



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 2012 admission onwards – approved – implemented - Orders issued.

UNIVERSITY OF CALICUT (G & A - IV - J)

U.O.No. 1439/2013/CU

Dated, Calicut University.P.O, 02.05.2013

*Read:-*1. U.O. No. GA/J2/3601/08 (Vol. II) dated 19.06.2009.

2. U.O.No: GA I/J1/5125/07 Dtd 25/06/09

3. U.O.No: GA I/J1/5125/07 Dtd 21.08.2009.

4. Item No:1 to 28 of the minutes of the meeting of Board of Studies in Botany held on 6/11/12.

5. Letter No: 4887/ID/Zoo/2012-13 dtd 01/02/2013.

6. Order of the Vice Chancellor in the file of even number on 20/03/2013

ORDER

As per paper read as (1) above, 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.

As per paper read as (2) above, the Scheme and Syllabus of B.Sc Programme in Botany under Choice based Credit Semester System has been implemented w.e.f 2009 admission onwards.

As per paper read as (3) above, modified syllabus of B.Sc Programme in Botany has been implemented.

As per paper read as (4) above, the Board of studies has revised the syllabus w.e.f 2012 admission onwards, and also clarified that the modifications has not been made in the 1st and 2nd semester of the syllabus and therefore will not effect the ongoing semesters of 2012 admission.

As per paper read as (5) above, the Dean, Faculty of Science has recommended to approve the syllabus.

The Vice-Chancellor, in view of the exigency, exercising the powers of Academic Council has approved the minutes subject to ratification by academic Council as per reference cited 6th.

Sanction has therefore been accorded to implement the revised scheme and syllabus of B.Sc programme in Botany under Choice based Credit Semester System in the University with effect from 2012 admission onwards.

Orders are issued accordingly. The Scheme and Syllabus appended.

Moideen Kutty C.E
Deputy Registrar

To

The Chairman, BOS in Botany
Parikshabhavan Ex1-SO
JCE-1, ES XII-SO, DR BSc, GAIF
Digital wing(to upload in the Website)
Principal Affiliated College

Forwarded / By Order

Section Officer

University of Calicut

RESTRUCTURED 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 assesment 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 Credit Semester System(CCSS)
- iii. Open course (freedom for students to choose one open course during Vth Semester) i.e., each department offers one open course for other stream students of the same institution.
- iv. Each department offers one elective course for their main stream students during VI Semester
- v. Duration of 1 semester = 18 weeks (i.e., 18 x 5 = 90 days)

Total contact hrs: $90 \times 5 = 450$

1 Programme = 30 courses

1 course = 4 hrs. /week = 1 full paper = 4 credits

i.e., 1 Programme = $30 \times 4 = 120$ 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 course

For Other streams 1 course x 4 credits = Total 4 credits
5. Core elective

Only for Main stream students during Semester VI

1 course x 4 credits = Total 4 credits

Total 120 credits

- | | | | | |
|----|------------------------|----|---|------------|
| 1. | Common course | 10 | = | 40 credits |
| 2. | Core course | 10 | = | 28 credits |
| 3. | Core course Practicals | 3 | = | 20 credits |
| 4. | Complementary I | 4 | = | 12 credits |
| 5. | Complementary II | 4 | = | 12 credits |
| 6. | Open course | 1 | = | 4 credits |

7.	Core elective	1	=	2 credits
8.	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 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

Grade	Grade points	Grade Point Average Range
A	4	3.5 to 4
B	3	2.5 to 3.49
C	2	1.5 to 2.49
D	1	0.5 to 1.49
E	0	Less than 0.5

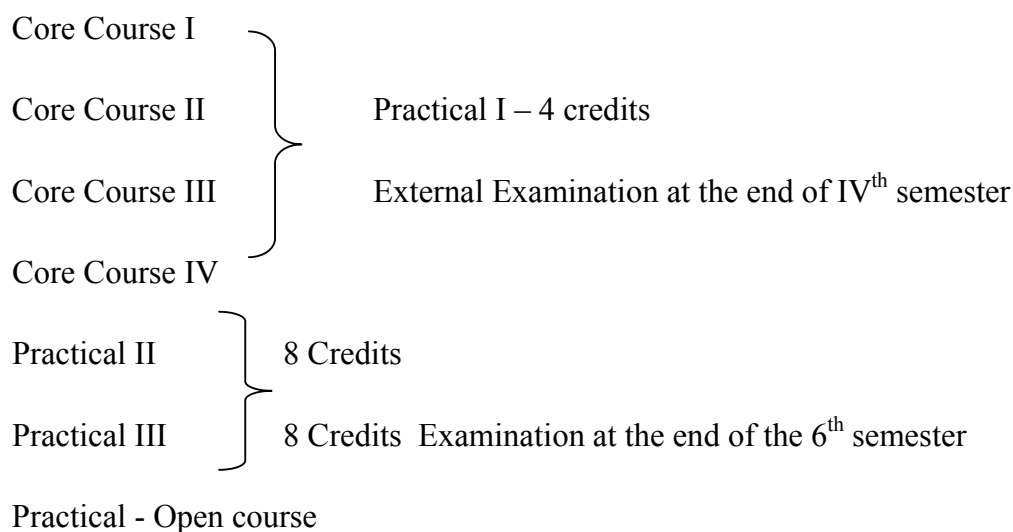
Details of Core Course in B.Sc. Botany Programme

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. Practical corresponding to each course will be conducted during the respective semesters.



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

Sl. No.	Parameter	% of Internal Assessment	Weightage
(a)	Attendance	5%	1
(b)	Class tests (2 Nos.)	10%	2
(c)	Seminar	5%	1
(d)	Assignment	5%	1
Total		25%	5

(a) Attendance

90% and above	5%	A Grade
80% to 89%	4%	B Grade
75% to 79%	3%	C Grade

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.

<u>Nature of Answer</u>	<u>Grade</u>	<u>Grade point</u>
Excellent	A	4
Very good	B	3
Good	C	2
Average	D	1
Poor	E	0

(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

Sl. No.	Parameter	% of Internal Assessment	Weightage
(a)	Attendance	5%	1
(b)	Punctuality, Performance, etc.	5%	1
(c)	Practical test	5%	1
(d)	Record	10	2
	Total	25%	5

(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:** One practical test must be conducted for a practical course during a semester, that form 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.

(C) Study Tour/Field Study

1. Students are expected to undertake a study tour of **not less than 7 days** for learning vegetation under the guidance of teachers of the departments in the 5th semester. They are also expected to visit atleast one research institution. They should prepare a tour report and submit it for the practical examination along with the Herbarium and filed notes. The report should be certified by HOD.
2. Students shall submit minimum 15 properly identified herbarium specimens in herbarium sheets of standard size and format (cultivars and ornaments should be excluded).

(D) Project work & Viva voce

3. **In addition to the practicals, the students will have to undertake a project work during sixth semester. Each student should submit a copy of the project report duly signed by the supervising teacher and certified by the Head of the Department.** All students have to appear for a viva-voce based on project in one separate session during practical examination.

Internal Assessment Grade – Theory: Weightage = 5

Criteria	Grade	Grade Point	Weightage	Weighted Grade Point
Attendance			1	
Class test (1)			1	
(2)			1	
Seminar			1	
Assignment			1	
Total			5	

Internal Assessment Grade – Practical: Weightage = 5

Criteria	Grade	Grade Point	Weightage	Weighted Grade Point
Attendance			1	
Punctuality, Performance, etc.			1	
Practical test (1)			1	
Record			2	
Total			5	

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

<u>Item</u>	<u>Weightage</u>
Project	3
Study tour	1
Viva Voce	1
	—
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.

Internal Assessment Grade: Project / Study tour / Viva-Voce

Crtieria	Grade	Grade Point	Weightage	Weighted Grade Point
Project			3	
Study tour			1	
Viva-Voce			1	
Total			5	

UNIVERSITY OF CALICUT
B.Sc. PROGRAMME IN BOTANY
Course structure, Work load and Credit distribution

Semester	Paper Code	Title of Paper	Hours/ Semester	Hours/ Week	Credit
S- I	BO1B 01	CORE COURSE I. METHODOLOGY AND PERSPECTIVES OF SCIENCE	36 hrs	2	2
	BO1B 01 (P)	CORE COURSE. PRACTICAL -I	36 hrs	2	
	BO1C 01	2 nd COMPLEMENTARY COURSE (Angiosperm Anatomy, Micro technique)	36 hrs	2	2
	BO1C 01 (P1)	COMPLEMENTARY COURSE PRACTICAL - I	36 hrs	2	
S -II	BO2B 02	CORE COURSE II. MICROTECHNIQUE AND HORTICULTURE	36 hrs	2	2
	BO2B 02 (P)	CORE COURSE. PRACTICAL -II	36 hrs	2	
	BO2C 02	2 nd COMPLEMENTARY COURSE (Plant Physiology & Ecology)	36 hrs	2	2
	BO2C 02 (P2)	COMPLEMENTARY COURSE PRACTICAL - II	36 hrs	2	
S-III	BO3B 03	CORE COURSE III. GENERAL AND BIOINFOMATICS	54 hrs	3	3
	BO3B 03 (P)	CORE COURSE. PRACTICAL -III	36 hrs	2	
	BO3 C 03	2 ND COMPLEMENTARY COURSE (Cryptogams, Gymnosperms, Plant Pathology & Genetics)	54 hrs	3	2
S-IV	BO4B 04	CORE COURSE IV MICROBIOLOGY, MYCOLOGY, PHYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY	54 hrs	3	3
	BO4B 04 (P)	CORE COURSE. PRACTICAL -IV	36 hrs	2	
	BO4B 04 (P 1- 4)	PRACTICAL PAPER - I - EXTERNAL			4

