b) Cation exchange capacity
   (c) Water holding capacity  (d) All the above.

8. Which of the following a delayed scion grafting?
   (a) Cleft grafting  (b) Whip grafting
   (c) Back grafting  (d) All the above

9. Bone meal is used as a fertilizer during lawn preparation, because:
   (a) It is a slow release fertilizer  (b) It gives better anchorage for grass
10. Which of the following is not an avenue tree?
   (a) Gulmohar   (b) Coppee pod tree
   (c) Ficus       (d) Croton

11. Which of the organism is generally utilized in coir-pith composting?
   (a) *Eudrilus enginae*   (b) *Pleurotus sajar-cayr*
   (c) *Phyllanthus niruri*   (d) *Agaricus compestris*

12. Parthenocarpy is the development of:
   (a) large fruits with attractive color
   (b) Fruits in absence of fertilization
   (c) Disease free fruits   (d) None of the above.

13. Clones are:
   (a) All asexually reproduced duplicates of plant.
   (b) All genetically identical individual of a species.
   (c) Duplicated plants that are produced through tissue culture techniques
   (d) All the above.

14. Which of the following is a best suitable soil treatment method in temperate regions?
   (a) Soil heating   (b) Soil pasteurization
   (c) Soil solarization   (d) Chemical treatment

15. Olericulture deals with the study of:
   (a) Flowers   (b) Mushroom
   (c) Vegetable   (d) Fruits

16. Indicon Institute of Horticulture Science is located in:
   (a) Delhi   (b) Trivandrum   (c) Bangalore   (d) Calcutta

17. Undifferentiated mass of tissue in micro propagation is called
   (a) Meristems   (b) Callus
   (c) Complex tissue   (d) DeAd tissue

18. Explant in tissue culture is:
   (a) Plant seen outer medium
   (b) Vegetative plant material extracted for tissue culture
   (c) Non living segment of plant part
   (d) None of the above.
19. The good stock for T budding is of about ______ old
   (a) 6 months        (b) 2 years
   (c) 2 months        (d) 6 years

20. Shears are the tools usually used in horticulture for:
   (a) Tillage operations   (b) Layering technique
   (c) Pruning operation    (d) Budding technique

5x1 = 5 weightage

PART B
(Answer any six of the following)

21. What is double fertilization?
22. What are manures?
23. What is NPK?
24. Explain air layering.
26. Give two implements in gardening.
27. Give binomial of edible mushroom.
28. Give two preservation techniques of horticultural produce.

6x1 = 6 weightage

PART C
(Answer any three of the following)

29. Give notes on edaphic factors influencing propagation.
30. Give an account of biofertilizers.
31. What is Grafting? What are the precautions to be done during grafting?
32. What is culture medium? What are the important components in a culture medium.
33. What are the features to be considered during the selection of indoor gardening?
34. Discuss the advantages and disadvantages of product marketing strategies.

3x2 = 6 weightage

PART D
(Answer any two of the following)

35. Explain the development, scope and significances of horticulture. Give a short note on irrigation practiced in horticulture.
36. Explain in detail the various steps involved in tissue culture.
37. Explain different propagating structures practiced in horticulture. Explain its significance.

2 x 4 = 8 weightage
1. Binominal nomenclature was proposed by
   (a) Robert Hooke  
   (b) Linnaeus  
   (c) Darwin  
   (d) Mendel

2. Sporphytic generation of plants involves the genetic phase
   (a) 2n diploid  
   (b) n, haploid  
   (c) 3n triploid  
   (d) 4n tetraploid

3. Widely used fumigant for storing fruits and seed
   (a) Carbon dioxide  
   (b) Methyl bromide  
   (c) Ethyle iodide  
   (d) Sulphur oxide

4. Which among the following is not a primary macronutrient?
   (a) Nitrogen  
   (b) Iron  
   (c) Potassium  
   (d) Phosphorus

5. Which of the following is correct regarding Bonsai?
   (a) Only evergreen species can be used in creating bonsai.  
   (b) Clay pots that are glazed on the inside are best for bonsai culture.  
   (c) Large-leaved plant species are most suitable for bonsai.  
   (d) Bonsai roots need pruning every 3 to 5 years.

6. What is IPM?
   (a) Indole propionic medium  
   (b) Inaegonic plant manure  
   (c) Integrated pest management  
   (d) Integrated plant management

7. Which of the following come under pomology?
   (a) Bamboo  
   (b) Bleeding heart  
   (c) Basil  
   (d) Banana
8. Long shoots are weeping stem such as those produced by grapes, raspberry, etc. are known as:
   (a) Canker  (b) Bench  (c) Cane  (d) Berry

9. Which among the following is an example for runner?
   (a) Raspberry  (b) Strawberry  (c) Mulberry  (d) Blackberry

10. A good stock for T. budding is of about _______ old.
    (a) six months  (b) 2 years  (c) 2 months  (d) 6 years

11. The pots that are 1 ½ times as tall as they are called:
    (a) Rose pots  (b) Standard pots  (c) Bulb pots  (d) Azalea pots

12. Sphagnum peat is preferred in potting media, mainly due to its features of
    (a) Light infiltration  (b) High drainage
    (c) High water holding capacity  (d) High nutrient content

13. An interstock is used to:
    (a) Overcome genetic incompatibility  (b) Make the graft virus free
    (c) Make the rooting easy  (d) Make the grafting procedure easy

14. Aviacides are pesticides used to kill:
    (a) Snails & slugs  (b) Termites  (c) Birds  (d) Ants

15. Mulching is done for
    (a) Fertilizing the soil  (b) Preventing water loss
    (c) Making the soil disease and pest free  (d) All the above.

16. Shears are tools usually used in horticulture for
    (a) Tillage operations  (b) Budding techniques
    (c) Approach grafting  (d) Pruning operation

17. Which of the following is related with arboriculture?
    (a) Aswagandha  (b) Bush jasmine
    (c) Strawberry  (d) Gulmohar

18. A kitchen garden promises
    (a) Proper utilization of land in the vicinity of the house
    (b) Utilization of kitchen water and wastes
    (c) Economising the food cost
    (d) All the above.

19. The best way for keeping the crops disease free, is by
(a) applying chemical pesticides (b) using disease resistant varieties
(c) keeping insect repellants (d) using biocontrol strategies.

20. Which of the following is a herbicide?
   (a) Ethylene (b) Methylene
   (c) 2,4,D (d) IBA

5x1 = 5 weightage

PART B

(Answer any six of the following)

22. What is organic manuring?
23. Define drip irrigation.
24. What is seed dormancy?
25. Define tissue culture.
27. Give two major pest of horticulture.
28. Give two post harvest operations.

6x1 = 6 weightage

PART C

(Answer any three of the following)

29. Write short note on biotic factors influencing propagation.
30. What is budding? What are the problems associated in budding?
31. What are the applications of tissue culture? Give examples.
32. Write a note on propagating structure, green house and its role in propagation.
33. Give two types of protection in horticultural plants. Explain.
34. List and describe the basic elements in a product marketing operation.

3x2 = 6 weightage

PART D

(Answer any two of the following)

35. What is a fertilizer? Explain the preparation of various compost and its uses.
36. Explain the economic importance of mushroom and give in detail the method of its culture.
37. What are the different types of vegetative propagation? Explain any three in detail.
2 x 4 = 8 weightage
SEMESTER - V
OPEN COURSE I - CHOICE II: BIOFERTILIZER TECHNOLOGY AND ORGANIC FARMING
(Total - 72 hrs., Theory - 36 hrs., Practical - 36 hrs.)

MODULE - I: SOIL MICROBIOLOGY 8 hrs.

a) Biofertilizers - Introduction, History, definition
   Importance of Biofertilizers, ecofarming
   Chemical fertilizers – health and the environment
b) Soil – Introduction – Definition. Components of soil - Mineral particles, Humus, soil atmosphere, soil water and biological system
c) Soil microorganisms - soil flora, soil fauna, role of soil organisms
d) Properties of soils – Physical properties of soils,
   chemical properties of soils - acid soils – saline and alkaline soil
e) Methods of studying microorganisms
   The Microscope - Phase contrast, ultra violet, dark field and electron microscopy.
   Staining of microorganisms. Isolation and culturing of microorganisms

MODULE- II: APPLIED MICROBIOLOGY – I Cyanobacteria, Azolla 8 hrs.

a) Cyanobacteria as Biofertilizer
   Isolation of cyanobacteria, culturing of cyanobacteria
   Identification, characterization and selection of cyanobacteria
   Inoculum preparation – small scale and large scale
   Factors affecting cyanobacterial growth
Azolla as Biofertilizer and other uses
   Morphology and life cycle of Azolla and
   Anabaena - azollae
   Nitrogen fixation by Azolla
   Growth rate and Nitrogen input
   Factors affecting the growth of Azolla
   Decomposition of Azolla and mobilization of its nitrogen
   Methods of Azolla utilization
   Control of insects and diseases
1. **Rhizobium** inoculant
   - Isolation of *Rhizobium* from nodules – Classification
   - Identification
   - Plant tests
   - Maintenance of culture
   - Cultivation and mass production
   - Quality control
   - Methods of inoculation

2. **Azotobacter** inoculant
   - Isolation of *Azotobacter* by soil dilution plating method
   - Identification and classification
   - Maintenance and cultivation
   - Crop response

3. **Azospirillum** inoculant
   - Isolation of *Azospirillum* from rice root
   - Identification and classification
   - Maintenance and cultivation
   - Crop response

4. Isolation of phosphate – solubilizing Microorganisms
   - *Pseudomonas*
   - *Bacillus*
   - Quantitative measurement of phosphate solubilization in culture
   - Medium
   - Agronomic Aspects

5. Mycorrhiza
   - Isolation and identification of Ectomycorrhizal fungi
   - Inoculation Technique for Ectomycorrhizal Fungi.
   - Isolation and Identification VAM fungal spores
   - Inoculum production of VAM Fungi
   - Field Response.

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**MODULE – IV: ORGANIC FARMING**

10 hrs.
1. **Soil Fertility**

   Vermi Compost, Green Manure
   Source of Natural Nitrogen in Rice Soil
   Legume Green Manure
   Stem Nodulating Green Manure
   Green Manuring in India – Limitations

2. **Organic Matter Decomposition**

   Measurement of CO₂ evolution in soil
   Measurement of lignin degradation
   Organic matter and Biological N Fixation
   Acceleration of composting by adding Microorganisms

3. **Anaerobic fermentation** of Human, Animal and Agricultural wastes.


5. **Plant protection Studies** Insecticidal Material for common use.

   Kerosene emulsion, Tobacco decoction, Neem kernel supervision, Pheromone trap

**Practical**

1. Algal inoculum preparation - Small scale; Large scale
2. *Azolla* inoculum preparations, spore production
3. *Rhizobium* - methods of inoculation
4. *Azospirillum* inoculation
5. Inoculation production of VAM fungi
6. Preparation of biopesticides and fungicides

**References**


SEMMESTER V
MODEL QUESTION PAPER I
OPEN COURSE-I CHOICE- II: BIOFERTILIZER TECHNOLOGY AND
ORGANIC FARMING

Time 3 Hours       Total Weightage - 25

PART A

(Answer all the questions)

1. Which among the following species is not a Nitrogen Fixer

2. Biological nitrogen fixation is conversion of
   a] Nitrogen to nitrate  b] Nitrogen to ammonia
c] Nitrogen to nitrate  d] All the above

3. Mycorrhiza is the association of
   a] Microbes with rhizoids  b] Microbes with rhizome
c] Rhizobium with fungus  d] Fungus with roots

4. Leg hemoglobin is present in
   a] Rhizobium  b] Haemoglobin
c] Leguminoseae  d] Root nodules of Pea plants

5. Which among the following is cyanobacteria?
   a] Methanococcus  b] Bacillus megatherium
c] Nostoc  d] None of the above

6. Azolla is an example of

7. Excess application of chemical fertilizers result in
   a] Increased productivity  b] Decreased soil health
c] Increase of pest attack  d] All the above

8. Organic farming includes application of
9. Example of a biopesticide is
   a] *Azadirachta indica*  
   b] *Salvinia molesta*
   c] *Azolla pinnata*  
   d] All the above

10. Bacillus megatherium is an example of
    a] Biofertilizer  
    b] Biopesticide  
    c] Cyanobacteria  
    d] Mycorrhiza

11. Role of mycorrhiza is to increase
    a] Phosphorus availability  
    b] Potash availability  
    c] Nitrogen Availability  
    d] None of the above

12. Most important requirement for crop plants is
    a] Iron  
    b] Compost manure  
    c] Maize  
    d] All the above

13. The plant used for green manuring is
    a] Wheat  
    b] Bereseem  
    c] Maize  
    d] All the above

14. Which of these is composited manure ?
    a] Mixture of cattle dung and crop residues  
    b] Rotten vegetable and animal refuse  
    c] Cattle dung and animal refuse  
    d] Rotten vegetable

15. Which of these is most commonly used for green menuring in India ?
    a] Sunn hemp  
    b] Lentil  
    c] Cow pea  
    d] All of these

16. The most quickly available source of nitrogen to plants are
    a] Nitrate fertilizers  
    b] Ammoniacal fertilizers  
    c] Ammoniacal - nitrate fertilizer  
    d] Amide fertilizer.

17. Green manuring increases crop yield by
    a] 5-10%  
    b] 20-25%  
    c] 30-50%  
    d] 80-90%

18. VAM represents
a) Saprophytic fungi       b) Symbiotic fungi

c) Saprophytic bacteria     d) Symbiotic bacteria

19. Frankia belongs to
    a) Phycomycetes       b) Actinomycetes
    c) Myxomycetes        d) Deuteromycetes

20. Pyrethrin is obtained from
    a) *Helianthus annus*   b) Chrysanthemum cinerarifolium
    c) Azadirachta indica  d) Pyrethrum

5x1 = 5 weightage

PART B

(Answer any six of the following)

21. Define Biofertilizer
22. What is Biological Nitrogen Fixation?
23. Comment the role of mycorrhiza
24. What is straight fertilizers?
25. What is basic slag?
26. What is associative symbiosis?
27. Give a brief note on green manure.

6x1 = 6 weightage
PART C

(Answer any three of the following)

29. Explain the mechanism of Nitrogen Fixation
30. What are biopesticides? Give examples.
31. Explain Integrated Pest Management
32. Differentiate Green manures from Biofertilizers with examples.
33. What are complex fertilizers?
34. What are additional uses of Azolla other than biofertilizer?

3x2 = 6 weightage

PART D

(Answer any two of the following)

IV Answer any two

35. Explain different types of Biofertilizers.
36. Explain the procedure for large scale production of algal flakes.
37. Explain decomposition of organic matter and mode of availability of nutrients to the crops.

2 x 4 = 8 weightage
SEMESTER - V
MODEL QUESTION PAPER II
OPEN COURSE- I CHOICE- II: BIOFERTILIZER TECHNOLOGY AND
ORGANIC FARMING

Time 3 Hours       Total Weightage - 25

PART A

(Apply all the questions)

1. BGA is chiefly used as fertilizer in
   a) Wheat   b) Paddy   c) Mustard   d) Gram

2. The best biofertilizer for rice is
   a) Azolla   b) Rhizobium   c) Bacillus   d) Frankia

3. Root nodules for nitrogen fixation of a non leguminous trees possess
   a. Frankia   b) Rhizobium   c) Azotobacter   d) Thiobacillus

4. Farm yard manure consists of
   a) Cattle dung   b) Cattle dung and crop residues
   c) Rotten Vegetables and animal refuse   d) Berseem

5. Biological control of pest is
   a) Polluting   b) Highly expensive
   c) Self perpetuating   d) Toxic

6. Phospho bacterin contains
   a) Bacillus megatherium   b) Azospirillum lipoferum
   c) Bacillus polymyxa   d) Rhizobium melilotis

7. Vesicular Arbuscular Mycorrhizae are important in
   a) Nitrate nutrition of plants   b) Phosphate nutrition
   c) Carbonate nutrition of plants   d) Sulphate nutrition of plants.

8. Example for amide fertilizer is
   a) Sodium nitrate   b) Ammonium sulphate
   c) Urea   d) Ammonium nitrate
9. Example for oxygenic diazotrophs are
   a) *Azospirillum*  b) *Anabaena*  c) *Azetobacter*  d) All the above

10. Which among the following is mosquito fern
   a) *Salvinia*  b) *Azolla*  c) *Lemna*  d) *Eichorenia*

11. Crop rotation is being practiced for
   a) Increase in the soil fertility  b) Reducing the pest attack
   c) Mixed cropping  d) All the above

12. Excess application of chemical Nitregon fertilizer will result in the
   a) Deterioration of soil health  b) decrease in potassium absorption
   c) increased pest attack  d) All the above

13. Weed suppression by *Azolla* in the paddy fields is due to
   a) Toxic substance produced by *Anabaena azollae*
   b) Toxic substance produced by *Azolla*
   c) Light cutting by *Azolla* mat
   d) All the above

14. Fibrous roots of grass is associated with
   a) *Azotobacter*  b) *Azospirillum*  c) *Frankia*  d) *Rhizobium*

15. *Bacillus thurigiensis* toxin is used as
   a) Bio pesticide  b) Bio weedicide
   c) Bio ameliorant  d) None of these

16. Carbon Nitrogen ratio is the indication of
   a) Soil chemistry  b) Soil conductivity
   c) Soil fertility  d) All the above

17. Cost of chemical nitrogen fertilizer mainly depends on
   a) Chemicals  b) electricity  c) Fossil fuel  d) None of the above

18. Sporulation in *Azolla* is stimulated by
   a) Nutrients  b) Crowding  c) Water scarcity  d) All the above
19. Algal flakes are
   a) dried Cyanobacteria          b) Dry clay with BGA
   c) BGA inoculum with supporting mixture  d) BGA inoculum with clay and water
20. Endomycorrhiza
   a) mobilizes phosphate              b) Solubilises insoluble phosphates
   c) is a VAM fungi                   d) All the above

5x1 = 5 weightage

PART B

(Answer any six of the following)

21. What are VAM fungi?
22. What is meant by soil amelioration?
23. What is the significance of organic farming?
24. Briefly explain the role of NGO in sustainable agriculture
25. Comment on crop rotation
26. What are green manures?
27. What is meant by Rhizobium loading?
28. Explain the role of cyanobacteria in agriculture.

6x1 = 6 weightage

PART C

(Answer any three of the following)

29. Explain incorporation of Azolla
30. Explain the isolation of VAM fungi
31. Describe ever green revolution
32. Mention the role of micronutrients
33. Explain organic farming

3x2 = 6 weightage

PART D

(Answer any two of the following)

34. Explain Organic farming with special notes on eco friendly plant protection methods.
35. Describe the procedure of *Rhizobium* inoculation
36. Explain the problems and prospects of Bio fertilizer application.

\[2 \times 4 = 8 \text{ weightage}\]
SEMESTER - V
OPEN COURSE - I , CHOICE -3: PLANT TISSUE CULTURE
(Total - 72 hrs., Theory - 36 hrs., Practical - 36 hrs.)

MODULE - I . 10 hrs.
1. Introduction, objectives and goals of Plant Tissue Culture, Historical perspective
2. Plant cell and tissue culture – Laboratory design and development
3. Equipments and apparatus of tissue culture lab.
4. Tissue culture media – a general account, MS Media composition, preparation, sterilization and storage.

MODULE – II. 10 hrs.
5. Sequence in tissue culture – explant selection, sterilization, inoculation, induction of callus, organogenesis and hardening.

MODULE – III. 10 hrs.
6. Application of plant tissue culture – Micropropagation, somatic embryogenesis, artificial seeds, germplasm conservation and transfer, embryo rescue and culture, protoplast isolation, culture and fusion, Anther, pollen and Ovary culture for production of haploids, cryopreservation, DNA banks and germplasm conservation, secondary metabolite production, Shoot apical meristem culture and production of pathogenfree stocks and somaclonal variation.

MODULE – IV. 6 hrs.
7. Plant transformation technology – transgenic plant production, Gene transfer methods in plants, multiple gene transfers, vectorless or direct gene transfer techniques.

Practicals 36 hrs.
Students must familiarize the following:

1. The preparation of MS Medium
2. Inoculation
3. Callus induction and differentiation
4. Embryo culture
5. Somatic embryogenesis
6. Artificial seed production
7. Meristem culture
8. Micropropagation

References


Reinert & Bajaj Plant Cell, Tissue and Organ Culture.

PART A

(Answer all the questions)

1. Who among the following is credited with starting the work on plant Tissue culture
   (a) Haberlandt    (b) Steward    (c) P. Maheswari    (d) P.R. White

2. Reproducing new plants by cells instead of seeds is known as
   (a) Amphimixis  (b) Hybridisation  (c) Tissue culture  (d) Mutation

3. The dividing and undifferentiated cells are known as
   (a) Proenbryo  (b) Primordium  (c) Embryo  (d) Callus

4. In cellular Totipotency roots can be induced by
   (a) Lower concentration of cytokinin and higher concentration of Auxin
   (b) Higher concentration of cytokinin and lower concentration of Auxin
   © both in equal proportion   (d) only auxin and no cytokinin

5. Which one of the following is required for plant tissue culture
   (a) Trypsin  (b) Kinetin  (c) ABA  (d) Ethylene

6. The embryos produced from somatic cells in Tissue culture are known as
   (a) embryoids  (b) callus  (c) callose  (d) embryo

7. Sterilization of glassware and related equipment for tissue culture is brought about by using
   (a) UV light  (b) alchol  (c) indubator  (d) Autoclave

8. Haploids are obtained by culturing
   (a) Pollengrians  (b) Somatic cells  (c) Embryo  (d) All of these

9. In an economically important plant species, embryo mortality is very high. What method do you suggest to check the mortality
   (a) Embryo culture  (b) Meristem culture  (c) Mircopropagaiton (d) Amphimixis

10. What term would you assign for variations appearing during tissue culture
    (a) Genetic variation  (b) Somaclonal variation
    © Clonal variation  (d) Parasexual variation

11. It is easier to make fusion between two animal cells than the plant cells because
    (a) they lack cells wall  (b) they lack cell membrane
    (c) paint cells have middle lamella  (d) all of these
12. During protoplast fusion in plant cells, cell walls need to be dissolved. This is brought about by using
   (a) PEG    (b) restriction endonuclease    (c) ligase   (d) cellulose
13. While plant materials are subjected to quarantine, shoot tips are not. Why it is so
   (a) Shoot tips can be easily grown    (b) shoot tips are disease free
   (c) the disease occurs in leaves only  (d) shoot tips show only viral disease
14. Virus free clones are obtained from
   (a) callus    (b) embryoids    (c) haploid culture   (d) shoot tips
15. Androgenic haploids were first produced by
   (a) Steward    (b) P. Maheswari    (c) Reinert and Bajaj  (d) Beadle and Tatum
16. An example to Transgenic plant is:
   (a) Bt cotton    (b) Flavr savr Tomato    (c) Golden rice   (d) All of these
17. In order to obtain disease free plants through tissue culture, the best method is:
   (a) Anther culture    (b) Embryo culture
   (c) Meristem culture   (d) Protoplast culture
18. Protoplast fusion is technically known as
   (a) Cloning    (b) Asexual reproduction
   (c) Para sexual hybridisation  (d) None of these
19. Cybrids are formed due to
   (a) Fusion of cytoplasm of two cells and nucleus of one cell
   (b) fusion of cytoplasm of two cells and nucleus of two cells
   (c) fusion of protoplasm of two cells (d) fusion of tow nuclei above
20. The first Transgenic crop produced was
   (a) Cotton    (b) Pea    (c) Tobacco   (d) Flax

5x1 = 5 weightage

PART B

(Answer any six of the following)

21. What if meant by inoculation
22. What is LAF
23. What is an autoclave
24. Define Transgenesis
25. Write the full form of Bt in Bt- cotton
26. Who is the father of plant Tissue culture
27. What are androgenic haploids
28. Name any one vector less gene transfer technique

6x1 = 6 weightage
PART C

(Answer any three of the following)

29. What is meant by hardening
30. What is a cybird
31. What are Artificial seeds
32. What is meant by embryo rescue
33. Write briefly on cryopreservation
34. How transgenic plants are produced

\[3 \times 2 = 6 \text{ weightage}\]

PART D

(Answer any two of the following)

35. Briefly explain the steps involved in Tissue culture
36. Write an essay on Anther culture and its importance
37. Write briefly on protoplast isolation, culture and fusion

\[2 \times 4 = 8 \text{ weightage}\]
SEMESTER - VI
CORE COURSE VIII - ENVIRONMENTAL SCIENCE, PHYTOGEOGRAPHY, EVOLUTION
Total – 117 Hrs. Theory – 81 Hrs., Practicals- 36 Hrs.

Distribution of Hours

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<tr>
<th>Course</th>
<th>Theory</th>
<th>Practical</th>
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<tbody>
<tr>
<td>1) Environmental Science</td>
<td>42</td>
<td>18</td>
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<tr>
<td>2) Phytogeography</td>
<td>15</td>
<td>18</td>
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<td>3) Evolution</td>
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ENVIRONMENTAL SCIENCE

MODULE 1- Environmental Science - Definition – Scope and Objectives – Significance.