Semester	Paper Code	Title of Paper	Hours/ Semester	Hours/ Week	Credit
	BO4C 04	2 ND COMPLEMENTARY COURSE (Morphology, Systematic Botany, Economic Botany, Pharmacognosy, Plant Breeding & Horticulture)	54 hrs	3	2
	BO4C 04 (P)	COMPLEMENTARY COURSE PRACTICAL IV - EXTERNAL	36 HRS	2	4
S-V	BO5B 05	CORE COURSE V ANGIOSPERM MORPHOLOGY, PLANT ANATOMY, REPRODUCTIVE BOTANY & PALYNOLOGY	90 hrs	5	3
	BO5B 05 (P)	CORE COURSE. PRACTICAL -V	36 hrs	2	
	BO5B 06	CORE COURSE VI BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS & PALAEOBOTANY	90hrs	5	3
	BO5B 06 (P)	CORE COURSE. PRACTICAL -VI	36 hrs	2	
	BO5B 07	CORE COURSE VII SYSTEMATIC BOTANY, ECONOMIC BOTANY & ETHNO BOTANY	72 hrs	4	3
	BO5B 07 (P)	CORE COURSE. PRACTICAL VII	54 hrs	3	
	BO5D 01	OPEN COURSE I - CHOICE I HORTICULTURE AND NURSERY MANAGEMENT (For other Streams) Open course practical	36 hrs(Theory) 18 hrs(Practical)	2 1	4
	BO5D 02	OPEN COURSE I - CHOICE II BIOFERTILIZER TECHNOLOGY AND ORGANIC FARMING (For other Streams) Open course practical	36 hrs(Theory) 18hrs(Practical)	2 1	4
	BO5D 03	OPEN COURSE I - CHOICE III PLANT TISSUE CULTURE (For other Streams) Open course practical	36 hrs(Theory) 18 hrs(Practical)	2 1	4
		Field study / Study Tour	18	1	-
S - VI	BO6B 08	CORE COURSE VIII ENVIRONMENTAL SCIENCE,	90 hrs	5	3

Semester	Paper Code	Title of Paper	Hours/ Semester	Hours/ Week	Credit
		PHYTOGEOGRAPHY AND EVOLUTION			
	BO6B 08 (P)	CORE COURSE. PRACTICAL VIII	36 hrs	2	
	BO6B 09	CORE COURSE IX PLANT PHYSIOLOGY, METABOLISM & BIOCHEMISTRY	90 hrs	5	3
	BO6B09 (P)	CORE COURSE. PRACTICAL IX	36 hrs	2	
	BO6B10	CORE COURSE X CELL BIOLOGY GENETICS AND PLANTBREEDING	90 hrs	5	3
	BO6B10 (P)	CORE COURSE. PRACTICAL X	36 hrs	2	
	BO6B11(E01)	CORE COURSE ELECTIVE - CHOICE I BIOTECHNOLOGY & RESEARCH METHODOLOGY (for Main Stream)	36 hrs	2	2
	BO6B11EE(P)	CORE COURSE ELECTIVE. PRACTICAL II	18hrs	1	
	BO6B11(E02)	CORE COURSE ELECTIVE - CHOICE II GENETICS AND CROP IMPROVEMENT (for Main Stream)	36 hrs	2	2
	BOTB11(EP)	CORE COURSE ELECTIVE. PRACTICAL II	18 hrs	1	
	BO6B11(E03)	CORE COURSE ELECTIVE - CHOICE III ADVANCES IN FLOWERING PLANT SYSTEMATICS (for Main Stream)	36 hrs	2	2
	BO6BB11E(P)	CORE COURSE ELECTIVE. PRACTICAL II	18 hrs	1	
	BO6B12(Pr)	Project Work	18 hrs(Practicals)	1	4
	BO6B13(P)	PRACTICAL PAPER II - EXTERNAL			8
	BO6B14(P)	PRACTICAL PAPER III - EXTERNAL			8

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. Representation 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:-Laws of probability. Addition theorem and Multiplication theorem.

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)
3. Measurement of pH using pH meter.
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:

1. P.G. Hewitt, J.A. Suchocki ISBN-10 0805 390385, Conceptual integrated science ISBN-139780805390384.
2. R.G. Newton – The truth of science, Viva Books, New Delhi, II Edition.
3. N. Gurumani 2006. Research Methodology for Biological Sciences, MJP Publishers, Nallathampi Street, Triplicane, Chennai-600 005.
4. Keith Wilson and John Walker (2008). Principles and techniques of Biochemistry and Molecular Biology. Cambridge University Press.
5. Hoppe, W. (edt). 1983. Biophysics. Springer Verlag.
6. Rogers, A.W. 1969. Techniques of Autoradiography. Elsevier Pub. Company.
7. Roy, R.N. 1996. A Text book of Biophysics. New Central Book Agency Pvt. Ltd., Calcutta.
8. Sasidharan, A. 1984. Selected Topics of Biophysics. Frontier Area Publishers.
9. Slayter. E.M. 1970. Optical methods in Biology. Wiley Intersciences.
10. Wong. C.H. 1965. Radiation Tracer Methodology in Biophysical Sciences. Prentice Hall.
11. Jasra. P.K. and Raj Gurdeep 2000. Biostatistics. Khan, I.A. and Khayum.
12. Fundamentals of Biostatistics. Wraaz Publ. Hyderabad. Norman, T.J. Bailey. Statistical methods in Biology Cambridge Univ. Press.
13. Prasad, S. 2003. Elements of Biostatistics. Rastogi Publ.
14. Ramakrishnan, P. Biostatistics, Saras Publishers.
15. Rastogi, V.B. Fundamentals of Biostatistics, Ane Book India.
16. Gregory N. Derry (1999) What is science and how it works. Prentice Hall University press.
17. R.L. Webes (1973) A random walk in science. IOP Publishing.
18. Thomas S. Kuhn (1970) The structure of scientific revolution.
19. Mark V. Selverman :-A Universe of atoms, An atom in the universe

SEMESTER I

MODEL QUESTION PAPER I

CORE COURSE- I : METHODOLOGY AND PERSPECTIVES OF SCIENCE

Time 3 Hours

Total Weightage -25

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) C¹⁴
 - 2) O¹⁸
 - 3) I¹³¹
 - 4) N¹⁵
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) sensible 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

(Answer any six of the following)

21. Write short note on Electrophoresis
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

(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. 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 and 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 x 4= 8 weightage

SEMESTER II
CORE COURSE- II: MICROTECHNIQUE AND HORTICULTURE

Total – 72 Hrs. Theory – 36 Hrs., Practicals- 36 Hrs.

Distribution of Hours	Theory	Practicals
1) Microtechnique	15	12
2) Horticulture	21	24
Total	36	36
		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 **(6 hrs.)**

MODULE- II: 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) **(3 hrs.)**

MODULE – III: Histological techniques

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

Dehydration and infiltration – general account of dehydration (Ethanol, Isopropyl alcohol, Acetone, Glycerine). Ethanol – Xylene series and Tertiary Butyl Alcohol Series.

Infiltration – paraffin wax method, Embedding.

Staining – General account, Classification: natural dyes, coal tar dyes. Histochemical Staining, Vital staining

Mounting: Whole mount, maceration and smears (6 hrs.)

Practicals (12 hrs.)

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

References

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

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.
4. Pots & potting:- Earthen, Fibre, Polythene bags, Potting mixture, Potting, Repotting, Top dressing.
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 tounge)
 - (c) Budding (T-budding, patch)
 - (d) Layering (simple trench, air).
3. Micropropagation:- General account, multiple shooting, somatic embryogenesis, Advantages **(7 hrs.)**
4. Gardening:- Definition; Site selection, Propagating structure: Green house, Poly house, Moist chamber, Net frame – Garden tools and implements.
 - (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.
5. Protection of Horticultural plants:- Principles, Precautions to avoid pests and diseases. Methods of pest control: Cultural, Biological, Chemical, Mechanical, Physical and Legislative. Major pests of horticulture plants, Pest management, Diseases and disease management, Pesticides – types and preparation.
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.
9. Cultivation of mushroom.
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

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

Subjectwise Distribution of Questions

Microtechnique - 35%

Horticulture - 65%

Type of questions	Weightage		
	Microtechnique	Horticulture	
Multiple choice	8	12	5x1=5
Short Answer	3	5	6x1=6
Short Essay	2	4	3x2=6
Essay		2	2x4=8

SEMESTER II

MODEL QUESTION PAPER I

CORE COURSE II-MICROTECHNIQUE & HORTICULTURE

Time 3 Hours

Total Weightage -25

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) GA₃
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 apruning tool
1) Trowel 2) Hose 3) Rake 4) Shears
8. Brancch of Horticulture that deals with the production of vegetables
1) Floriculture 2) Pomology 3) Olericulture 4) Arboriculture
9. Aplant 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
- 1) Peziza 2) Pleurotus 3) Toad stool 4) None of these
13. 60-65% coarse 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) Formation – 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 x 1 = 6 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 x 2= 6 weightage**

Part D

(Answer any two of the following)

- 35. Define vegetative propagation. Explain the different methods in vegetative propagation with examples.
- 36. Explain the principle and advantages of phase contrast microscopy over Transmission Electron Microscopy.
- 37. Describe the methods of irrigation **2 x 4= 8 weightage**

SEMESTER-III

CORE COURSE III. GENERAL AND BIOINFORMATICS

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

Distribution of Hours	Theory	Practicals
1) General Informatics	36	18
2) Bioinformatics	18	18
Total	54	36

GENERAL INFORMATICS (Theory 36 hrs.)

MODULE-1: 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)
3. Computer hardware – input, output and memory devices.
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. Social net work sites, orkut, facebook, myspace etc. emerging trends, benefits, potential for misuse and hazards.
2. Cyber ethics, security, cyber crimes, cyber laws, privacy issues, cyber addiction, information overload.
3. Health issues: guidelines for proper usage of computers and internet.
4. e-wastes and green computing.

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.