- **Plant adaptations**: Adaptations of the following plant groups – Hydrophytes, xerophytes, halophytes, epiphytes ,parasites. 4 hrs.
- **Plant Succession**: Definition – Primary and Secondary succession – Autogenic and allogenic succession–Mechanism of plant succession–xerosere,hydrosere

3 hrs.

- **Natural Resources**: Types – Renewable and non-renewable resources – Over explored and under explored resources. Petrocrops – Sustainable management of resources (brief account). 3 hrs.

MODULE- II Population Ecology


**Synecology:** Ecological community – Coevolution of populations – Association of flowering plants and honeybees – Population interactions – Symbiosis, mutualism, commensalism, predation, parasitism, herbivory – concept of species diversity - $\alpha$, $\beta$, $r$ – sampling techniques in plant community studies – Quadrat and transect methods – species area curve – density, frequency, abundance, dominance of populations – importance value index – construction of phytographs.

### Practicals

1. Construct a food web from the given set of data, (Representative of a natural ecosystem).

2. Construct ecological pyramids of number, biomass, energy from the given set of data, (Representative of a natural ecosystem).

3. Determination of pH of soil solution by using pH meter.


5. Study of plant communities – Determination of density, abundance, dominance, frequency by quadrat method.

6. Determination of dissolved oxygen by Winkler’s method.

7. Study of morphological and anatomical characteristics of plant groups – Hydrophytes, Xerophytes, halophytes, epiphytes, parasites.

### References


Web Pages


5. ecology.unm.edu/populus.
PHYTOGEOGRAPHY

MODULE – III. (Theory 15 hrs.)

1. Definition, concept, scope and significance of phytogeography. 2 hr
2. Centres of origin and distribution of species. 2 hr.
3. Patterns of plant distribution - continuous distribution and discontinuous
distribution, vicarism, migration and extinction 4 hr
4. Continental drift - evidences and impact; glaciation; theory of land bridges 3 hrs
5. Endemic distribution, theories on endemism, age and area hypothesis. 2 hr
6. Phytogeographical zones (phytochoria) of the world and India 2 hr.

Practicals (18 hrs)

1. Field visit to National Park or natural vegetation to study species composition and characteristics.
2. Draw the phytogeographic zones of the world.
3. Draw the phytogeographic zones of India.

Reference


Web Pages:

www.pewclimate.org
www.britannicaonline.org
www.wikipedia.org
www.biologybrowser.org
www.earthtrends.wri.org
1. **Origin of Earth** – Introduction; Evidences of organic evolution – evidences from morphology, Anatomy, Embryology, Palynology, genetics and molecular biology. **2 hrs.**


3. **Theories on origin and evolution of species**


4. **Genetic Constancy and Creation of Variability**


5. **Molecular phylogenetics**: Phylogeny – Construction of Phylogenetic trees based on biomolecules – Evolutionary classification based on aminooacid sequences, Quantitative DNA measurements, Repetitive DNA sequences, DNA – DNA hybridization (brief), restriction enzyme sites and nucleotide sequences – Evolutionary clocks. **7 hrs.**

6. **Speciation**: Isolating mechanism – Modes of speciation – sympatric and allopatric. **2 hrs.**

**References**


**Web pages**

2. [www.bbc.co.uk/education/darwin/index.shtml](http://www.bbc.co.uk/education/darwin/index.shtml)
3. www.nhm.ac.uk
4. www.biologybrowser.org
5. tofweb.Org/tree/phylogeny.html
Subjectwise Distribution of Questions

Envt.al Biology - 60%
Phytogeography - 16%
Evolution - 24%

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<tr>
<td>Multiple choice</td>
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SEMMESTER VI
MODEL QUESTION PAPER I

CORE COURSE- VIII: ENVIRONMENTAL SCIENCE, PHYTOGEOGRAPHY, AND EVOLUTION

Time 3 Hours   Total Weightage - 25

PART A

(Answer all the questions)

1. Soil that is made up of particles that have been carried in water and then deposited is called
1. Subsoil: a) subsoil  b) clay  c) silt  d) loam

2. Xerophytic adaptations in Meuhlenbeckia is
   a) phyllode  b) cladode  c) phylloclade  d) all the above.

3. Which is the major hot spot in Kerala?
   a) Silent Valley  b) Ezhimala  c) Nilgiri  d) Muthumalai

4. Which one of the following is an endangered species?
   a) *Rauwolfia serpentina*  b) *Tridax procumbens*  c) *Solanum torvum*
   d) *Euphorbia pulcherrima*

5. Approximate % of sp endemic in hot spots of India is:
   a) 15  b) 17  c) 30  d) 33

6. Which one of the following is a petrocrop?
   a) Jatropha  b) Abutilon  c) Annona  d) Pisum

7. The pioneer of xerosere is
   (a) Annuals  (b) Biennials  (c) Perennials  (d) Lichen

8. A dental disease characterised by molting of teeth is due to presence of a certain chemical element in drinking water, which is that element?
   a) B  b) Cl  c) Fl  d) Hg

9. An example for endemic spp. is
   a) Ginko  b) Pinus  c) Gnetum  d) Ephedra

10. Where do tropical rain forests occur?
    a) Jammu & Kashmir  b) Himachal Pradesh  c) Bihar  d) Andaman

11. Richest sources of fossil is:
    a) basalt  b) granite  c) lava  d) sedimentary

12. Closely related organisms with very different traits have experienced
    a) coevolution  b) convergent evolution  c) divergent evolution
    d) parallel evolution

13. The unit of natural selection is
    a) individual  b) family  c) population  d) species

14. Reproductive isolation in sympatric speciation develops without
    a) geographic barrier  b) barrier to gene flow
    c) change in chromosome number  d) barrier to mating.

15. Genetic drift or changes in allelic frequency due to chance factors, occurs in population that
are very
a) isolated   b) small in number   c) mobile
d) closely adapted to local environments.

16. ------- is an abiotic factor
a) producer     b) consumer
c) decomposer     d) soil

17. Concentration of CO2 in the atmosphere
a) 21%   b) 3%   c) 72%   d) 0.03%

18. ________ is a Cause of peeling off of Ozone umbrella
a) CFC   b) CO   c) NO2   d) Pesticide

19. A National park
a) Silent valley   b) Thekkady   c) Tholpetty

20. Term endemic means
a) native   b) introduced   c) not living   d) vulnerable

5x1 = 5 weightage

PART B
(Answer any six of the following)

21. Why do we need to conserve keystone species?
22. What are the precautions to be taken to prevent thermal pollution?
23. What are e-waste?
24. What are paleoendemic?
25. What is adaptive radiation?
26. What is phylogeny?
27. Name the species of earthworm used in vermicompost.
28. Define pomology. 6x1 = 6 weightage

PART C
(Answer any three of the following)

29. Comment on kyoto protocol.
30. Give short notes on carbon cycle.
31. Imagine a situation of eradication of soil decomposer. Comment on its after effects.

32. What is meant by discontinuous distribution? Explain the various theories.

33. Theory of Natural selection.

34. Write a short note on the evolution of eukaryotic cell.  

\[ 3 \times 2 = 6 \text{ weightage} \]

Part D

(Answer any two of the following)

35. Explain the strategies of solid waste management.

36. Define ecosystem. Explain in detail the components of an ecosystem.

37. Define vegetative propagation. Explain the different methods in vegetative propagation with examples.  

\[ 2 \times 4 = 8 \text{ weightage} \]
PART A

(Answer all the questions)

1. Which are among the following factor is biotic.
   a) CO₂ content  b) soil microbes  c) soil texture  d) soil air

2. In an ecosystem, the functions of producer is
   a) convert organic matter into inorganic compounds
   b) transduce solar energy
   c) convert solar energy into radiant energy
   d) release energy

3. Mechanical tissues are highly reduced in
   a) xerophyte  b) mesophyte  c) hydrophyte  d) halophyte

4. Vivipary is a character of
   a) parasitte  b) mesophyte  c) hydrophyte  d) halophyte

5. International day of biological diversity is celebrated
   a) June 5  b) February 2  c) May 22  d) August 15

6. Fossil Fuels are
   a) Renewable resource  b) None-renewable resource
   c) In exhaustible resource  d) Non-renewable and exhaustible

7. Primary succession takes much longer than secondary succession because it involves
   a) development of the soil  b) development of the seen bank
   c) colonization by organic  d) colonization of more K-selected organisms

8. When huge amount of sewage is dumped into a river BOD will
   a) increase  b) remain unchanged  c) Slightly decrease  d) decrease

9. Species with restricted distribution are called
   a) wides  b) endemics  c) cosmos  d) sympatric
10. In India coniferous forests are found in
   a) MP    b) HP    c) Satupura Hills    d) Rajasthan

11. In allopatric speciation, the initial barriers for gene flow is
   a) behavioural    b) post zygotic    c) geographic    d) ecological

12. Dissimilar organisms with closely related traits have experienced
   a) co-evolution    b) convergent evolution
   c) divergent evolution    d) parallel evolution

13. After pollution destroyed lichens (which are light in colour) on the trees, the survival of the
dark coloured peppered moths increased, because they were
   a) protected from carcinogens    b) protected from lichen poisons
   c) more robust    d) protected from predation

14. Phylogeny describes a species
   a) morphological similarities with other species
   b) reproductive compatibilities with other species
   c) evolutionary history
   d) geographic distribution

15. A new mutation spreads from one population to another by means of
   a) removed bottlenecks    b) emigrants and immigrants
   c) mutation pressures    d) crossovers

16. The science dealing with the interaction between living and non living components
   a) Ecology    b) physiology    c) mycology    d) Phycology

17. Select a hydrophyte
   a) cactus    b) cassuarina    c) musa    d) Hydrilla

18. An example of halophyte
   a) Pistia
   b) Muehlen beckia
   c) Rhizophora
   d) paddy

19. Green house effect
   a) CO2    b) SO2    c) NO2    d) CO

20. Eravikulam is a
   a) Bioreserve    b) Sanctuary    c) National park    d) Tourist place
PART B

(Answer any six of the following)

21. What is the application of cryopreservation
22. Why do some plants grow in saline oil.
23. What happens if ozone gets depleted?
24. Why do some species show restricted distribution?
25. What is endosymbiotic theory?
26. What are the major objections against Lamarckism?
27. Define homeostasis
28. What are the principles of thermodynamics

6x1 = 6 weightage

PART C

(Answer any three of the following)

29. What is species diversity? Compare α, β, and γ diversities.
30. Comment on the wise and judicious utilization of natural resources.
31. Discuss the role of various international organization on environment protection.
32. Comment on the climates of India
33. Comment on the variability in a population.
34. Which account on the evidences in support of evolution. 3x2 = 6 weightage

Part D

(Answer any two of the following)

35. Define biodiversity. Explain the various means of conservation of biodiversity.
36. What is plant succession? Explain the various stages involved in xerosere.
37. Describe Bio geo chemical cycling 2x4=8 weightage
**PHYSIOLOGY** Theory 36 Hrs, Practical 18 Hrs.

**MODULE 1. PLANTS WATER AND MINERALS** 15 Hrs.

1. **Plant cell and Water**
   - Water and hydrogen bonds. Properties of water. Temperature and physical state.

2. **The ascent of xylem water.**
   - Transpiration pull and cohesion of water molecules. Merits and demerits of cohesion-tension theory.

3. **Absorption of water by transpiration pull and cohesion of water molecules.** Radial movement of water through root. Soil-plant-atmosphere continuum of water. 3 hrs.


**Module II Photosynthesis and Translocation of Photoassimilates.** 12 Hrs.

1. **Photosynthesis in higher plants.**

2. Translocation and distribution of photo assimilates.

MODULE III  PLANT GROWTH AND DEVELOPMENT.

3. The hormone concept in plants. Plant growth and development. Auxins, gibberellins, cytokinins, abscisic acid and ethylene, their physiological roles. Chemistry and biosynthesis (Brief study). Photoperiodism and vernalization. (Brief study).

4. Plant movements.
   Phototropism, gravitropism. Nyctinastic and seismonastic movements.

5. Photomorphogenesis:
   Phytochrome: chemistry and physiological effects. (Brief study).

6. Seed dormancy and germination. (Brief study).

Practicals

1. Determination of water potential by tissue weight change method.
2. Study of stomatal index.
3. Relation between water absorption and transpiration.
4. Demonstration of Hill reaction.
5. Extraction of leaf pigments.
6. Separation of leaf pigments by paper chromatography/ column chromatography/TLC.
7. Effects of light intensity on photosynthesis by Wilmot's bubbler.
8. Effect of scarification on seed germination.
10. Testing of seed viability by 2,3,5-triphenyl tetrazoliumchloride test.
12. Determination of the rate of transpiration using Ganong’s photometer.

8 hrs.
4 hrs.
9 hrs.
4 hrs.
1½ hrs.
2 hrs.
1½ hrs.
18 hrs.
References.


**METABOLISM**  
Theory 18 Hrs., practical 9 Hrs.

**MODULE IV CATALYSIS AND INTERMEDIARY METABOLISM**

   2 hrs.
   2 hrs.
3. Plants and nitrogen metabolism.  
   2 hrs.
   Citric acid cycle: Formation of acetate, reaction of citric acid cycle, anapleurotic reactions of citric acid cycle. Regulation of citric acid cycle (brief). Glyoxylate cycle. Amphibolic nature of citric acid cycle.  
   2 hrs.
5. Oxidation of fatty acids. Activation and entry of fatty acids, β oxidation of saturated fatty acids in plants. Glyoxylate cycle. α-oxidation (Brief study).  
   2 hrs.
6. Biosynthesis of saturated fatty acids in plants. Involvement of fatty acid synthase complex and acyl carrier protein.  
   2 hrs.
7. Oxidation of amino acids and entry to TCA cycle.


Practicals

1. Extraction of invertase (from any source).
3. pH dependent activity profile of enzymes

References

MODULE- V. BIOMOLECULES

1. Biomolecules.
   Heirarchy of biomolecules: (organelle-supramolecular assemblies-macromolecules-building block biomolecules - metabolic intermediates-precursors). 4 hrs.

2. Carbohydrates. Classification; structure and functions of simple sugars and compound carbohydrates; Glycobiology. 5 hrs.

3. Lipids. Classification. Complex lipids, Simple lipids. Storage and structural lipids, Fatty acids saturated and unsaturated, triacyl glycerols, phospholipids, sphingolipids. Lipids in membranes, the supramolecular architecture of membranes. 4 hrs.


   Functions of nucleotides and nucleotide derivatives (NAD⁺, NADP⁺, FAD, FMN, cyclic AMP, cyclic GMP). 4 hrs.

   Significance: ecological importance (Plant-plant interaction, plant pathogen interaction, as defence compounds, and as phytoalexins) and phylogenetic importance. 3 hrs.

Practicals 9 Hrs.

1. Qualitative tests for monosaccharides, and reducing non reducing oligosaccharides, starch, amino acids and protein.
   a. Molisch’s test for all carbohydrates
   b. Benedict’s test for reducing sugars
   c. Barfoed’s test for monosaccharides
   d. Seliwanoff’s test for ketoses
   e. Fearson’s test (methyl amine test) for reducing disaccharides
   f. Iodine test for starch
   g. Ninhydrin test for amino acids and protein
   h. Xanthoproteic test for amino acids with aromatic R-groups
   i. Millon’s test for tyrosine
   j. Hopkins- Cole test for tryptophan
   k. Biuret test for peptide linkage and proteins


References:
### Subjectwise Distribution of Questions

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PART A

(Answer all the questions)

1. What are the assimilatory powers in photosynthesis.
   a. ATP and NAD\(^+\).  b. NADP\(^+\) and ADP.  c. ATP and NADPH.  d. ADP and NADPH.

2. The primary event during the absorption of water is
   a. diffusion b. imbibitions c. osmosis d. mass flow.

3. The universal currency of free energy in biological systems is
   a. GTP.  b. NADPH.  c. ATP.  d. NAD\(^+\)

4. Carbohydrates are
   a. Polyalcohols. b. hydroxy aldehydes c. hydroxy ketones
   d. Polyhydroxy aldehydes or Polyhydroxy ketones.

5. Which among the following exhibit seismonastic movement

6. Fatty acid biosynthesis in germinating seeds takes place in

7. Which among the following is a non reducing disaccharide.

8. Which among the following is a secondary metabolite.

9. One of the methods of breaking dormancy is
   c. Etiolation.  d. Phosphorylation

10. The translocation of photoassimilation occur through

11. Which among the following is an imino acid.

12. The TCA cycle is marked by
13. Which hormone is involved in stomatal closure.
   a. Abscisic acid. b. IAA c. GA3 d. Ethylene

14. The repeating bond in amylose is called

15. Which pigment is involved in the perception of photoperiodic signal.

16. The symbiotic nitrogen fixing bacteria inhabiting in the root nodules of leguminous plants

17. The hormone that induces parthenocarpy
   a. Acetylene b. Ethylene c. IAA d. ABA

18. Which among the following is a natural antitranspirants.

19. Glyoxylate pathway is concerned with
   c. Synthesis of ATP. d. Synthesis of NADPH.

20. Which among the following is the transport form of sugar.

5x1 = 5 weightage

PART B

(Answer any six of the following)

21. What is cohesion.

22. Define chlorosis.

23. Define tropic movements.

24. Define intermediary metabolism.

25. Mention the significance of glyoxylate cycle.


27. What is the difference between purines and pyrimidines.

28. Give a brief note on supramolecular assembly.

6x1 = 6 weightage

PART C

(Answer any three of the following)
29. Explain the mechanism of guard cell movement
30. Enumerate the physiological roles of auxin. Give the outline of auxin biosynthesis.
31. What are the components of water potential.
32. Explain the GS/GOGAT pathway.
33. What are glycoconjugates.
34. Explain the structure of phospholipids. Why these structures can conjugate with proteins to organize the membranes.

3x2 = 6 weightage

Part D

(Answer any two of the following)

35. Trace the path of electrons from water to NADP$^+$ during photosynthetic electron transport.
36. Give the IUB classification of enzymes. Explain the mechanism of enzyme action and add a note on the regulation of enzyme activity.
37. Explain the different levels of architecture of proteins. Briefly explain the weak interactions which maintains the native protein conformation  2x4 = 8 weightage
PART A

(Answer all the questions)

1. Name the cation involved in the photolysis of water.
   a. Mg
t   b. Mn
t   c. Mo
t   d. K

2. Which among the following is the product of photophosphorylation.
   a. ADP
   b. NADP
   c. GTP
   d. ATP.

3. The initial acceptor of CO2 in C3 pathway is
   a. PEP.
   b. RuBP.
   c. GDP.
   d. NAD

4. The glycosidic bond involved in the branch points of amylopectin is
   a. α 1        4
   b. α 1        6
   c. β 1        6
   d. β 1        4

5. In rainy season the wooden doors and windows swell up due to
   a. imbibition of water
   b. Endosmosis of water
   c. Exosmosis of water
   d. Plasmolysis

6. Which among the following is the principal pigment in photosynthesis
   a. Chlorophyll a
   b. Chlorophyll b
   c. Carotene.
   d. Xanthophyll.

7. Osmosis refers to the diffusion of
   a. Solute through a semipermeable membrane
   b. Solvent through a semipermeable membrane
   c. Solution through a semipermeable membrane
   d. Gases through a semipermeable membrane

8. The initial acceptor of acetyl coA in glyoxylate cycle is
   a. Glyoxylate.
   b. Malate
   c. Oxaloacetate.
   d. Citrate

9. Which among the following is a building block biomolecule of nucleic acid
   a. Purine.
   b. Pyrimidine.
   c. Nucleoside.
   d. Nucleotide

10. The induction of flowering by low temperature treatment is called
    a. Cryobiology.
    b. Vernalization.
    c. Pruning.
    d. Photoperiodism

11. Which among the following is the co-enzyme of transaminase.
    a. Pyridoxal phosphate.
    b. TPP
    c. Biotin
    d. Co-enzyme A.

12. The type of interactions involved in the quarternary structure of protein is
    a. Weak interactions.
    b. Covalent bond
c. Electrovalent bond  
d. disulfide linkage

13. Which among the following is a growth retarding plant hormone.
   a. Abscisic acid.  
   b. IAA  
   c. GA3  
   d. Cytokinin

14. The amino acid that acts as a precursor of for the biosynthesis of IAA is
   a. Tryptophan.  
   b. Tyrosine.  
   c. Methionine.  
   d. Glutamine.

15. The enzyme involved in ATP synthesis is.
   a. ATP synthase.  
   b. ATP synthetase. 
   c. Acyl coA synthetase  
   d. Lyase.

16. Which among the following is a nonsaponifiable lipid?
   a. Stearic acid.  
   b. Arachidonic acid.  
   c. Terpene.  
   d. Phophatidyl choline.

17. Breaking the seed dormancy by low temperature treatment is called
   a. Scarification  
   b. Stratification  
   c. Vernalization  
   d. Lyophylization

18. Which among the following is a multienzyme complex?
   a. Fatty acid synthase  
   b. Glycolytic enzymes  
   c. β oxidation enzymes  
   d. TCA cycle enzymes.

19. Natural rubber is a
   a. Monoterpene.  
   b. Diterpene  
   c. Sesquiterpene  
   d. Polyterpene.

20. Which among the following nucleotide is known as the second messenger in hormonal regulation?
   a. AMP  
   b. UMP.  
   c. cAMP.  
   d. CMP.

   5x1 = 5 weightage

PART B

(Answer any six of the following)

Give brief explanations of the following


22. Significance of crassulacean acid metabolism in succulents.

23. Water potential.

24. Isoenzymes.

25. Transamination.

26. α oxidation.

27. Steroids.

28. Zwitterion

   6x1 = 6 weightage

PART C
(Answer any three of the following)

29. Describe briefly how the bundle sheath and mesophyll cells cooperate in photosynthetic carbon reduction in C4 plants
30. What is phytochrome. Give a brief description of the physiological effects of phytochrome
32. Explain the classification of amino acids based on polarity.
33. Give an account of chemiosmotic hypothesis.
34. Outline the structure and functions of phospholipids

3x2 = 6 weightage

Part D
(Answer any two of the following)

35. Give an account of the mechanism of mineral uptake by plants.
36. Describe the process of root nodule formation in leguminous plants and the biochemistry of N₂ fixation
37 Secondary metabolism is considered as the byways of metabolism. Substantiate.

2x4 = 8 weightage
SEMESTER VI
CORE COURSE X
CELL BIOLOGY, GENETICS AND PLANT BREEDING
Total – 117Hrs. Theory – 81 Hrs., Practicals- 36 Hrs.

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CELL BIOLOGY Theory-18 Hrs., Practicals - 9Hrs.

MODULE – I. The Dynamic cell Structure and functions

1. Architecture of cells. Prokaryotic and Eukaryotic cells. 1 hr.

2. Structure and function of the following -cell membrane (fluid mosaic model), Endoplasmic reticulum, Golgi complex, mitochondria - mt DNA chloroplast, cp DNA, Lysosomes, Glyoxisomes, Ribosomes, Cytoskeleton, Cytosol, Vacuole 5 hrs.


   Special types of chromosomes –Polytene chromosomes, lampbrush chromosomes 1 hr.

5. Cell division - cell cycle - Mitosis & Meiosis – significance- molecular control of cell division 1 hr.

6. Chromosomal changes - structural aberations deletion, duplication, inversion, translocation - their meiotic consequences and significance 2 hrs.

7. Numerical aberration - Defintion - Basic chromosome number (Genomic Number) Aneuploidy, Haploidy and Polyploidy - their meiotic behaviour and significance. 2 hrs.

8. Radiation cytology - ionising and non-ionising radiation, Isotopes and their
applications Biological effects of radiation.  

**Practicals** 9 Hrs.

2. Calculation of mitotic index

**References**

MODULE- II. CLASSICAL GENETICS


Incomplete dominance - *Mirabilis*


Co-dominance - Blood groups in man

Lethal genes - coat colour in mice

3. Non-allelic interaction (genic)

Epistasis – a) Dominant - Fruit colour in summer squashes

b) Recessive epistasis - Coat colour in mouse

Complementary genes - Flower colour in sweet pea

Non-epistasis - Comb pattern in Fowls


5. Linkage and crossing over - chromosome theory of linkage, crossing over, types of crossing over, mechanism of crossing over (Holliday model) Linkage map, 2 point and 3 point crosses, interference and coincidence

6. Sex linked inheritance - X-linked, Y-linked, Morgan's experiment eg. eye colour in Drosophila, sex limited and sex influenced inheritance, pedigree analysis.


8. Mutation - types - mutagens - Physical, Chemical molecular mechanisms of gene mutation

Practicals -18 hours

Students should work out genetics problems in dihybrid inheritance, modified ratios, and in chromosome mapping - 2 point and 3 point crosses.
Module – III.

1. Nucleic acids - DNA - The genetic material, discovery of bacterial transformation (Griffith’s & Avery's experiments), Hershey and Chase experiment. 2 hrs. DNA - structure, Watson & Crick's Model, Types of DNA-(A,B,Z) 2 hrs. - Replication - Semi conservative replication – Meselson and Stahl's experiment - Molecular mechanism of Replication 3hrs. RNA - structure, types and properties. 2 hrs.