6. Application of Bioinformatics.

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 (Enterz

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 Rathswohl, Computer Confluence, Pearson Education,
7. Barbara Wilson, Information Technology: The Basis, Thomson Learning
8. John Ray, 10 Minute Guide to Linux, PHI, ISBN 81-203-1549-9

9. Ramesh Bangia, Learning Computer Fundamentals, Khanna Book Publishers
10. Baxevanis AD & Ouellette BFF (2001) Bioinformatics - A practical guide to the analysis of genes and proteins, Wiley Interscience , New York.
11. Dov Stekel (2005) Microarray Bioinformatics; Cambridge university press.
12. Attwood DJ and Arry Smith Introduction to Bioinformatics; Pearson education
13. Sundararajan S & Balaji R - Introduction to Bioinformatics; Himalaya publishing House.
14. David W. Mount (2004) Bioinformatics – sequence and Genome analysis; CBS Publishers and Distributers.
15. Ignacimuthu S(2005) Basic Bioinformatics; Narosa Publishing House.
16. Lesk AM(2005) Introduction to Bioinformatics: Oxford University Press.
17. Gautham N (2006) Bioinformatics databases and algorithms; Narosa Publication house.
18. Rastogi SC, Namita Mendiratta and Rastogi P (2003) Bioinformatics, Concepts, Skill and Application; CBS publishers and distributes

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
8. <http://computer.howstuffworks.com>

9. <http://vmoc.museophile.org> Computer History
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
15. [http://ezinearticles.com/? Understanding-The-Operation-Of-Mobile-Phone-Networks & id=68259](http://ezinearticles.com/?Understanding-The-Operation-Of-Mobile-Phone-Networks-&id=68259)
16. <http://www.studentworkzone.com/question.php?ID=139>
17. <http://www.scribd.com/doc/259538/all-about-mobile-phones>
18. <http://www.studentworkzone.com/question.php?ID=96>
19. [http:// www.oftc.usyd.edu.au/edweb/revolution/history/mobile2.html](http://www.oftc.usyd.edu.au/edweb/revolution/history/mobile2.html)

SEMESTER- III
CORE COURSE III. GENERAL AND BIOINFORMATICS MODEL
QUESTION PAPER

I. Objective questions - answer all

1. INFLIBNET is used in
 - a. Business sector
 - b. Banks
 - c. Library
 - d. Weather forecast
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
 - 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
 - a. Google
 - b. Yahoo
 - c. Rediff
 - d. Mozilla firefox
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. BLAST
 - b. 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. Histidine 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
 a. Amino acid b. Sugar c. Nucleotides d. Nucleosides
17. WEEE is
 a. Wired Electrical and Electronic Equipment b. Waste Electrical and Electronic Equipment
 c. Wired Electrochemical and Electronic Equipment
 d. Waste Electro chemical and Electronic Equipment
18. Program used to label green computing
 a. Energy star b. Energy bar c. Energy Premium d. Energy Basic
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 any one 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.

Distribution of Hours	Theory	Practicals
1) Microbiology	12	9
2) Mycology & Lichenology	12	9
3) Phycology	18	9
4) Plant Pathology	12	9
Total	54	36

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 bacteriophages and TMV. Brief account of retroviruses, HIV, Viroids, Prions.
4. Soil microbiology:- Rhizosphere, Nitrogen fixation symbiotic and nonsymbiotic Phyllosphere.
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

1. Dubay R.C. & D.K. Maheswari 2000. A Textbook of Microbiology, Chand & Co, New Delhi.
2. Frazier W.C. 1998. Food Microbiology, Prentice Hall of India, Pvt. Ltd.
3. Kumar H.D. & S. Kumar. 1998. Modern Concepts of Microbiology Tata McGraw Hill, Delhi.
4. Pelzar M.J., E.C.S. Chan & N.R. Kreig. 1986. Microbiology McGraw Hill, New York.
5. Rangaswami, R & C.K.J. Paniker. 1998. Textbook of Microbiology, Orient Longman.
6. Ross, F.C. 1983. Introductory Microbiology. Charles E. Merrill Publishing Company.
7. Sharma P.D., 2004. Microbiology and Plant Pathology Rastogi Publication.

MODULE – II: Mycology & Lichenology

(Theory-12 Hrs.)

1. Introduction – General characters and phylogeny
2. A general outline on classification – Ainsworth and Bisby (1983)
3. Myxomycetes – a general account
4. Mastigomycota : General characteristics, occurrence, reproduction, and life cycle – Type: Pythium,
5. Zygomycota: General characters, occurrence, reproduction, and life cycle – Type: Mucor
6. Ascomycota: General characters, occurrence, reproduction and life cycle – Type: Peziza.
7. Basidiomycota: General characters, occurrence, reproduction and lifecycle -Types: Puccinia, Agaricus
8. Deuteromycota: General characters, occurrence reproduction and life cycle- Type: Cercospora.
9. Economic importance of fungi: Medicinal, industrial, Agricultural, Food, Genetic Studies and fungal toxins.

Practicals

(9 hrs.)

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

References

1. Alexopoulos C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology, 4th Edn. John Wiley and Sons, New York.
2. Alexopoulos, C.J. and Mims C.W. 1979. Introductory Mycology, 3rd Edition, John Wiley and Sons, New York.

3. Mehrotra R.S. and Aneja K.R. 1990. An Introduction to Mycology, Wiley, Eastern Limited, New Delhi..

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, cephal

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, Bioremediation, 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 forms of Lichen

References

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

<http://www.lichen.com>

<http://www.newscientistspace.com>

MODULE – III: Phycology

Theory-18 Hrs.

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.
3. Cyanophyceae : General Characters, occurrence, thallus structure, reproduction and economic importance. Type - Nostoc
4. Chlorophyceae : General characteristics, occurrence, thallus structure, cell structure, flagella, reproduction, interrelationships. Types -*Chlamydomonas*, *Volvox*, *Spirogyra*, *Oedogonium*, *Chara*.
5. Xanthophyceae : General characteristics, occurrence, range of thallus structure, reproduction, interrelationships. Type- *Vaucheria*.
6. Bacillariophyceae (Diatoms) General characteristics, occurrence, thallus structure, cell structure, cell division, sexual reproduction, auxospores, classification, interrelationships. Type -*Pinnularia*.
7. Phaeophyceae : General characteristics, occurrence, range of thallus structure, anatomy, cell structure, flagella, reproduction, alternation of generations, interrelationships. Type - *Sargassum*.

8. 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, eutrophication, neurotoxins, parasitic algae.

Practicals

(9 Hrs.)

1. Identification of one Alga from Algal mixture (Microscopic algae) including *Volvox*, *Oedogonium*, *Spirogyra*, *Vaucheria* and *Polysiphonia*.
2. Identify the vegetative and reproductive structures of the types studied.

References

1. Anand, N. 1989. Culturing and cultivation of BGA. Handbook of Blue Green Algae Bishen Sing Mahendra Pal Sing.
2. Fritsch, F.E. 1935. The structure and reproduction of the algae. Vol. 1 and II, Uni. Press. Cambridge.
3. Kanika Sharma 2007. Manual of Microbiology. Tools and Techniques 2nd Edition. Ane Books India. (pp. 376-377. Composition of media used for algal culture.
4. Mamatha Rao. 2009. Microbes and Non flowering plants: impact and application. Ane Books Pvt. Ltd., New Delhi.
5. Morris, I. 1967. An Introduction to the algae. Hutchinson and Co. London.
6. Papenfuss, G.F. 1955. Classification of Algae.

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.)
1. Citrus Canker 2. Mahali disease of Arecanut, 3. Blast of Paddy, 4. Grey leaf spot of coconut, 5. Mosaic disease of Tapioca, 6. Bunchytop of Banana, 7. Quick wilt of pepper, 8. Rhizome rot of ginger, 9. Coffee rust, 10. Abnormal leaf fall of rubber, 11. Root wilt of coconut, 12. 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

- Agros, G.N. 1997. Plant Pathology (4th ed) Academic Press.
- Bilgrami K.H. & H.C. Dube. 1976. A textbook of Modern Plant Pathology. International Book Distributing Co. Lucknow.
- Mehrotra, R.S. 1980. Plant Pathology – TMH, New Delhi.
- Pandey, B.P. 1999. Plant Pathology. Pathogen and Plant diseases. Chand & Co. New Delhi.

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

Sharma P.D. 2004. Plant Pathology Rastogi Publishers.

Subjectwise Distribution of Questions

Microbiology	- 32%
Phycology	- 32%
Mycology & Lichenology	- 26%
Plant Pathology	- 10%

Type of questions	No. of Questions				Weightage
	Microbiology	Phycology	Mycology & Lichenology	Plant Pathology	
Multiple choice	4	8	4	4	5x1=5
Short Answer	3	2	2	1	6x1=6
Short Essay	2	2	1	1	3x2=6
Essay	1	1	1	-	2x4=8
Total Weightage					25

SEMESTER IV
MODEL QUESTION PAPER I
CORE COURSE- IV: MICROBIOLOGY, MYCOLOGY, PHYCOLOGY,
LICHENOLOGY AND PLANT PATHOLOGY

Time 3 Hours

Total Weightage 25

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.
1. Which algae are almost exclusively marine
a) brown algae b) blue green algae c) desmids d) green algae.
2. Lichen grown on the trees are called
a) saxicoles b) corticoles c) lithophytes d) psammophytes.
3. Red rust of tea is caused by
a) Fungus b) virus c) algae d) mycoplasma
4. Male sex organ in Chara
a) antheridium b) spermatium c) nucule d) globule
5. Cyanophyceae is separated from alga because it is
a) eukaryotic b) unicellular c) prokaryotic d) filamentous
6. Floridean Starch is the energy reservoir of
a) Chlorophyta b) Xanthophyta c) Phaeophyta d) Rhodophyta.
7. Apothecium is the fruit body
a) Ascomycota b) Basidiomycota c) Phycomycota d) Zygomycota
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) Pertussis, 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. Damping off disease is caused by
a) Stemmonitis b) Peziza c) Puccinia d) Pythium
14. Type of thallus in Volvox is
a) Heterotrichous b) filamentous c) colonial d) siphonous.
15. Auxospores are produced from
a) Volvox b) Diatoms c) Chara d) Oedogonium
16. A virus that may not destroy the host

- a) Virulent phage b) Temperature phage c) Cyanophage d) Lysogenic phage
17. A retro virus
a) HIV b) TMV c) T2 Phage d) None of the above
18. Which microorganism produces the gum Dextran
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. Archaeobacteria and its significance
21. Define Plaque
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**