2. Genetic code - Characters of genetic code 1 hr.

3. Central dogma - - protein synthesis Transcription, post-transcriptional modification of RNA, translation; Teminism. 4hrs.


5. One gene - one enzyme hypothesis, one cistron one polypeptide hypothesis, modern concept of gene-cistrons, recons and mutons 2 hrs.

6. Plant Genome sequencing - brief account, Human Genome Project - brief account. 2 hrs.

References


PLANT BREEDING     Theory -9 hrs.
Module – IV.

1. Definition & Objectives of Plant breeding - Important national and international plant breeding institutes

2. Plant Genetic Resources – Components of Plant Genetic Resources, Significance

3. Breeding techniques -
   a. Plant introduction
   b. Selection - mass selection, pureline selection and clonal selection.  
   c. Hybridization (techniques only) hybrid vigour inbreeding depression
   d. Mutation breeding
   e. Polyploidy breeding
   f. Breeding for disease resistance


Practicals  
Techniques of emasculation and hybridization of any bisexual flower.

References

5. Swaminathan, Gupta & Sinha - Cytogenetics of Crop plants

Subjectwise Distribution of Questions

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1. Which of the following organelle contains enzymes that have digestive action.
   a) Lysosome  b) Ribosome  c) Plastids  d) Polysome
2. One gene - one enzyme hypothesis was proposed by
   a) Temin & Baltimore  b) Watson & Crick
   c) Robert M. Koch  d) Beadle & Tatum
3. The plant in which genome sequencing was done for the first time.
   a) Gossypium  b) Arabidopsis  c) Zea  d) Triticum
4. The headquarters of IPGRI is in
   a) Rome  b) New Delhi  c) Geneva  d) Lucknow
5. The non-sticky end of a chromosome is called
   a) Centromere  b) Telomere  c) Chromosome  d) Kinetochore
6. Nucleus was discovered by
   a) Robert Brown  b) Robert Hooke  c) Mendel  d) Morgan
7. If thymine makes up 15% of the bases in a certain DNA sample, what % of the bases must be cytosine.
   a) 15%  b) 30%  c) 35%  d) 85%
8. Dihybrid Testcross ratio is
   a) 9 : 3 : 3 : 1  b) 3 : 1  c) 1 : 1 : 1 : 1  d) 1 : 1
9. Single membrane bound organelle
   a) Lysosome  b) Ribosome  c) Mitochondria  d) Plastid
10. Initiation codon in protein synthesis is
    a) AUU  b) AUC  c) AUG  d) ACC
11. Reverse transcriptase is
    a) DNA dependent DNA polymerase  
    b) DNA dependent RNA polymerase  
    c) RNA dependent RNA polymerase  
    d) RNA dependent DNA polymerase
12. *Triticum aestivum* is an example for
    a) autopolyploid  b) aneuploid  c) allopolyploid  d) haploid
13. The double helix model of DNA was elucidated by Watson & Crick in
    a) 1962  b) 1953  c) 1941  d) 1950
14. More the distance between the two genes in a chromosome
    a) Linkage strength remains unchanged
b) More the linkage strength
c) Lesser the linkage strength
d) None of the above
15. The giant nature of Salivary gland chromosome is due to
   a) endomitosis b) mitosis c) amitosis d) meiosis
16. Diagrammatic representation of chromosome of an organism arranged according to their size is called
   a) genotype b) genome c) idiogram d) phenotype
17. Dicentric bridges are formed due to
   a) duplication b) inversion c) deletion d) translocation
18. The number of genotypes in Mendelian dihybrid cross is
   a) 3 b) 16 c) 12 d) 9
19. If 75% of the offspring of F2 show dominant character, the parents are
   a) both homozygous recessive b) both homozygous dominant
   c) both hybrids d) one dominant and one recessive
20. Father of green revolution in India is
   a) Boshisen b) T.S. Venkataraman
   c) K. Ramaih d) M.S. Swaminathan

   5x1 = 5 weightage

Part B
(Answer any six of the following)

21. What is vertical resistance.
22. Mention any 2 differences between mass selection and pure line selection.
23. What is plant introduction.
24. What are lethal genes? Give an example.
25. What are holandric genes?
26. Differentiate between transition and transversion.
27. Mention any two characteristic features of Fluid-Mosaic Model.
28. Write any two applications of radio isotopes in medicine. 6x1 = 6 weightage
Part C
(Answer any three of the following)

29. Explain the structure and functions of an organelle associated with photosynthesis.
30. Describe the morphology and ultrastructure of chromosomes.
31. Explain the complementary gene action.
32. What is an operon? Explain the functioning of lac operon in Prokaryotes.
33. Differentiate between sex-limited and sex-influenced traits with suitable examples.
34. Explain the hybridization techniques adopted in Rice.  
   \[3 \times 2 = 6 \text{ weightage}\]

Part D
(Answer any two of the following)

35. With the help of labelled diagrams, explain the process of meiosis I.
36. Explain the molecular mechanism of DNA replication.
37. What are multiple alleles? Explain with a suitable example.
   \[2 \times 4 = 8 \text{ weightage}\]
PART A
(Answer all the questions)

1. F2 ratio in complementary gene action
   a) 9 : 3 : 4  b) 9 : 3 : 3 : 1  c) 9 : 7  d) 9 : 6 : 1

2. The rice variety PTB-10 is obtained from
   a) selection  b) hybridisation  c) introduction  d) mutation breeding

3. An example of termination codon
   a) UUU  b) UUA  c) AUG  d) CGU

4. mt DNA is present in
   a) mitochondria  b) microsomes  c) ribosome  d) chloroplast

5. Multiple copies of the same base pair sequence of DNA
   a) nucleosome  b) tandem repeats  c) replisomes  d) okazaki fragments

6. An example of Y linked inheritance
   a) Haemophilia  b) Baldness  c) Hypertrichosis  d) Anemia

7. The enzyme acid phosphatase serves as an excellent marker for
   a) ribosomes  b) microsomes  c) peroxisomes  d) lysosomes

8. During cell cycle DNA replication takes place in
   a) S-phase  b) G1 phase  c) G2 phase  d) prophase

9. Nucleic acid was first identified by
   a) Lewin  c) Miescher  c) Johansen  d) Correns

10. Sharbathi Sonora is an achievement of
    a) polyploidy breeding  b) resistance breeding  c) genetic engineering  d) mutation breeding

11. The genetic information is transported from the nucleus to ribosome by
    a) m RNA,  b) t RNA  c) r RNA  d) r RNA

12. Number of mitotic divisions required to form 128 cells from a cell of root tip.
    a) 3  b) 64  c) 127  d) 128

13. Karyokinesis means division of
    a) nucleus  b) cytoplasm  c) protoplasm  d) none of these

14. Percentage of crossing over will be more if
    a) Linked genes are located close to each other
    b) Linked genes are located far apart from each other
    c) both one and two
    d) None of the above
15. In Z- DNA the pitch of each turn of helix is
   a) 20 Å          b) 24 Å          c) 45 Å          d) 34 Å
16. 3 : 1 Monohybrid ratio is modified to 1 : 2 : 1 in the following type of inheritance.
   a) lethal genes    b) incomplete dominance
   c) supplementary genes    d) complementary genes
17. Head quarters of IARI
   a) Bombay    b) Calcutta    c) New Delhi    d) Trivandrum
18. All are membrane bounded ell organelles except
   a) Mitochondria    b) Lysosome    c) Chloroplast    d) Ribosome
19. Operon concept is proposed in the year
   a) 1961    b) 1962    c) 1970    d) 1980
20. Which of the following is not a mutagen
   a) EMS    b) Acetic acid    c) Nitrous acid    d) Ethylene oxide

Part B
(Answer any six of the following)

21. What is horizontal resistance
22. Mention any two advantages of mass selection
23. Differentiate between back cross and test cross
24. What is acclimatization?
25. Define replisomes
26. What is Human Genome Project?
27. Mention any two functions of nucleolus?
28. Differentiate between metaphase of mitosis and that of meiosis I

Part C
(Answer any three of the following)

29. Explain the structure and function of an organelle associated with respiration.
30. Give an account of polyploidy and their role in plant breeding.
31. Briefly explain the genetic basis of cancer.
32. Before being transported into the cytoplasm many changes takes place in m RNA. Substantiate
33. Explain the ratio 12 : 3 : 1
34. Explain the breeding techniques adopted in Potato

Part D
(Answer any two of the following)

35. Give an account of structural abberation and their meiotic consequences.
36. Cytoplasm of the mother is inherited in some case. Explain your views with examples.
37. What are mutagens, explain how they induces mutation.
2 \times 4 = 8 \text{ weightage}
MODULE- I. PLANT TISSUE CULTURE
Introduction to Biotechnology – History, Definition, scope, significance
Plant Tissue Culture – History, Principle – Totipotency, differentiation, dedifferentiation, redifferentiation. Facilities of Tissue culture laboratory,
Media – MS medium composition, Preparation, Sterilization techniques, Explant selection, sterilization and Inoculation.
Types of culture – Meristem culture, Organ culture; Callus culture; Cell suspension culture; Protoplast culture.
Isolation of protoplasts, somatic hybridization and its significance;
Somatic embryogenesis and synthetic seeds.
Haploid production – Anther and pollen culture, its significance;
Embryo culture and Embryo rescue
Micropropagation – Multiple shoot culture and large scale propagation of crop plants,
Somaclonal variation – Disease free plants;
Production of secondary metabolites in Bioreactors
Application of tissue culture in Biodiversity and conservation

MODULE – II.
RECOMBINANT DNA TECHNOLOGY AND GENE MANIPULATION
a. Tools:
   Enzymes- Exonucleases; Endonucleases; Restriction endonucleases Type I,II&III;
   Ligases; Reverse Transcriptase, Terminal transferase, Polymerase, Alkaline phosphatase
   Vectors- General account of plasmids, cosmids, bacteriophages, Phasmids – Advantages and disadvantages; Structure of pBR 322; Artificial chromosome vectors – BAC, YAC, Shuttle vectors

b. Prokaryotic expression of foreign genes
Isolation of gene of interest – Artificial gene synthesis; cDNA library - cDNA synthesis, genomic DNA library- identification and isolation of the gene from cDNA, Genomic DNA or Libraries using probes, PCR, RACE.
DNA Ligation – Linkers, adaptors, Homopolymer tailing,

Transformation, selection of transformed bacteria – antibiotic selection, reporter genes - GUS,GFP, colony hybridization and immunological tests

Heterologous protein expression, purification and characterization

c. **Gene transfer methods in plants**

Direct methods of gene transfer – Biolistics, Lipofection, Electroporation, microinjection – Advantages and disadvantages
Vector mediated gene transfer-Agro bacterium mediated gene transfer – T DNA, Ti plasmid and Ri plasmid derived vector systems
Process of transfer - Bacterial colonization, Induction of virulence, generation of TDNA transfer complex, T-DNA transfer, Integration of TDNA into plant genome

**MODULE III TECHNIQUES AND APPLICATIONS OF BIOTECHNOLOGY**

**TECHNIQUES**

a. Polymerase chain reaction – Principle, types of primers, Taq polymerase, protocol, Application and problems, Reverse Transcriptase PCR and Real Time PCR
b. DNA sequencing – Maxam Gilbert’s method, Sanger’s method, Automated DNA sequencing
c. Molecular Analysis of gene and gene products – Southern, Northern and Western blotting, ELISA, RIA
d. Molecular markers – RAPD, RFLP, AFLP, Brief account of DNA Finger printing and Bar coding of plants
e. Brief account of: Antisense RNA technology – FLAVR SAVR Tomato; Gene Silencing; RNA interference; miRNA.

**APPLIED BIOTECHNOLOGY**

a. Medical Biotechnology: Disease diagnosis – Infectious diseases and genetic diseases; Therapeutics-Antisense oligonucleotides, RNAi as therapeutics; Endogenous therapeutics – Insulin, somatostatin, Interferons, Antibiotics, Vaccines, Biopolymers, Designer drugs, Gene therapy, Stem cells and their relevance
b. Agricultural Biotechnology : Applications of plant tissue culture, Application of transgenic plants Bt cotton, Golden rice; Biosafety concern
c. Environmental Biotechnology: Biodiversity and conservation; Waste management
Industrial Biotechnology - Large scale production of beverages, pharmaceuticals, hormones.

Food biotechnology – SCP, Improved food and food products

Practicals
1. Preparation of plant tissue culture medium
2. Demonstration of the technique of organ culture
3. DNA isolation
4. Restriction mapping – problem
5. Sequence reading – Sanger method/Maxam Gilbert method – problem
6. Demonstration of preparation of synthetic seeds
7. Visit to a leading biotechnology institute – submission of report.