SEMESTER IV
MODEL QUESTION PAPER II
CORE COURSE IV - MICROBIOLOGY, MYCOLOGY, PHYCOLOGY,
LICHENOLOGY AND PLANT PATHOLOGY

Time 3 Hours

Total Weightage -25

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) ϕ x 174 b) Small pox virus c) T₂-bacteriophag d) Polyoma virus
3. Citrus canker 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. Sporing is related to
a) Mushroom cultivation b) Sporulation in Ascomycota c) Sporulation of Agaricus
d) Sporulation in Mucor
8. Fruticose Lichens come under the growth form
a) Powdery b) Scaly c) Foliose d) Branched
9. Orcein is obtained from
a) Parmelia b) Usnea c) Rochella d) Cladonia
10. Creutzfeldt-Jakob disease is caused by
a) Prion b) Virion c) Virus d) Bacteria
11. A neurotoxin produced from fungus
a) Amylopectin b) Aflatoxin c) Chitin d) Pectin
12. Blast of paddy is caused by
a) Xanthomonas b) Rhizoctonia c) Pythium d) Pyricularia
13. Sexual reproduction is not observed in
a) Ascomycota b) Phycomycota 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
(2n) $\xrightarrow{\text{meiosis}}$ gamete (n) $\xrightarrow{\text{fertilization}}$ zygote (2n)
a) Volvox b) Oedogonium c) Sargassum d) Spirogyra
16. Mannitol and Laminarin 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

5x1 = 5 weightage

Part B

(Answer any six of the following)

21. Define arbus
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.

6 x 1 = 6 weightage

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

3x2=6 weightage

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

2x4=8weightage

SEMESTER V
CORE COURSE V - ANGIOSPERM MORPHOLOGY, PLANT ANATOMY
REPRODUCTIVE BOTANY & PALYNOLOGY

Total – 126 Hrs. Theory – 90 Hrs., Practicals- 36 Hrs.

Distribution of Hours	Theory	Practicals
1) Angiosperm morphology	18	9
2) Plant Anatomy	54	18
3) Reproductive Botany & Palynology	18	9
Total	90	36

MODULE- I: Angiosperm Morphology

Theory 18 –Hrs.

- I Morphological description of a flowering plant- Plant Habit **1 hr.**
 - A. Root: Types - Tap root, fibrous root; Modifications - Definition with examples - Storage, aerial, pneumatophores, buttress **1½ hrs.**
 - B. Stem: Habit - Acaulescent, Caulescent, Cespitose Prostrate, Repent, Decumbent, Arborescent, Suffrutescent (Definition with examples only); Modification - Underground, Aerial, Subaerial with examples **3 hrs.**
 - 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. **2½ hrs.**
- II Inflorescence: racemose, cymose and specialised (cyathium, hypanthodium, coenanthium verticillaster, thyrsus) **3½ hrs.**
- 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. **3½ hrs.**
- IV Fruits - Types, classification with examples; Seed structure - dicot and monocot - albuminous and exalbuminous, aril, caruncle; Dispersal of fruits and seeds - types and adaptations. **3 hrs.**

Practicals

9 Hours

1. Students have to identify the types mentioned in the syllabus and should draw the diagrams 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

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

Module – II: Plant Anatomy

Theory -54 Hrs.

1. Introduction: Brief history and significance **1 hr.**
2. Plant cell- Structure, types with regard to size and shape
 - A. Cell wall - Primary - Wall layers. Secondary - Thickening, Pits - simple, bordered, half bordered - Plasmodesmata, their structure and function.

Fine structure - Orientation of micellae, sub-micellae, microfibrils & cellulosic chains. **3 hrs.**
 - B. Growth of cell wall - Apposition, Intussusception
 - C. Extra cell wall materials - lignin, cutin, suberin, callose, wax.
 - D. Cell wall properties. **2 hr.**
3. Non-living inclusions with special emphasis on economic importance:-
 - a. Reserve food materials - carbohydrates, proteins, fats & oils
 - i. Carbohydrates - sugars & starch

Starch grains -structure, different types with examples

- ii. Proteins - Aleurone grains with examples
 - iii. Fats & oils examples. **2 hrs.**
 - b. Secretory materials **1 hr.**
 - c. Waste materials - Nitrogenous – alkaloids, Non-nitrogenous - glucosides, gums, resins, tannins
 - Mineral crystals - Calcium oxallate - prismatic, Drusses raphides
 - Calcium carbonate - cystoliths with examples **2½ hrs.**
- 4. Tissues :- Definition -Types
 - a. Meristematic tissues - classification.
 - 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 **6 hrs.**
 - b. Mature tissues- definition classification- simple complex and secretory
 - i. Simple tissues – parenchyma, collenchyma, sclerenchyma, - fibres and sclereids- structure occurrence and function. **4 hrs.**
 - ii. Complex tissues - Definition - Xylem & Phloem structure, origin and function
 - Phylogeny, tracheary elements & Sieve elements **3 hrs.**
 - iii. Secretory tissues - glands, glandular hairs, nectaries, hydathodes, schizogenous and lysigenous ducts, resin ducts, mucilage ducts, laticifers - articulated and non-articulated - with examples. **3½ 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)
- Monocot Root (Colocasia, Musa)
- 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 (Metcalfe & Chalk) **7½hrs.**
- 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**
- VII 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

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

MODULE – IV: Reproductive Botany**Theory -11 Hrs.**

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 embryo sac, 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 Monocot embryo - Sagittaria (structure only)
1½ hrs.
7. Apomixis- definition and kinds; Polyembryony - causes, types and significance
1½ hrs.
8. Germination of seed - Epigeal and Hypogeal type
9. Experimental Embryology: *In vitro* culture of embryo, anther, pollen, ovary and ovule (Brief description only)
10. Role of embryology in Taxonomy
2½ hrs.

Practicals

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

References

1. Bhojwani S & S.P. Bhatnagar 198. The Embryology of Angiosperms. Vikas Publishing House (P) Ltd.
2. Davis C.L. 1965. Systematic Embryology of Angiosperms. John Wiley, New York.
3. Eames M.S 1960. Morphology of Angiosperms Mc Graw Hill New York.
4. Johri BD 1984 (ed.) Embryology of Angiosperms Springer - Verlag, Berlin.
5. Maheswari P. 1985. Introduction to Embryology of Angiosperms - Mac Graw Hill, New York.
6. Sharam & Aswathi: Embryology of Angiosperms.

MODULE – V: - Palynology

Theory -7 Hrs.

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

1. Erdtman G 1952. Pollen Morphology and plant Taxonomy Part I. Almquist & Wicksell Stockholm
2. Erdtman G 1969. Hand Book of Palynology. National Botanical Gardens Publication, Lucknow.
3. Nair PKK 1970. Pollen Morphology of Angiosperms Vikas Publishing House, Delhi.
4. Saxena M.R. Palynology –A treatise-Oxford, I.B.H. New Delhi
5. Shivanna, K.R. & N.S. Rangaswami, 1993. Pollen Biolgy Narosa Publishing House - Delhi.

6. Shivanna & Johri. The Angiosperm Pollen.

Subjectwise Distribution of Questions

Morphology - 20%

Plant Anatomy - 47%

Reproductive Botany & Palynology - 33%

Type of questions	No. of Questions			Weightage
	Morphology	Anatomy	Rep. Bot. & Palynology	
Multiple choice	4	8	8	5x1=5
Short Answer	2	3	3	6x1=6
Short Essay	2	2	2	3x2=6
Essay	1	1	1	2x4=8
Total Weightage				25

SEMESTER - V

MODEL QUESTION PAPER - I

**CORE COURSE V - ANGIOSPERM MORPHOLOGY, PLANT ANATOMY,
REPRDOUCTIVE BOTANY & PALYNOLOGY**

Time 3 Hours

Total Weightage-25

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) Moncot 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) Piper c) Amaranthus d) Bignonia
20. Polyembryony occur in
a) Pinus b) Ficusc) 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. Give 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 x 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. Give an account on experimental embryology
37. Write an essay on root-stem transition with suitable diagrams.

2x4 = 8 weightage

SEMESTER V

MODEL QUESTION PAPER - II

**CORE COURSE V. ANGIOSPERM MORPHOLOGY, PLANT ANATOMY,
REPRODUCTIVE BOTANY & PALYNOLGY**

Time 3 Hours

Total Weightage - 25

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 pollengrains 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) Anatropous 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) Inflorescence
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) Schmidt d) Schuepp
11. Chrysanthemum is an example for

- a) Stolon b) Runner c) Sucker d) Offset
12. Calcium carbonate crystals are found as
a) Raphides b) Druses c) Cystolith d) Styloids
13. Monothealous 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 embryo sac is present in
a) Polygonum b) Adoxa c) Allium d) Oenothera
19. Placentation found in Hibiscus
a) Basal b) Marginal c) Axile d) Parietal
20. Root cap is derived from
a) Dermatogen b) Phellogen c) Calyptragen 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.
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.

3x2 = 6 weightage

Part D

(Answer any two of the following)

35. With suitable labelled diagrams, describe the ultra structure of cell wall.
36. Give an account of micropropagation with the help of labelled diagrams.
37. Describe the normal secondary growth in dicot root with suitable diagrams.

2 x 4 = 8 weightage

SEMESTER - V
CORE COURSE VI - BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS &
PALAEOBOTANY

Total – 126 Hrs. Theory – 90 Hrs., Practicals- 36 Hrs.

Distribution of Hours	Theory	Practicals
1) Bryology	18	9
2) Pteridology	36	18
3) Gymnosperms	18	18
4) Palaeobotany	18	9
Total	90	36

MODULE – 1; Bryology

Theory-18 Hrs

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 = 12hrs.

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

1. Campbell H.D, 1940, The Evolution of land plants (Embryophyta), Univ. Press, Stanford.
2. Chopra R.N. and P.K. Kumar, 1988, Biology of Bryophytes. Wiley Eastern Ltd. New Delhi.
3. Gangulee Das and Dutta., College Botany Vol.1, Central Book Dept. Calcutta.
4. Parihar, N.S. An Introduction to Bryophyta Central Book Depot, Allhabad, 1965.
5. Shaw.J.A. and Goffinet B., 2000, Bryophyte Biology, Cambridge University Press.
6. Smith G.M. 1938, Cryptogamic Botany Vol.II. Bryophytes and pteridophytes. Mc Graw Hill Book Company, London.
7. Sporne K.R.,1967, The Morphology of Bryophytes. Hutchinson University Library, London.
8. Vasishta B.R. Bryophyta. S. Chand and Co. New Delhi.
9. Watson E.V. 1971, The structure and life of Bryophytes. Hutchinson University Library, London.
10. Gangulee, H.C. and Kar A.K. College Botany Vol.II, New Central Book Agency, Calcutta.

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; Stellar 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

1. Bower, F.O. 1935, Primitive Land Plants – Cambridge, London.
2. Chandra S. & Srivastava M., 2003, Pteridology in New Millenium, Khuwer Academic Publishers.
3. Eames, A.J. 1979, Morphology of Vascular Plants, lower group. Wiley International edition, New Delhi.
4. Parihar, N.S. 1977, Biology and Morphology of Pteridophytes, Central Book Depot, Allhabad.
5. Pichi Sermolli, R.E.G. 1977, A tentative classification of Pteridophyte genera. Webbia 31 (2): 313-512.
6. Rashid, A. 1976, An Introduction to Pteridopyta, Vikas publ. Co. New Delhi.
7. Smith G.M. 1938, Cryptogamic Botany Vol. .II. Bryophytes and Pteridophytes. McGraw Hill Book Company, London.
8. Sporne, K.R. 1967, Morphology of Pteridophytes – Hutchi University Library, London.
9. Sreevastava, H.N. A text book of Pteridophyta.
10. Vasishta B.R. 1993, Pteridophyta – S. Chand and Co., New Delhi

MODULE – IV: Gymnosperms

Theory-18 hrs.

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

9 hrs.

1. Cycas- Cycas seedling, coralloid root, T.S. of coralloid root, T.S. of leaflet, petiole, male cone and L.S. of male cone , microsporophyll, megasporophyll, T.S. of microsporophyll, ovule, L.S. of ovule and seed. **6 hrs.**
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**
3. Gnetum- Habit, stem T.S., leaf T.S., male and female cones, L.S. of ovule, seed. **6 hrs.**

References

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

MODULE-V: Palaeobotany

Theory-18 Hrs.

1. Introduction and objectives **1 hr.**
2. Fossil formation and types of fossils **2 hr.**
3. Geological time scale- sequence of plants in geological time **2 hr.**
4. Fossil Pteridophytes-Rhynia, Lepidodendron, Lepidocarpon, Calamites **5 hrs**
5. Fossil gymnosperms- Williamsonia **2 hr.**
6. Importance of Birbal Sahni Institute (brief) **1 hr.**
7. Brief mention of fossil deposits in India **1 hr.**
8. Indian Palaeobotanists **2 hr.**
9. Applied aspects of Palaeobotany- Exploration of fossil fuels **2 hr.**

Practicals

9 hrs.

Fossil Pteridophytes-Rhynia stem, Lepidodendron, Lepidocarpon and Calamites
Fossil gymnosperms- Williamsonia

References

- Andrews H.N. 1961, Studies in Paleobotany. John Wiley and Sons Inc., New York..
- Arnold C.A., 1947, Introduction to paleobotany, Tata McGraw Hill, New Delhi.
- Shukla, A.C. & S.P. Misra, 1975, Essential of Palaeobotany, Vikas Publishing House, Pvt. Ltd., Delhi.
- Sreevastava H.N., 1998, Palaeobotany, Pradeep Publishing Company, Jalandhan.
- Sewart, W.N., 1983, Palaeobotany and the Evolution of Plants. Cambridge Uni. Press, London.
- Taylor, T.N. Paleobotany. An Introduction to Fossil Plant Biology. Mc Graw Hill, New York.
- Steward A.C., 1935, Fossil Plants Vol. I to IV.
- Watson J. An introduction to study of fossil plants. Adams and Charles Black Ltd. London.

Subjectwise Distribution of Questions

Bryology	- 25%
Pteridology	- 35%
Gymnosperms	- 30%
Palaeobotany	- 10%

Type of questions	No. of Questions				Weightage
	Bryology	Pteridology	Gymnosperms	Palaeobotany	
Multiple choice	4	8	4	4	5x1=5
Short Answer	2	3	2	1	6x1=6
Short Essay	1	2	2	1	3x2=6
Essay	1	1	1	-	2x4=8
Total Weightage					25

SEMESTER -V

MODEL QUESTION PAPER I

**CORE COURSE –VI: BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS &
PALAEOBOTANY**

Time 3 Hours

Total Weightage - 25

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. Psudoelaters 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 is regulated by
a) annulus b) calyptra c) peristomial teeth d) operculum
8. Famous Indian Palaeontologist
a) M.O.P. Iyengar b) P.C. Vasishta c) 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) phyllosum b) dendron c) xylon d) carbon

5x1 = 5 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 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 stellar 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

3x2 = 6 weightage

Part D

(Answer any two of the following)

35. With the help of 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.

2 x 4 = 8 weightage

SEMESTER - V
MODEL QUESTION PAPER - II
CORE COURSE – VI: BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS &
PALAEOBOTANY

Time 3 Hours

Total Weightage - 25

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) waterd) air
3. Sporophyte of Riccia is protected by
a) indusium b) calyptra c) endothecium d) amphithecium
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) episore 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) Lepidodendrom
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) heterothallic
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

5x1 = 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

6x1 = 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

SEMESTER - V
CORE COURSE - VII: ANGIOSPERM SYSTEMATICS, ECONOMIC BOTANY
AND ETHNOBOTANY

Total - 126 hrs., Theory - 72 hrs, Practicals - 54 hrs.

Distribution of Hours	Theory	Practicals
1) Angiosperm Taxonomy	54	45
2) Economic Botany	9	9
3) Ethno Botany	9	-
Total	72	54

MODULE-I: **16 hrs.**

1. Introduction, objectives and importance of systematics **2 hrs.**
2. Systems of classification – Artificial – Linnaeus; Natural – Bentham and Hooker; Phylogenetic – Engler and Prantl. Angiosperm Phylogeny Group system – introduction only. (Detailed study of Bentham and Hooker's system only).
Diagnostic features of families studied in practical classes *viz.*
Annonaceae, Malvaceae, Rutaceae, Leguminosae, Myrtaceae, Cucurbitaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Orchidaceae, Liliaceae, Poaceae.

14 hrs.

MODULE – II: **17 hrs.**

3. Taxonomic structure – Hierarchy; Concepts of taxa; Species – Biological, Phenetic and Phylogenetic; Genus; Family. **5 hrs.**
4. 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. **5 hrs.**

5. History of taxonomy in India – Contributions of eminent Taxonomists *viz* Hendrich van Rheed, William Roxburg, Robert White, S. Gamble. **7 hrs.**

MODULE – III: 21 hrs.

6. 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.**
7. Plant identification – Keys- construction and applications. **7 hrs.**
8. 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 45 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 by using the field study hour allotted during V semester 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 atleast one research station and should submit a duly certified study tour report along with herbarium sheets and field notes for external evaluation.

References

- Forman, L. & D. Bridson. 1989. The herbarium Hand Book. Royal Botanic Gardens, Kew
- Sivarajan, V.V. 1991. Introduction to Principles of Plant Taxonomy. Oxford & IBH, New Delhi.
- Sporne, K.R. 1974. Morphology of Angiosperms. Hutchinson University Press London.
- Radford, A.E. 1986. Fundamentals of plant systematics. Harper & Row Publishers, New York.
- NaiK, V.N. Taxonomy of Angiosperms. TATA McGraw Hill, New Delhi
- Burkill, I.H. 1965. Chapters on the History of Botany in India, Delhi.
- Gurucharan Singh, 2001. Plant systematics - Theory and Practice. Oxford & IBH, New Delhi.
- Davis, P.H. & V.H. Heywood, 1963. Principles of Angiosperm Taxonomy. Oliver & Boyd Ltd., London.
- Henry, A.N. & Chandrabose An aid to International Code of Botanic Nomenclature.
- Jeffrey, C. 1968. An introduction to Plant Taxonomy, London.
- Simpson, M.G. 2006. Plant Systematics. Elsevier Academic Press, London
- Stressy, T.F. 1990. Plant Taxonomy – The systematic evaluation of Comparative data. Columbia University Press, New York.
- Sharma, B.D. *et al.* (Eds.) Flora of India vol. I. Botanical Survey of India, Calcutta.
- Pandey, S.N. & S.P. Misra. 2008. Taxonomy of Angiosperms. Ane Books India, New Delhi.
- Sharma, O.P. 1996. Plant Taxonomy. TATA McGraw Hill, New Delhi

MODULE – IV: Economic Botany

9 hrs.

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

4. Fruits – Apple, Pine Apple, Pappaya, Banana, Mango, Guava, Jack, Grapes, Sapota, Pomegranate, Mangosteen.
5. Vegetables – Root – Carrot, Beet Root, Tapioca; Stem – Corm, Potato.
6. Fruits – Cucurbits- Bitter gourd, Cucumber, Snake gourd, Ridge gourd; Laies finger; Leaves – Cabbage, Amaranthus, Moringa, Boerhaavia.
7. Ornamentals – Rose, Anthurium, Jasmine.
8. Masticatories – Betel vine, Betel nut, Tobacco.
9. Beverages – Coffee, Tea, Cocoa.
10. Fibre – Coir, Cotton, Jute.
11. Timber – Teak, Rose wood, Jack, Ailanthus.
12. Fats and oils – Coconut, Gingelly, mustard, Sun flower, Oil palm.
13. Latex – Rubber
14. Gums and Resins – Dammer, Gum Arabic, Asafoetida
15. Spices – Pepper, Ginger, Cardamom, Turmeric, Clove, Mace, Allspice, Cinnamon
16. Medicinal – Adhatoda, Boerhaavia, Catheranthus, Eclipta, Phyllanthus, Rauvolfia, Aloe, Trichopus, Aristolochia, Terminalia, Long pepper.
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
20. Fuel – Jatropha.

Practicals

9 hrs.

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.

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

Varma, V. 2009. Text Book of Economic Botany. Ane Books India, New Delhi.