References
3. Dubey RC Introduction to Plant Biotechnology; S Chand & Co
4. Purohit SS (2003) Agricultural Biotechnology, Agrobios (India)

**MODULE- IV  NANOTECHNOLOGY**

a. Introduction, concept, history, scope and significance of nanotechnology, nanomaterials, classification – zero dimension, one dimension, two dimension and special types, physical, chemical and electrical properties of nanomaterials.

b. Synthesis of nanomaterials – Top down and bottom up, its characterization, bionanomaterials and tissue engineering

c. Biological application of nanotechnology – in disease diagnosis, drug delivery, drug targeting and as drug, tissue culture and tissue engineering, biosensors and war field.

**MODULE- V: RESEARCH METHODOLOGY**

1. Introduction; Need for research; Stages of Research – Definition of problem, execution of the problem, interpretation of results

2. Review of Literature

   a. Structure of a scientific library: Books-reference and issues, Journals – current and back volumes, periodicals and other sources; Journals – indexing journals, Abstracting journals, research journals, Reviews; Other sources – internet; Impact factor of journals

   b. Preparation of review – Outline of review, selection of keywords, preparation of index – author index and subject index

3. Preparation of a project proposal: Title and abstract; Aim and scope; Present status; Materials and methodology; Expected outcome; Estimated cost.

4. Preparation of a project report : Data analysis and consolidation of photographs, illustrations, tables and graphs; Preparation of manuscript – Title, introduction, review of literature, materials and methods, results, discussions, summary, references, acknowledgements; Bibliography – Method of citing and arrangement of references.

5. Presentation of findings in seminars and workshops – OHP, Slides, Powerpoint presentation

**Practicals**

1. Preparation of a project proposal
2. Prepare a project report
3. Prepare a list of references
4. Presentation of a small project in the class with the help of OHP or powerpoint presentation.

Reference
**SEMESTER VI**

**MODEL QUESTION PAPER I**

**OPEN COURSE II-CHOICE 1. BIOTECHNOLOGY, NANOTECHNOLOGY & RESEARCH METHODOLOGY**

**Time 3 Hours**

**Total Weightage - 25**

**PART A**

*(Answer all the questions)*

1. Which of the following is an indirect gene transfer method?
   a) Microinjection  
   b) Biolistics  
   c) Lipofection  
   d) Cosmid

2. The denaturation temperature in PCR
   a) 30-40  
   b) 40-50  
   c) 60 - 72  
   d) 90-95

3. The technique used to solve parental dispute is
   a) DNA finger printing  
   b) Western blot  
   c) RIA  
   d) ELISA

4. DNA fingerprinting has been proved useful. It involves
   a) cDNA  
   b) VNTR  
   c) BDNA  
   d) TDNA

5. Genetic diseases can be rectified by
   a) Antibiotics  
   b) Gene therapy  
   c) Vaccines  
   d) Monoclonal antibodies

6. An ocean oil spillage has been cleaned using bacteria. The process is
   a) Biocatalysis  
   b) Bioremediation  
   c) Southern blotting  
   d) Polymerization

7. The sequencing method which employs the use of ddNTPs
   a) Maxam Gilbert method  
   b) Sanger’s method  
   c) Benedict’s method  
   d) None of the above

8. The correct expansion of RFLP
   a) Random Fragment Length Polymorphism  
   b) Restriction Fragment Length Polymorphism
   c) Restriction Fraction Length Polymorphism  
   d) Rapid Fraction Length Polymorphism

9. Key enzyme in PCR
   a) Taq polymerase  
   b) Bam HI  
   c) Restriction endonuclease  
   d) Ligase

10. Nitrogen fixing ability in plants has been enhanced by introducing
    a) nif gene  
    b) cro gene  
    c) cry gene  
    d) lux gene

11. Method employed in the detection of proteins
    a) Northern  
    b) Southern  
    c) Western  
    d) PCR

12. Suppression of gene expression in antisense RNA technology occurs at
    a) DNA level  
    b) RNA level  
    c) Protein level  
    d) None of the above
13. The capacity of a plant cell to differentiate and regenerate to form a complete plant is known as
   a) Organogenesis   b) cytodifferentiation   c) Totipotency   d) somatic embryogenesis

14. Which of the following is not in India?
   a) RGCB       b) CCMB       c) IARI       d) IRRI

15. Among the following which is a macronutrient in MS medium
   a) Calcium nitrate   b) Ammonium molybdate   c) Manganese sulphate   d) Potassium nitrate

16. Osmotic balancer in protoplast isolation
   a) Mannitol   b) Agar Agar   c) Sodium alginate   d) None of the above

17. Which of the following is not an instrument to characterize nanoparticles?
   a) X-Ray Diffraction   b) Spectroscopy   c) Compound light microscopy   d) SEM

18. Nanoparticle, that is used for imaging cancer
   a) CdSe   b) Fullerene   c) C   c) Titanium

19. What is the colour of gold at 50 nm range?
   a) Yellow   b) Orange   c) Dark blue   d) Green

20. How many carbon atoms are there in Buckminster fullerene?
   a) 20   b) 39   c) 60   d) 65

5x1 = 5 weightage

Part B

(Answer any six of the following)

Explain the following:
21. Somaclonal variation
22. Chelating agents
23. T-DNA
24. Totipotency
25. Restriction enzyme linkers
26. RT PCR
27. SSR
28. mRNA

6x1 = 6 weightage

Part C

(Answer any three of the following)
29. What is biostatistics? What are its advantages?
30. What is PCR? Enumerate the steps involved in PCR.
31. How antisense oligonucleotides serve as a therapeutic?
32. What are the properties of nanomaterials?
33. Give the outline of a project report.
34. Explain the structure of a scientific library.  

3x2 = 6 weightage

Part D

(Answer any two of the following)

35. Saccharum and Oryza belong to the family Poaceae. Saccharum is known to tolerate high level of salinity. Consider that the tolerance of Saccharum is determined at genomic level. You want to transfer the trait to Oryza. They are difficult to be hybridize by conventional means. How can you generate an intergeneric hybrid between these two genera?

36. Earlier the insulin was extracted from calf pancreatic tissue and so it was very costly. But now it is cheaply available in the market. Explain the technology involved in it.

37. Explain DNA sequencing. Explain different methods in sequencing.

2 x 4 = 8 weightage
PART A

(Answer all the questions)

1. Enzymes that add nucleotides at the end
   a) Ligase          b) Transferase            c) Phosphatase         d) Helicase

2. Starting point of replication in a plasmid
   a) Ori                b) att                          c) cos

3. Which of the following is present on a Ti plasmid, but not on any component of a binary vector system?
   a) vir genes       b) LB, RB                  c) MCS               d) opine genes

4. Which enzyme is used for specific cleavages of DNA in vitro
   a) RNA exonuclease       b) RNA endonuclease      c) Restriction endonuclease
   d) Ribozymes

5. The gene targeted in the production of Flavr Savr tomato
   a) polygalacturonase       b) Cry 1             c) cry 2           d) reverse transcriptase

6. The quickest way to produce homozygous breeding lines from heterozygous parents is through:
   a) doubled haploids          b) rDNA technology   c) aneuploidy
   d) protoplast fusion

7. Which is the optimum pH range suitable for culturing a plant tissue?
   a) 7-7.5              b) 3.5 – 5.0              c) 5.6 – 5.8             d) 6.5 – 7.0

8. The process by which an organ is regenerated from a callus tissue is
   a) Dedifferentiation       b) Redifferentiation    c) Differentiation
   d) Embryogenesis

9. Cybrids contain
   a) Nuclei of both parents and cytoplasm of one parent
b) Cytoplasm of both parents and nucleus of one parent

c) Cytoplasm and nuclei of both parents

d) Cryopreserved hybrids

10. The US company which has introduced transgenic plants in India for the first time
   a) Monsanto          b) Bangalore Genei      c) Calgene
   d) IndoAmerican hybrid seeds

11. The correct expansion of AFLP is
   a) Amplified Fragment Length Polymorphism
   b) Amplified Fraction Length Polymorphism
   c) Accessory Fragment Length Polymorphism
   d) Augmented Fragment Length Polymorphism

12. Which of the following is most likely to be present in a BAC?
   a) cDNA         b) LB, RB          c) UTR         d) opine genes

13. Among the following, which is a restriction enzyme
   a) EcoRI         b) Bam HI         c) Hind III     d) All of the above

14. The chemical constituent of the seed coat in an artificial seed is
   a. Calcium chloride            b. Calcium alginate
   c. Sodium nitrate                d. Sodium alginate

15. Spinal cord injury can be cured with
   a) Antibiotics           b) Stem cell therapy           c) Polyclonal antibodies          d) Taxol

16. Diagnosis test for HIV
   a) ELISA & chromosomal analysis
   b) ELISA & c banding
   c) ELISA & southern blot
   d) ELISA & Western blot

17. Name an enzyme which is active at 900
   a) Taq polymerase          b) Helicase        c) RNA polymerase    d) DNA polymerase

18. Immunological reaction is the basic principle in
   a) Western blot          b) RIA           c) ELISA          d) All of these

19. GAATTC is the recognition sequence of
a) Eco R I  
b) Eco R V  
c) Hind III  
d) Bam HI

20. GFP stands for

a) Green Flourescent Protein  
b) Gene Finger Printing  
c) Grey Flourescent Protein  
d) Green Flourescent Plants

*5x1 = 5 weightage*

**PART B**

(Answer any six of the following)

21. Synthetic seeds
22. CCMB
23. Reverse transcriptase
24. Lipofection
25. AFLP
26. Designer drugs
27. Nanoparticles. Instruments used to characterize nanoparticles.
28. Name 2 major commercial plant tissue culture firms in India

*6x1 = 6 weightage*

**PART C**

(Answer any three of the following)

29. What are cloning vectors? Explain the structure of pBR322.
30. Differentiate Ti and Ri plasmid.
31. Enumerate the steps involved in RNA interference.
32. What are the biological applications of nanotechnology?
33. Outline the structure of a manuscript for publication.
34. You are asked to submit a project proposal. How will you collect the resources for the same?

*3x2 = 6 weightage*

**PART D**

(Answer any two of the following)

35. What are secondary metabolites? Explain the large scale production of secondary metabolites by tissue culture methods.
36. How biotechnology is useful in solving the problems in Agriculture sector?

37. What are molecular markers? Explain any two molecular marker techniques enumerating its advantages and disadvantages. \(2 \times 4 = 8\) weightage
SEMESTER - VI
OPEN COURSE II - CHOICE 2: GENETICS AND CROP IMPROVEMENT
(Total - 72 hrs., Theory - 36 hrs., Practical - 36 hrs.)

MODULE -1. CROP GENETICS
General account of origin, genetic variability, floral biology, breeding techniques and
achievements in (a) Rice, (b) Coconut (c) Rubber (d) Arecanut (e) Cashew (g) Pepper 10 hrs

MODULE –II.  PLANT GENETIC RESOURCES
(a).Definition; Classification of Plant Genetic Resources
(b).Plant Genetic Resources activities – Exploration, conservation, evaluation,
documentation and utilization. Agencies involved in plant genetic resources activities –
NBPGR and IPGRI
(c). International institutes for crop improvement – IRRI, ICRISAT,CIMMYT,IITA
Brief account on research activities and achievements of national institutes – IARI,
CCMB, IISc, BARC, CPCRI, IISR, RRII, CTCRI, KFRI, TBGRI 8 hrs.

MODULE- III.  METHODS OF CROP IMPROVEMENT
a. Plant introduction
b.Selection - Principles, Selection of segregating populations, achievements
c. Hybridization – Interspecific hybridization; intergeneric – achievements
d. Genetics of - back crossing, Inbreeding, Inbreeding depression, Heterosis and
Heterobeltiosis 4 hrs.

MODULE IV.  GENETICS
(a). Heteroploidy in crop improvement – achievements and future prospects – Significance
of haploids and polyploids
(b). Mutations in crop improvement – achievements and future prospects
(c ). Genetics of nitrogen fixation – Use of biofertilizers in crop improvement
(d). Genetics of photosynthesis 7 hrs.

MODULE- V.  STRESS RESISTANCE
A.Breeding for resistance to abiotic and biotic stresses – Introduction, importance of
abiotic and biotic stresses and its characteristics
(a ). Breeding for drought resistance – Genetics of drought resistance; Breeding
methods and approaches; Difficulties in breeding for drought resistance
(b). Breeding for mineral stress resistance – Introduction – Salt affected soils –
Management of salt affected soils
(i). Salinity resistance – General account – Genetics of salinity resistance – Sources of salinity resistance – Breeding approaches – Problems in breeding for salinity resistance  
(iii). Mineral toxicity resistance – General account - Genetics of mineral toxicity resistance – Sources of mineral toxicity resistance 
Problems in breeding for mineral deficiency/toxicity resistance  

(c). Heat and cold resistance  
Heat stress – General account; Heat stress resistance - Genetics of heat tolerance – Sources of heat tolerance  
Chilling resistance – Chilling tolerance – Genetics of chilling tolerance – Sources of chilling tolerance  
Problems in breeding for freezing tolerance  

15 hrs  

B. Breeding for resistance to biotic stresses  
(i). Disease resistance – History of breeding for disease resistance; Genetics of pathogenicity – Vertical and horizontal resistance; Mechanism of disease resistance; Genetics of disease resistance – Oligogenic, polygenic and cytoplasmic inheritance – Sources of disease resistance – Methods of breeding for disease resistance.  