MODULE – V: Ethnobotany

9 hrs.

1. Introduction, scope and significance
2. Major tribes of South India
3. Ethnobotanic significance of the following:

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

References

Jain. S. K. 1981. Glimpses of Indian Economic Botany. Oxford

Baker. H.g. 1970. Plant and Civilization.

Jain. S. K. 1995. A Manual of Ethnobotany. Scientific Publishers , Jodhpur.

Cotton, C.M. 1996. Ethnobotany – Principles AND Applications. Wiley and Sons.

Subjectwise Distribution of Questions

Angiosperm Taxonomy - 71%

Economic Botany - 20%

Ethnobotany - 9%

Type of questions	No. of Questions			Weightage
	Angiosperam Taxonomy	Economic Botany	Ethnobotany	
Multiple choice	12	8	-	5x1=5
Short Answer	5	2	1	6x1=6
Short Essay	3	2	1	3x2=6
Essay	3	-	-	2x4=8
Total Weightage				25

SEMESTER - V
MODEL QUESTION PAPER I
CORE COURSE – VII: ANGIOSPERM SYSTEMATICS, ECONOMIC BOTANY
& ETHNOBOTANY

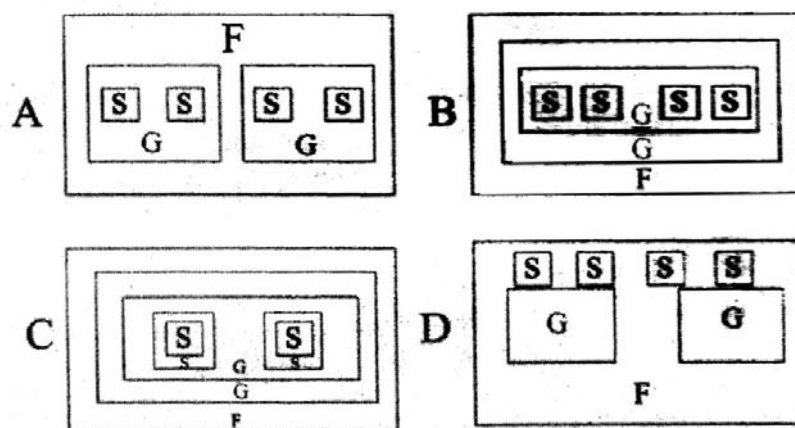
Time 3 Hours

Total Weightage - 25

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
a. Apiaceae b. Apocynaceae c. Rutaceae d. Labiatae
7. The abbreviation of OIU 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
 - a. Flora
 - b. Monograph
 - c. Plant press
 - d. Data base
12. Tropicos is -----
 - a. Data base
 - b. Plant
 - c. Herbarium forest
 - d. Synonym of tropical rain.
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
 - a. Beet root
 - b. Sugar cane
 - c. Dates
 - d. Sugar beet
19. Name of a tribe in South India
 - a. Bhel
 - b. Yadava
 - c. Naga
 - d. Parava
20. An ethnobotacnical plant

- | | |
|-------------------|----------------------------|
| a. Aegle marmelos | b. Artocarpus 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.
28. Define ethnobotany.

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 Asafoetida.
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 concepts 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

SEMESTER - V
MODEL QUESTION PAPER II
CORE COURSE – VII: ANGIOSPERM SYSTEMATICS, ECONOMIC BOTANY
& ETHNOBOTANY

Time 3 Hours

Total Weightage - 25

PART A

(Answer all the questions)

1. Binomial nomenclature introduced by
a. Hooker b. Linnaeus c. Aristotle d. Engler
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 Vanrheed
a. Flora of presidency b. genera plantarum of Madras
c. Hortus indicus malabaricus d. Species plantarum
5. Ruminant 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
c. Phylum – order – class – family – genus – species
d. Class – phylum – 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 coccinea
 - c. Datura Stramonium d. Nerium odoratum
10. In Asteraceae androecium is
- a. Monadelphous b. Synandrous
 - c. Polyadelphous 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. Pisum 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. Pisum 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. Artocarpus

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?
37. What is taxon? What the different hierarchical ranks of taxa are as accepted in ICBN?

2 x 4 = 8 weightage

SEMESTER - V

**OPEN COURSE - I: CHOICE I: HORTICULTURE AND NURSERY
MANAGEMENT**

Total - 54 hrs., Theory - 36 hrs, Practicals - 18 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.
6. Irrigation – Surface, spray, drip irrigation, sprinklers.
7. Shade regulation.

MODULE – II.

10 hrs.

1. Plant propagation – Introduction, principles, concept and significance – Role of propagation in human history.
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.

12 hrs.

1. Nursery management- Definition, concept and principle.
2. Site selection, propagating structure – green house, poly house, moist chamber, net frame.
3. Gardening – Definition – Garden tools and implements.
 - (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

18 hrs

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.
6. Laying out drip irrigation, sprinklers.
7. Topiary and pruning.
8. Preparation of vermicompost.
9. Cultivation of mushroom.
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.

References

- Nishi Sinha: Gardening in India, Abhinav Publications, New Delhi.
- Andiance and Brison. 1971. Propagation Horticultural Plants.
- Rekha Sarin. The Art of Flower Arrangement, UBS Publishers, New Delhi.
- Katyal, S.C., Vegetable growing in India, Oxford, New York.
- Naik, K.C., South Indian Fruits and their Culture.
- Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India.
- Premchand, Agriculture and Forest Pest and their Management, Oxford Publication.
- George Acquaah, Horticulture: Principles and Practices. Pearson Education, Delhi.
- Prasad, S., and U. Kumar. Green house Management for Horticultural Crops, Agrobios, Jodhpur.
- Kumar, U.: Methods in Plant Tissue Culture. Agrobios (India), Jodhpur.
- Kolay, A.K. Basic Concepts of Soil Science. New Age International Publishers, Delhi.
- Bal, J.S., Fruit growing, Kalyani Publishers, Delhi.
- Rodgran, M.K. Plant Tissue Culture, Oxford & IBH Publishing Ltd., New 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.
- Hudson, T. Hartmann, Dale K. Kester, Fred T. Davies, Robert L. Geneve, Plant Propagation, Principles and Practices.

Subjectwise Distribution of Questions

Type of questions	No. of Questions	Weightage
	Horticulture and Nursery Management	
Multiple choice	20	5x1=5
Short Answer	8	6x1=6
Short Essay	6	3x2=6
Essay	3	2x4=8
Total Weightage		25

SEMESTER V
MODEL QUESTION PAPER I
OPEN COURSE I CHOICE I. HORTICULTURE & NURSERY MANAGEMENT

Time 3 Hours

Total Weightage - 25

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 delated 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
- (c) It is cheap (d) It is easy to apply.
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.
25. Give two methods of sterilization.
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

SEMESTER V
MODEL QUESTION PAPER II
OPEN COURSE- I: CHOICE I. HORTICULTURE & NURSERY MANAGEMENT

Time 3 Hours

Total Weightage - 25

PART A

(Answer all the questions)

1. Binomial nomenclature was proposed by
 - (a) Robert Hooke
 - (b) Linnaeus
 - (c) Darwin
 - (d) Mendel
2. Sporophytic 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
 - (c) 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)

- 21. Define binomical nomenclature.
- 22. What is organic manuring?
- 23. Define drip irrigation.
- 24. What is seed dormancy?
- 25. Define tissue culture.
- 26. Define Bonsai.
- 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 - 54 hrs., Theory -36 hrs., Practical - 18 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 micro organisms
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

MODULE – III: APPLIED MICROBIOLOGY-II

Rhizobium, Azospirillum, Azotobacter

10 hrs.

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.

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 composing by adding Microorganisms
3. Anaerobic *fermentation* of Human, Animal and Agricultural wastes.
4. Vermiculture. Introduction – Identification of elite strains of earth worm, significance of vermin compost.
5. Plant protection Studies Insecticidal Material for common use.
 - Kerosene emulsion, Tobacco decoction,
 - Neem kernel supervision, Pheromone trap

Practical

18 hrs.

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

1. Kanniyar.S.1990. Biofertilizer Technology for Rice. TNAU , Coimbatore

2. Lumpkin T.A and D.L. Plucknett, 1980. *Azolla*; Botany, Physiology and use as a green manure. *Econ.Bot*; 34:111-153.
3. Balasundaran, V.R, and Subha Rao , N.S. 1977. A review of development of rhizobial inoculants for soybeans in India. *Fertilizer News*. 22 : 42-46.
4. Subha Rao, N.S. 1993, *Biofertilizers in agriculture and forestry*. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Elkan, H.H.1984. Taxonomy and metabolism of *Rhizobium* and its genetic relationship in biological nitrogen fixation, Ed. M. Alexander. Plenum Press, New York.
6. Date , R.A. 1976. Principles of *Rhizobium* strain selection. In symbiotic nitrogen fixation in plants. Ed.P.S. Nutman. Cambridge University Press. Cambridge.
7. Brown, M. 1962. Population of *Azotobacter* in the rhizosphere and effect of artificial inoculation. *Plant and soil*. 17 :15.
8. Lehri, L.K and C.L. Mehrotra. 1972 . Effect of *Azotobacter* inoculation on the yield of vegetable crops . *Indian J. Agriculture Research*. 9 : 210 -204.
9. Terrand, J.J, Kreig, N.R and J. Dobereiner. 1978. A taxonomic study of *Spirillum lipoferum* group, with description of a new genus *Azospirillum* gen. Nov and two species. *Azospirillum braseilliense* sp.Nov., *Caud J. microbial.*, 24 :967 -980.
10. Trappe, J.M.1962. Fungus associates of ectotrophic mycorrhizae. *Bot Rev*. 28: 538-606.

SEMESTER 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
a] *Rhizobium* b] *Azospirillum* c] *Nitrosomonas* d] *Anabaena*
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] Leguminosae 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
a] Ferns b] Angiosperms c] Algae d] Fungi
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
a] Biofertilizers b] Green manures c] Compost d] All the above
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] Berseem 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 manuring 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 annuus* 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

(Answer 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 Nitrogen 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 are associated with
 - a) *Azotobacter*
 - b) *Azospirillum*
 - c) *Frankia*
 - d) *Rhizobium*
15. *Bacillus thuringiensis* 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

- 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 x 4 = 8 weightage

SEMESTER - V
OPEN COURSE -I . CHOICE -3: PLANT TISSUE CULTURE
(Total - 54 hrs., Theory - 18 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 18 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

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

SEMESTER- V
MODEL QUESTION PAPER I
OPEN -COURSE I. CHOICE- 3: PLANT TISSUE CULTURE

Time 3 Hours

Total Weightage - 25

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) Proembryo (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
(c) 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) embryon
7. Sterilization of glassware and related equipment for tissue culture is brought about by using
(a) UV light (b) alcohol (c) incubator (d) Autoclave
8. Haploids are obtained by culturing
(a) Pollengrains (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) Micropropagation (d) Amphimixis
10. What term would you assign for variations appearing during tissue culture
(a) Genetic variation (b) Somaclonal variation
(c) Clonal variation (d) Parasexual variation
11. It is easier to make fusion between two animal cells than the plant cells because

- (a) they lack cell wall (b) they lack cell membrane
(c) plant 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) cellulase
13. While plant materials are subjected to quarantine, shoot tips are not. Why is it 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 of a 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) Parasexual hybridization (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 two 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 is 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

3x2 = 6 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 x 4 = 8 weightage

SEMESTER - VI
CORE COURSE VIII- ENVIRONMENTAL SCIENCE, PHYTOGEOGRAPHY,
EVOLUTION

Total – 126 Hrs. Theory – 90 Hrs., Practicals- 36 Hrs.

Distribution of Hours	Theory	Practical
1) Environmental Science	54	18
2) Phytogeography	18	18
3) Evolution	18	-
Total	90	36

ENVIRONMENTAL SCIENCE Theory-54 Hrs., Practicals -18 Hrs.

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

Ecosystem – Definition – abiotic and biotic factors — trophic structure - Food chain and food web – ecological pyramids – Energy flow – Productivity of ecosystems. Biogeochemical cycles (carbon, nitrogen, phosphorous) – **5 hrs.**

Plant adaptations: Adaptations of the following plant groups – Hydrophytes, xerophytes, halophytes, epiphytes ,parasites. **5 hrs.**

Plant Succession: Definition – Primary and Secondary succession – Autogenic and allogenic succession–Mechanism of plant succession–xerosere.,hydrosere **5 hrs.**

Biodiversity and Conservation: Definition – Levels of biodiversity – values of biodiversity — Biodiversity in global and Indian Scenario – megadiversity nations and hotspots – Biosphere reserves – Threats to biodiversity; Endangered and endemic plant species – Red data book - Exotic and indigenous plant species – Keystone species – Flagship species – Conservation strategies exsitu and in situ methods. Organizations – IUCN, UNEP & WWF – Biodiversity centres in India (NBPGR) Biodiversity Board of Kerala (KSBDB). **9 hrs.**

Natural Resources: Types – Renewable and non-renewable resources – Over explored and under explored resources. Petrocrops – Sustainable management of resources (brief account). **5 hrs.**

Pollution – concepts and examples from regional, National and Global situations Sources and types of pollution – air, water, soil, thermal and noise – biodegradable and nonbiodegradable pollutants – biomagnifications – BOD – Heavy metal contamination – climatic change, its impact and mitigation measures – global warming and greenhouse gases – acid rains. **13 hrs**

MODULE- II Population Ecology

Autecology: Population growth – exponential and logistic – population density – Natality – Mortality - Age distribution – Ecological amplitude – Ecological indicators – Role of indicators in environmental monitoring. **6 hrs.**

Synecology: Ecological community – Coevolution of populations – Association of flowering plants and honeybees – Population interactions – Symbiosis, mutualism, commensalism, predation, parasitism, herbivory – concept of species diversity - α , β , 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. **6 hrs.**

Practicals

18 hrs.

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.
4. Determination of biomass of any plant species in your locality.
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

1. Ahluvalia V.K. Malhotra S. 2009. Environmental Science. Ane Books – New Delhi.
2. Ambasht R.S. 1988. A text book of Plant Ecology. Students Friends Co. Varanasi.
3. Beeby A. & Brennan A.M. First Ecology. Ecological Principles and Environmental Issues. International Student Edition.
4. Benon E. Plant Conservation Biotechnology. Taylor & Francis Ltd. II New Felter Lane,

London. EC4P4EE.

5. Cunningham W.P. and M.A. Cunningham 2003. Principles of Environmental Science: Inquiry and Applications. Tata McGraw Hill Pub. N.D.
6. Dash M.C. 1993. Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd.
7. Dix J.H. 1989. Environmental Pollution. Atmosphere, Land, Water and Noise. Wiley Chichester.
8. Khitoliya R.K. 2007. Environmental Pollution – Management and Control for Sustainable development S. Chand and Company Ltd., New Delhi.
9. Kumar H.D. 1977. Modern Concepts of Ecology. Vikas Publications. New Delhi.
10. Michael S. 1996. Ecology. Oxford University Press, London.
11. Mishra D.D 2008. Fundamental Concepts in Environmental Studies. S. Chand & Co.,
12. Mishra S.P. & S.N. Pandey 2008. Essential Environmental Studies. Ane Books Pvt. Ltd. Thiruvananthapuram.
13. Odum E.P. 1983. Basics of Ecology. Saunders International UN Edition.
14. Shukla R.S. & P.S. Chandel 2005. A Text Book of Plant Ecology S. Chand & Co. Ltd.
15. Wise D.L. 2005. Global Environmental Biotechnology. Ane Books. Trivandrum.
16. Bharucha E. 2005. Text Book of Environmental Studies for UG courses. University Press (India) Private Limited Hyderabad.
17. Archibold. O.W. 1995. Ecology of World Vegetation. Chapman & Hall, London.
18. Diamond, J., T.J. Case 1986. Community ecology. Harper & Row, New York.
19. Futuyma P.J., Slatkin M. 1983. Co-evolution. Sinauer Associates, Sunderland, Mass.
20. Krebs, C.J. 1985. Ecology 3rd edn. Harper & Row New York.
21. Sharma, P.D. 2008-2009. Ecology and Environment. Rastogi Publication.

Web Pages

1. www.biologybrowser.org.

2. www.unep.org.
3. www.iucn.org.
4. www.cites.org.
5. ecology.unm.edu/populus
6. www.redlist.org
7. www.all-hrs-species.org.

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 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 India.

Reference

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

Web Pages:

www.pewclimate.org

www.britannicaonline.org

www.wikipedia.org

www.biologybrowser.org

www.earthtrends.wri.org

MODULE- IV: EVOLUTION

Theory - 24 hrs

- 1. Origin of Earth** – Introduction; Evidences of organic evolution – evidences from morphology, Anatomy, Embryology, Palynology, genetics and molecular biology. **3 hrs.**
- 2. Molecules and Origin of Life:** Origin of basic biological molecules – Condensation and Polymerisation. Protenoids and Prions – Oparin concept, Miller's experiment, Evolution of prokaryotic and eukaryotic cells. Archaeobacteria – Early fossilized cells. Anaerobic metabolism, Photosynthesis and Aerobic metabolism. **8 hrs.**
- 3. Theories on origin and evolution of species**

Spontaneous generation – Lamarckism – Darwinism, Weismann and deVries. Neo-Darwinism. **4 hrs.**
- 4. Modern trends in evolutionay studies:** Phylogeny – Construction of Phylogenic trees based on biomolecules. **7 hrs.**
- 5. Speciation:** Isolating mechanism – Modes of speciation – sympatric and allopatric. **2 hrs.**

References

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

Web pages

1. [www. ucmp. Berkeley. Edn/history/evolution.htm/](http://www.ucmp.Berkeley.Edn/history/evolution.htm/)
2. www.bbc.co.uk/education/darwin/index.shtml
3. [www. nhm.ac.uk](http://www.nhm.ac.uk)
4. [www. biologybrowser.org](http://www.biologybrowser.org)
5. [tolweb. Org/tree/phylogeny.html](http://tolweb.Org/tree/phylogeny.html)

Subjectwise Distribution of Questions

Envt.al Biology - 60%

Phytogeography - 16%

Evolution - 24%

Type of questions	No. of Questions				Weightage
	Envt.al Biology	Phytogeography		Evolution	
Multiple choice	10	5		5	5x1=5
Short Answer	4	2		2	6x1=6
Short Essay	3	1		2	3x2=6
Essay	3	-		-	2x4=8
Total Weightage					25

SEMESTER 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
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 a 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 peelingoff 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.

3x2 = 6 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.

2x4 = 8 weightage

SEMESTER VI
MODEL QUESTION PAPER II

**CORE COURSE VIII. ENVIRONMENTAL SCIENCE, PHYTOGEOGRAPHY,
AND EVOLUTION**

Time 3 Hours

Total Weightage – 25

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. 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.) parasite b) mesophyte c) hydrophyt e 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 c) 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 seed 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) Muehlenbeckia

- 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

5x1 = 5 weightage

PART B

(Answer any six of the following)

- 21. What is the application of cryopreservation
- 22. Why do some plants grow in saline soil.
- 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 an 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**

SEMESTER VI
ORE COURSE IX- PLANT PHYSIOLOGY, METABOLISM AND
BIOCHEMISTRY

Total 126 Hrs., Theory- 90 Hrs., Practical-36 Hrs.

Distribution of Hours	Theory	Practical
1) Physiology	36	18
2) Metabolism	27	9
3) Biochemistry	27	9
Total	90	36

PHYSIOLOGY Theory 36 Hrs, Practical 18 Hrs.

MODULE 1. PLANTS WATER AND MINERALS

15 Hrs.

1. Plant cell and Water **3 hrs.**
 Water and hydrogen bonds. Properties of water. Temperature and physical state. Adsorption and dissipation of heat. Water as a solvent. Cohesion and adhesion. Diffusion, osmosis, osmotic pressure, concept of water potential, components of water potential, osmotic potential, turgor pressure, imbibition, matric potential. Water relations of the whole plant.
 Transpiration. Types and process. Mechanism of guard cell movement. K^+ ion mechanism. Why transpiration? Antitranspirants.
2. The ascent of xylem water. **3 hrs.**
 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.**
4. Plants and inorganic nutrients. Essential elements, criteria of essentiality of elements (refer Noggle and Fritz page No.236). Macro and Micro nutrients. Beneficial elements. Specific roles, deficiency and toxicity.