10 hrs.  

Practicals  

18 hrs.  

1. Identification of major pests and diseases of crop plants by field identification.  
Submission of specimens related to pathology and crop improvement  
2. Visit to a leading breeding station in South India and submission of study report  
3. Demonstration of hybridization in Rice, Cashew and Solanum  
4. Study of variability under induced stress (salinity and moisture) of seedlings of rice and green gram and submission of report  

References  
1. Headquarters of NBPGR is at
2. International rice research Institute is located at
3. A conceptual model plant which is considered as ideal for the given environment is termed as
   a. Holotype  b. Ideotype  c. Phenotype  d. Genotype
4. An individual with one genotype in one part and another in other parts is termed as
   a. Chimera  b. Landrace  c. Mutant  d. Heteroploid
5. The chromosome constitution in a nullisomic is
   a. 2n-1  b. 2n-2  c. 2n+1  d. 2n+2
6. Chromosome doubling can be effected by
7. Raphanobrassica is an example for
8. Gradual loss of variability from germplasm is known as
   a. Inbreeding depression  b. Heterosis  c. Genetic erosion  d. Random drift
9. Sum total of unfavourable genes in an individual is known as
10. Overdominance hypothesis explains
    a. Heterosis  b. mutagenesis  c. hybridization  d. Lethality
11. Mutation in a nucleotide is known as
    a. point mutation  b. chimera  c. genetic erosion  d. chromosome mutation
12. Variations can be of
    a. Somatic  b. Somatogenic  c. Germinal  d. All
13. Genetic causes of variations are
    a. Mutation  b. Change in str. Of chromosome  c. change in chr. Number  d. all
14. Triticale is a hybrid plant of
    a. Wheat and rice  b. Rice and rye  c. Rye and wheat  d. wheat and bajra
15. CPCRI is involved in improvement of
   a. Plantation crops   b. rice   c. Spices   d. tubers
16. IPGRI is at
17. A high yielding rubber variety is
   a. RRI 105   b. RRI 24   c. RRI 95   d. RRI 100
18. Panniyoor 1 is a high yielding variety of
19. Pokkali rice is a
   a. salt tolerant line   b. high yielding   c. drought tolerant line   d. disease resistant
20. Hsps are involved in giving
   a. Stress Tolerance   b. disease resistance   c. high yield   d. increased height

5x1 = 5 weightage

PART B

(Answer any six of the following)

21. PGR
22. Heterobeltiosis
23. ICRISAT
24. Inbreeding depression
25. Haploidy
26. Chloroplast genome
27. Acclimatization
28. Freezing resistance

6x1 = 6 weightage

PART C

(Answer any three of the following)

29. Interspecific hybridization
30. ICAR
32. What are the breeding techniques used in rice?
33. Enumerate the steps involved in Plant Genetic Resources conservation.
34. How polyploidy is made useful in crop improvement?

3x2 = 6 weightage

PART D
35. Give an account of the genetics of disease resistance giving emphasis to sources of disease resistance genes.

36. What are mutagens? How mutations induced by different mutagens are useful in crop improvement?

37. What are Nif genes? How the genotype controls the nitrogen fixation in plants?

\[
2 \times 4 = 8 \text{ weightage}
\]
MODULE I PRINCIPLES OF ANGIOSPERM TAXONOMY
Definition and use of terms – Primitive and Advanced; Homology and Analogy; Parallelism and Convergence; Monophyly and Polyphyly

15 hrs.

MODULE II PLANT NOMENCLATURE
History of nomenclature – Polynomial and binomial systems
Brief outline of ICBN
Effective and valid publication; Rule of priority; Author citation

5 hrs.

MODULE III IDENTIFICATION
Use of floras – National, Regional and local.
Identification using taxonomic keys – Dichotomous keys – Intended and bracketed
Herbarium – Definition, Steps involved in preparation of herbarium – General account of regional and national herbaria with special emphasis to CAL, MH, CALI, TBGT
Botanic gardens and their importance in taxonomic studies – Important National and International Botanic Gardens – Royal Botanic Gardens, Kew; Indian Botanic Gardens, Calcutta; National Botanic Garden, Lucknow; Tropical Botanic Garden, Trivandrum; Malabar Botanic Garden, Calicut

8 hrs.

MODULE IV: SOURCES OF TAXONOMIC EVIDENCES
a. Cytology, Physiology, Biochemistry and biosynthetic pathways as sources of taxonomic characters
b. Other sources of taxonomically useful information – Ecology, Plant geography, co-evolution of parasites and pathogens
c. Comparative study of traditional and biosystematic approaches in plant taxonomy – Traditional and Biosystematic categories

7 hrs.

MODULE V TAXONOMIC REVIEW OF SELECTED FAMILIES
Critical study of the following families with emphasis on identification of local members using flora, economic importance, inter relationships and evolutionary trends

Ranunculaceae, Capparidaceae, Sterculiaceae, Rutaceae, Meliaceae, Combretaceae, Myrtaceae, Lythraceae, Apocynaceae, Scrophulariaceae, Convolvulaceae, Bignoniaceae, Acanthaceae, Verbenaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Urticaceae, Amaryllidaceae, Arecaceae, Araceae, Poaceae

19 hrs.

Practicals

18 hrs.

1. Identification of locally available plants using flora for the families mentioned under module V.
2. Familiarize local flora and study the preparation of taxonomic keys and taxon card for plants coming under the families in module V.
3. Students must critically study minimum 15 members of the plants under the families in module V, make suitable sketches, prepare the taxon card and key to identification of these members and submit as a report for the practical examination
4. Field study report for 5 days which is ecologically different from the locality of the college

References

1. Acronym of Calicut University herbarium  
   a. CAL  
   b. CALI  
   c. MH  
   d. CUH  

2. Father of Taxonomy  
   a. Linneaus  
   b. Theophrastus  
   c. Michael Adanson  
   d. Hutchinson  

3. The beginning of botanical nomenclature  
   a. 1753  
   b. 1869  
   c. 1735  
   d. 1900  

4. Classificatory system of post Darvinian systematics  
   a. Artificial  
   b. Nominalistic  
   c. Natural  
   d. Phylogenetic  

5. Rules of Botanical nomenclature are compiled in  
   a. ICZN  
   b. ICNB  
   c. ICBN  
   d. ZCBN  

6. Most primitive among the following  
   a. Nymphaeaceae  
   b. Ranunculaceae  
   c. Annonaceae  
   d. Malvaceae  

7. Marginal placentation is characteristic of  
   a. Apocynaceae  
   b. Capparidaceae  
   c. Ranunculaceae  
   d. Meliaceae  

8. Which of the following is a biosystematic category  
   a. Species  
   b. Deme  
   c. Ecotype  
   d. OTU  

9. NBG is located at  
   a. Calcutta  
   b. Madras  
   c. Lucknow  
   d. Delhi  

10. Essentialistic philosophy is the contribution of  
    a. Plato  
    b. Aristotle  
    c. Theophrastus  
    d. Pliny  

11. Gynandrophore is present in  
    a. Kleinhofia  
    b. Hibiscus  
    c. Melia  
    d. Ranunculus  

12. Gynobasic style is present in  
    a. Sterculiaceae  
    b. Lamiaceae  
    c. Poaceae  
    d. Amaryllidaceae  

13. TBGRI is in  
    a. Kerala  
    b. Tamilnadu  
    c. Karnataka  
    d. Andhra Pradesh  

14. Prominent bracts and bracteoles are characteristic of  
    a. Scrophulariaceae  
    b. Lamiaceae  
    c. Acanthaceae  
    d. Capparidaceae
15. Divaricate anthers are present in
   a. Lamiaceae  b. Acanthaceae  c. Meliaceae  d. Myrtaceae
16. Obdiplostemony is characteristic of
17. Monadelphy is present in
18. Spiral arrangement of floral whorls is seen in
19. *Azadirachta indica* is in the family
20. Number of carpels in Arecaceae
   a. 1  b. 2  c. 3  d. 4

5x1 = 5 weightage

PART B
(Answer any six of the following)
21. Homology and analogy
22. Author citation
23. Explain the inflorescences of Euphorbiaceae
24. Dichotomous key
25. Parallelism and convergence
26. Nominalism
27. Compare Rutaceae and Meliaceae
28. Poaceae is the most advanced family. Substantiate.

6x1 = 6 weightage

PART C
(Answer any three of the following)
29. Rule of priority
30. Explain how the characters are given the status of primitiveness
31. Compare the floral traits of Myrtaceae, Lythraceae and Combretaceae.
32. Compare effective and valid publication
33. Compare and contrast Acanthaceae, Verbenaceae and Lamiaceae
34. Spikelet variation in Poaceae

3x2 = 6 weightage

PART D
(Answer any two of the following)

35. Give an account of the conceptual basis of pre-darwinian classificatory systems
36. Briefly explain the structure of ICBN
37. Explain the steps involved in the preparation of herbarium

2 x 4 = 8 weightage
1. Methodology of Science
   Construct a histogram/ pie diagram with the date provided 4 weightage

2. Microtechnique
   1. Measure the width of fungal filament/ diameter of pollen/spore using micrometer 2 weightage
   2. Spot at sight – Parts microscope/ camera lucida/ fixative 1 weightage
   Submission 2 Permanent Slides 2 weightage
   (Hand section, maceration/ whole mount/ smear/ squash )

3. Methodology
   Problem - $\chi^2$ or standard deviation 5 weightage

4. Bioinformatics
   Comment on the home pages of NCBI/ EMBL/ GEN Bank
   Or 3D Model picture of any protein 2 weightage

5. Microbiology
   a) Gram staining (+ve and negative) preparation 3 weightage
      Procedure 2 weightage
      Identification 1 weightage
   b) Spot at sight (Two)
      Growth curve/ inoculation loop/ cavity slides 2 weightage

6. Phycology
   a. Identification of two microscopic algae studied from an algal mixture
      Preparation $\frac{1}{2}$
Identification
Diagram
Reason
b. Spot at sight (Two) 2 weigtage
c. Submission of 5 Algal herbarium 2 weigtage

7. Methodology
Determination of pH of a given solution
Procedure 2 weigtage
Demonstration 2 weigtage

8. Mycology and Lichenology
a. Sectioning of any one of the following
Albugo/ Peziza/ Puccinia/ Cercospora
Preparation 2 weigtage
Diagram 1 mark
Identification ½
Reason ½
b. Write critical notes on any two Fungal specimen 2 x 2=4weigtage

9. Plant Pathology
Write critical notes on any two pathological specimens 1 x 2=2 weigtage
Submission 2 weigtage

MODEL QUESTION PAPER 2009
Time 3 hrs
Max Weigtage 50+5

PRACTICAL PAPER II
(Bryology, Pteridology, Gymnosperm, Paleobotany, Environmental Biology, Phytography, Plant Physiology, metabolism and Biochemistry)
1. Make suitable micropreparations to bring out the structure of A, B and C. Draw ground plan and label the parts. Identity giving reasons. Leave the preparation for valuation.
   (Preparation 1) Dia - 1, ident ½, reasons 1 ½)  
   (3x5=15weightage)

2. Identify giving important features of D. Draw labelled diagram
   (ident-1, Dia - 1, Features - 1)  
   (1x3=3weightage)

3. Separate chromatographically the different chloroplast pigments of the given extract E. Write the procedure Determine the optimum pH of the enzyme E.
   (1x6=6weightage)

4. Determine the pH of the given soil solution using pH meter or
   Calculation of density, frequency and abundance of species from the given data F
   OR
   Determination of Dissolved oxygen of the given water sample F by Winkler's method
   (Proce- 1 mark, Determination/calculation : 3 month)  
   (1x4=4weightage)

5. Demonstrate the physiology expt  
   (1x5=5weightage)

6. Analyse Qualitatively and Identity the given sample H
   (analysis - 4, Identification-1)  
   (1x5=5weightage)

7. Construct food web from the given data I  
   (1x2=2weightage)

8. Locate two phytogeographical zones in the map J provided
   OR
   Locate two vegetational types in the map J provided  
   (1x2=2weightage)

9. Identify the instrument K and mention its use
   (Ident1-, Use -1)  
   (1x2=2weightage)

10. Identity the ecological group and adaptation of L.
    (Identification - ½, adaptations, 1½)  
    (1x2=2weightage)

11. Spot at sight M, N, O, P.  
    (1x4=4weightage)

   **Scheme of Specimens**

   A, B + C - Fresh or well preserved materials each from Brophyta, Pteridophyta and Gymnosperms.

   D - Fossil slide

   E - Chloroplast pigment extract using paper / The method.

   F - Determination of pH/calculation of density, frequency and abundance/Determination of Dissolved Oxygen.

   G - Material for vegetative propagation

   H - Biochemistry (glucose, Fructose, Maltose, Lactose, starch, egg white, tyrosine, Tryptophan, Phenyl alanine)

   I - Data may be given from a small ecosystem such as pond or grassland.
      species may be limited

   J - Outline map of India

   K - Physiology apparatus (Any one of the following)
Willmott's bubbler, TLC spreader
Gonong's poto meter, Water balance, Clinostat.

L – Ecological group

M.N.O.P, Material or slide from Bryophyta, Pteridophyta and Gymnosperm (representing all groups)
1. Take a T.S. of a specimen A. Stain and mount in glycerine. Draw a ground plan and a labelled diagram of a portion enlarged. Identity giving reasons. Leave the preparation for valuation.
   Preparation - 2
   Identification - ½
   Diagram - 1½
   Reason
   Total 5 weightage

2. Prepare an acetocarmine squash preparation of the material B
   Preparation - 2
   Identification - ½
   Diagram - 1
   Total 3½ x 2 = 7 weightage

3. Describe C in technical term and derive up to the respective family.
   Family - ½
   Taxa up to spp. - 1½
   Description - 3
   Total 5 weightage

4. Analyse the morphological features of D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub>, D<sub>4</sub>, D<sub>5</sub>, D<sub>6</sub>. Construct a dichotomous key. 5 weightage ½ each for each step

5. Take a V.S. of flower E. Draw its labelled diagram. Construct the floral diagram and write the floral formula.
   L.S. flower - ½
   Diagram - 1
   Fl. diagram - 1
   Fl. formula - ½
   Total 3 weightage

6. Identity and bring out the embryological features of specimen F. Draw labelled diagram.
   Identification - ½
   Diagram - 1
   Features - ½
   Total 2 weightage

7. Determine the viability of specimen G. Write down the procedure leave the preparation for valuation
   Procedure - 1
   Preparation - 2
   Total 3 weightage

8. Demonstrate the emasculation and hybridization in specimen H.
   Emasculation - 1
   Hybridization - 1
   Baggenyl labelling - 1
   Total 3 weightage

9. Give the binomial and morphology of useful part of I<sub>1</sub> & I<sub>2</sub>
   Binomial - ½ x 2 = 1
Morphology
of useful part - ½ x 2 = 1

Total - 2 weigtage

10. Write the notes of morphological interest on J₁ & J₂ (1x2 = 2 weigtage)

11. Work out genetics problem K and L
   K - 4 (In complete dihybrid modified ratio)
   L - 5 weigtage (Chromosome mapping – 3 point cross)

Total - 9 weigtage

12. Spot at sight materials
   M, N, O, Q, R, S

   1x7=7 weigtage

   Practical Submissions

   1 Record 5 weigtage
   Herbarium 5 weigtage
   Tour Report 1 mark
   Field note 1 mark

   10 Morphology specimens 1 mark
   10 Economic Botany specimens 1 mark

Scheme for Practical Question Paper III

(A) Anatomy:-
   Dicot Root aerial - Ficus, Tinospora
   Monocot Root - Rheo, Colacasia
   Dicot Stern - Centella
   Normal & Bicollateral- Cephalandra (Primary)
   Monocot stern - Grass, Asparagus, Bamboo
   Anomalous Secondary Growth - Boerhaavia, Bignonia
   (Amaranthus, Piper)
   Monocot stern - Dracaena

(B) Onion Root Tip

(C) Plants from Annonaceae, Malvaceae, Rutaceae, Papilionaceae, Myrtaceae,
   Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae,
   Euphorbiaceae.

(D) Specimens from families mentioned in the syllabus.

(E) Flower with flower buds of the following specimens. Annona, Cananga, Hibiscus,
   Crotalaria, Clitoria, Glyricidia, Hamelia, Ixora, Allamanda, Thevetia, Nerium,
   Vinca, Tabernaeontana, Datura, Thunbergia, Salvia, Leucas.

(F) Specimens from Embryology.
   Young and Mature Anther T.S,
   Ovules :- Dicot: Young and mature Monocot embryo
   Seed - Dicot & monocot seed L.S.

(G) Pollen Grains:- Any three types –
Datura, Hibiscus, Cucurbita, Balsum, Crotalaria.

(H) Hybridization: - Crotalaria, Glyricidia, Anacardium, Solanum.

(I) One Economic Botany material submitted by the student

(I2) Any Economic Botany material mentioned in the syllabus supplied by the Examiner.

(J) One Morphology specimen submitted by the student.

(J2) Any Morphology specimen mentioned in the syllabus supplied by the Examiner.

(K) Genetics Problem :- Incomplete/Dihbrid/Modified Ratio

(L) Chromosome Mapping – 3 point cross.

Spot at sight Specimens

M Anatomy M - Tissue or Vascular Bundles

N - Cell inclusions

O Cytology O - Stages of meiosis –

P - Campus Plants

Q - Herbarium plants

MODEL QUESTION PAPER 2009
OPEN COURSE II- PRACTICAL
Biotechnology and Research Methodology

Time -1½ Hrs. 20 weightage, Record – 5 weightage

1. Isolate DNA from the given Sample A
   Procedure – 4
   Isolation - 6 10 weightage

2. Work out the given problem B. DNA Fragments generated by using 3 restriction enzymes in a plasmid are given below. Construct the map 5 weightage

3. Read the sequence from the given data C 3 weightage
4. Identify the specimens D & E
   Pictures/graphs/parts/equipments/chemicals from biotechnology and nanobiotechnology)

   \[
   2 \times 1 = 2 \text{ weigtage}
   \]
1. Determine the pH of given sample A. Write procedure. 4 weigtage
   pH determination : 2
   Procedure : 2

2. Measure the width of the filament B using micrometer. 3 weigtage

3. Calculate standard deviation of given data C.
   OR
   Test of hypothesis 9:3:3:1 using chi-square test. 5 weigtage

4. Prepare single stained permanent slide of material D. 2 weigtage

5. Write critical notes on E. (parts of microscope). 1 mark
SEMESTER-IV
Core Course IV  Microbiology, Phycology, Mycology & Lichenology and Plant Pathology

Internal Practical Examination

Time: 1 hr   Maximum : 15 weightage
Record : 5  
Attendance : 2
Viva : 3
Total : 25 weightage

1. Microbiology – Gram staining Positive & Negative 5 weightage
2. Phycology – Identification of 2 algae from algal mixture 3 weightage
3. Identification, giving reasons (Algae) 2 weightage
4. Mycology & Lichenology – Sectioning fungal specimen 3 weightage
   Critical notes – Lichen 1 weightage
5. Plant pathology – submission 5 herbarium specimens 1 weightage
   Identification of one pathology specimen 1 weightage
1. Take a V.S. of flower A. Draw its labelled diagram. Construct the floral diagram and give the floral formula. Leave the preparation for valuation.
   Preparation ½  
   V.S. Diagram 1  
   Floral Diagram 1  
   Floral formula ½ 3 weigtage

2. Take a T.S. of specimen B. Stain and mount in glycerine, draw a labelled diagram of a portion enlarged, identify giving reasons. Leave the preparation for valuation.
   Preparation 3  
   Diagram 2  
   Identification 1  
   Reason 1 7 weigtage

3. Identify and bring out the embryological features of C.
   Identification 1  
   Features 1 2 weigtage

4. Determine the viability of the pollen grain 'D'. Write down the procedure, find out the viability percentage. Leave the preparation for valuation.
   Preparation 1  
   Procedure 1  
   Viability percentage 1 3 weigtage
1. Make micropreparation of A, B and C to bring out the structure of A, B and C. Make diagrammatic sketch and label the parts. Identify giving reasons. Leave the preparation for valuation.
   (Preparation – 1; diagram – ½ ; identification – ½ ; Reasons – 1)
   (3x3 = 9 weightage)

2. Identify D giving important features. Draw a labelled diagram.
   (Identification – ½ ; Diagram – ½ ; Features – 1)
   (1 x 2 = 2 weightage)

   (½ x 8 = 4 weightage)
V Semester
Core Course VII : Taxonomy & Economic Botany
Internal Practical Examination

Time: 1 Hr.                   Maximum : 15 weigtage
Record : 5
Attendance : 2
Viva : 3
Total : 25 weigtage

1. Describe 'A' in technical terms and derive upto the respective family.
   Family ½
   Derivation of taxa upto family : 1 ½
   Description 3
   5 weigtage

2. Analyse the morphological features of B₁ B₂ B₃ B₄ B₅ B₆. Construct a
dichotomous key.
   3 weigtage (½ for each step)

3. Give the binomial and morphology of useful part of C₁ and C₂.
   Binomial (½ + ½) 2 = 2
   Morphology of useful part (½ + ½) 2 = 2
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   Total 4 weigtage
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4. Spot at sight materials, D E F & G 1 x 4 = 4 weigtage

Practical Submissions
Record 5
Herbarium 2
Ten no. of morphology specimens 1
Ten no. of economic botany specimens 1
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Total 9 weigtage
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Scheme for Practicals

1.A. Plants from Annonaceae, Malvaceae, Rutaceae, Papilionaceae, Myrtaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae and Euphorbiaceae.

2.B. Specimens from families mentioned in the Syllabus. One set of six plants from different families.

3.C. Two economic botany materials, one from submission and one from specimen mentioned in the syllabus.

4. Spot at right specimens.
   D, E – Campus plants.
   F, G – Herbarium plants.
SEMESTER VI
Core Course VIII - Environmental Science / Phytogeography / Horticulture
Internal Practical Examination

Time: 1 Hr.  Maximum : 15 weightage

Record : 5
Attendance : 2
Viva : 3
Total : 25 weightage

I. Construct food web from the given data.  3 weightage

II. Determination of dissolved oxygen from the given water sample.

   OR

   Determination of pH of the given soil solution.

   OR

   Calculation of density, frequency, abundance of species from the given sample.  6 weightage

III. Demonstration of T budding / Approach grafting / Air layering.  5 weightage

IV. Location of two phytogeographical zones in the map provided.  1 mark
1. Determine the pH optimum of given enzyme.
2. Estimate colorimetrically the quantity of reducing sugars in the given sample by 3,5-dinitrosalicylic acid method.
3. Estimate colorimetrically the quantity of protein in the given sample by biuret method.
4. Separate chromatographically the different chloroplast pigments of the given sample.
5. Determine the water potential of the given tissue by weight change method (Any one of the above experiments by lot method) 7 weigtage.

II. By conducting appropriate tests identify the presence of any two compounds given below.

III. Identify the instrument and mention its use.
1. Wilmot’s bubbler
2. Water balance apparatus
3. TLC spreader.
4. Ganong’s photometer.
5. Klinostat.
1. Prepare an acetocarmine squash preparation of A (onion root tip). 4 weightage
2. Identify the meiotic stage B. 1 mark
3. Work out the given genetics problems C and D. 5 + 3 = 8 weightage
4. Demonstrate the hybridization technique of the given specimen E 2 weightage
1. Demonstrate 'T' budding / plate budding with suitable diagrams and procedure.
   Demonstration – 5; Procedure – 3; Diagram – 1 (9 weigtage)

2. Demonstrate Grafting / Layering. Give procedure with suitable diagram.
   Demonstration – 5; Procedure – 3; Diagram 1 (9 weigtage)

3. Identify the implements A and B. Give its uses.
   Identification – 1; Uses – 1 (2x2 = 4 weigtage)

4. Identify the disease in C and name the pathogen.
   Disease -1, Pathogen 1 (2 weigtage)

5. Mention the method of preparation and uses of material D (3+3) (6 weigtage)

   30 weigtage
   Record 10 weigtage
   Submission 5 weigtage
   (Seeds / Produces of any ten plants)
   Field trip 10 weigtage

   55 weigtage
1. Isolate DNA from the given Sample A
   Procedure – 3
   Isolation - 5
   **8 weigtage**

2. Work out the given problem B. DNA Fragments generated by using 3 restriction enzymes in a plasmid are given below. Construct the map
   **4 weigtage**

3. Read the sequence from the given data C
   **2 weigtage**

4. Identify the specimens D & E
   **2 x ½ = 1 mark**
   (D,E- Pictures/graphs/parts/equipments/chemicals from biotechnology and nanobiotechnology)