Uptake of mineral elements. Difference between passive uptake and active uptake. Simple and facilitated diffusion. Carriers and channels. Aquaporins. Active uptake. Carrier concept. Evidences. **6 hrs.**

Module II Photosynthesis and Translocation of Photoassimilates.

12 Hrs.

1. Photosynthesis in higher plants.

General concept and equation. Photosynthetic apparatus. Electromagnetic radiation. Photosynthetically active radiation. Absorption of light. Fluorescence and phosphorescence. Organization of light harvesting antenna pigments. Photochemical and chemical phases of photosynthesis and its evidences. Red drop and Emerson enhancement effect. Two pigment systems, components. Redox potentials of the electron carriers. Photosynthetic electron transport and photophosphorylation. Assimilatory powers- ATP and NADPH. Photosynthetic carbon reduction cycle (PCR), RUBISCO, C₃, C₄, and CAM pathways. Ecological significance of C₄, and CAM metabolism. Photorespiration. Law of limiting factors. **8 hrs.**

2. Translocation and distribution of photo assimilates.

Composition of phloem exudates. Source sink relationship. Mechanism of phloem transport. Phloem loading and unloading, pressure flow hypothesis. Partitioning of assimilates among sinks. **4 hrs.**

MODULE III PLANT GROWTH AND DEVELOPMENT.

9 hrs.

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 hrs.**

4. Plant movements.

Phototropism, gravitropism. Nyctinastic and seismonastic movements. **1½ hrs.**

5. Photomorphogenesis:

Phytochrome: chemistry and physiological effects. (Brief study). **2 hrs.**

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

1½ hrs.

Practicals

18 hrs.

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.
9. Photomorphogenesis in seedlings grown under normal light and darkness.
10. Testing of seed viability by 2,3,5-triphenyl tetrazoliumchloride test.
11. Demonstration of gravitropism using Klinostat.
12. Determination of the rate of transpiration using Ganong's photometer.

References.

1. William G. Llopkins, (1999). Introduction to Plant Physiology, 2nd edition, John Wiley & Sons, Inc.
2. Lincoln Taiz and Eduardo Zeiger (2002). Plant Physiology 2nd edition. Sinauer Associates, Inc. Publishers. Sunderland, Massachusetts.
3. Frank B. Salisbury and Cleon W. Ross (2002). Plant Physiology 3rd edition. CBS publishers and distributors.
4. G. Ray Noggle and George J. Fritz Introductory Plant Physiology Prentice Hall.
5. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.

METABOLISM Theory 27 Hrs., practical 9 Hrs.

MODULE IV CATALYSIS AND INTERMEDIARY METABOLISM

1. Enzymes Classification (IUB), Mechanism of enzyme action, optimization of weak interactions in the transition state. Co-enzymes, inhibition, regulation: allosteric enzymes, Isoenzymes. **4 hrs.**
2. An introduction to intermediary metabolism **2 hrs.**
3. Plants and nitrogen metabolism.
Biological nitrogen fixation, symbiotic nitrogen fixation in leguminous plants. Biochemistry of nitrogen fixation. Export of fixed nitrogen from nodules. Genetics of nitrogen fixation, Ammonia assimilation, assimilation of nitrate. Biosynthesis of amino acids reductive amination and transamination. **6 hrs.**
4. Catabolism of hexoses.

Glycolysis: Two phases of glycolysis. Overall balance sheet. Regulation (brief) , fate of pyruvate under aerobic and anaerobic conditions.

Citric acid cycle: Formation of acetate, reaction of citric acid cycle, anapleurotic reactions of citric acid cycle. Regulation of citric acid cycle(brief). Glyoxylate cycle. Amphibolic nature of citric acid cycle. **5 hrs.**

5. Oxidation of fatty acids. Activation and entry of fatty acids, β oxidation of saturated fatty acids in plants. Glyoxylate cycle. (Brief study study) . **3 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.

8. Oxidative phosphorylation: Electron transport reactions in mitochondrion. Electron carriers, redox potential, electron carriers function as multienzyme complexes, ATP synthesis. Chemiosmotic hypothesis. Shuttle systems. **5 hrs.**

Practicals

9 hrs.

1. Extraction of invertase (from any source).
2. Assay of invertase.
3. pH dependent activity profile of enzymes
4. Colorimetric estimation of reducing sugars in germinating seeds.

References

1. David I. Nelson and Michael M. Cox (2000). Lehninger. Principles of biochemistry, 3rd edition, Macmillan U.K.
2. Geoffrey Zubay Biochemistry Macmillan Publishing Company, Newyork.
3. Trevor Palmer. Enzymes- Biochemistry, Biotechnology and Clinical Chemistry. Norwood Publishing, Chichester.
4. Donald Voet and Judith Voet. (2004). Biochemistry. 3rd edition. Wiley international edition.
5. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.

BIOCHEMISTRY Theory 27Hrs., Practicals 9 Hrs.

MODULE- V. BIOMOLECULES

1. Biomolecules.
Hierarchy 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 **4 hrs.**
4. Amino acids, peptides and proteins. Amino acids: classification based on polarity; properties, zwitterions, acid base properties.
Proteins: Classification based on function and physical and chemical properties. Covalent structure of proteins. Three dimensional structures of proteins. Primary, secondary, tertiary and quaternary structures of proteins. Native conformation and biological functions of proteins. Weak interactions. Denaturation and renaturation. **6 hrs.**
5. Nucleotides structure of nucleotides. Purine and pyrimidine derivative in nucleotides.
Functions of nucleotides and nucleotide derivatives **4 hrs.**
6. Secondary metabolites – a brief study only **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
2. Quantitative estimation of protein by Biuret method.

3. Quantitative estimation of DNA and RNA by colorimetric / spectrophotometric method.

References:

1. David L; Nelson and Michael M Cox (2000).Lehninger. Principles of Biochemistry. 3rd edition. Macmillon, Worth U.K.
2. Geoffrey Zubay Biochemistry Macmillen Publishing Company, Newyork
3. David T. Plummer, An Introduction to Practical Biochemistry. Tata Mc Grow Hill.
4. Sadasivam and Manickam, Biochemical methods. New Age International Publishers. New Delhi.
5. Secondary plant products, vol.8. Encyclopedia of Plant Physiology, 1980, Springer – Verlag, Berlin (This book is available in the library of Department of Botany, University of Calicut).
6. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.
7. Donald Voet and Judith Voet. (2004). Biochemistry. 3rd edition. Wiley international edition.
8. Keith Wilson and John Walker.(2008). Principles and techniques of Biochemistry and Molecular Biology. 6th edition. Cambridge University Press.

Subjectwise Distribution of Questions

Physiology - 41%

Metabolism - 31%

Biochemistry - 28%

Type of questions	No. of Questions			Weightage
	Physiology	Metabolism	Biochemistry	
Multiple choice	8	4	8	5x1=5
Short Answer	3	2	3	6x1=6
Short Essay	3	2	1	3x2=6
Essay	1	1	1	2x4=8
Total Weightage				25

SEMESTER VI
MODEL QUESTION PAPER.1
CORE- IX .PLANT PHYSIOLOGY, METABOLISM AND BIOCHEMISTRY.

Time 3 Hours

Total Weightage – 25

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
a. *Enterolobium saman*. b. *Phaseolus vulgaris* c. *Mimosa pudica* d. *Dioniea*
6. Fatty acid biosynthesis in germinating seeds takes place in
a. Mitochondrion b. Chloroplast.c. Cytosol.d. Glyoxysomes.
7. Which among the following is a non reducing disaccharide.
a. Maltose b. Lactose c. Isomaltose d. sucrose.
8. Which among the following is a secondary metabolite.
a. Alkaloid. b. Rhamnose c. Amylopectin. d. Indole-3-acetic acid.,
9. One of the methods of breaking dormancy is
a. Mechanical scarification. b. Vernalization.
c. Etiolation. d. Phosphorylation
10. The translocation of photoassimilation occur thorough
a. Xylem. b. Phloem parenchyma. c. Sieve tube. d. Companion cell

11. Which among the following is an imino acid.
a. Glycine. b. Arginine c. Proline d. Glutamine.
12. The TCA cycle is marked by
a. Dehydration.. b. Dehydrogenation c. Transamination d. Transacetylation
13. Which hormone is involved in stomatal closure.
a. Abscissic acid. b. IAA c. GA3 d. Ethylene
14. The repeating bond in amylose is called
a. Glycosidic bond. b. Peptide bond. c. Phosphodiester bond. d. Disulfide bond.
15. Which pigment is involved in the perception of photoperiodic signal.
a. Cytochrome. b..Phytochrome. c. Cryptochrome. d. Phycobilins.
16. The symbiotic nitrogen fixing bacteria inhating in the root nodules of leguminous plants
a..Anabaena. b...Rhizobium. c..Lactobacillus. d..Azotobactor.
17. The hormone that induces parthenocarpny
a. Acetylene b. Ethylene c. IAA d. ABA
18. Which among the following is a natural antitranspirants.
a. CO₂ b. CO c. O₂ d. Ozone.
19. Glyoxylate pathway is concerned with
a. Net synthesis of glucose from fatty acids. b. Synthesis of sucrose.
c. Synthesis of ATP. d. Synthesis of NADPH.
20. Which among the following is the transport form of sugar.
a. Glucose b. Fructose. c. Sucrose. d. Lactose.

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.
26. Give a brief description of secondary metabolites.
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 maintain the native protein conformation **2x4 = 8 weightage**

MODEL QUESTION PAPER.II
CORE- IX .PLANT PHYSIOLOGY, METABOLISM AND BIOCHEMISTRY.

Time 3 Hours

Total Weightage – 25

PART A

(Answer all the questions)

1. Name the cation involved in the photolysis of water.
a. Mg^{2+} b. Mn^{2+} c. Mo^{2+} 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 CO_2 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. $\alpha 1 \rightarrow 4$ b. $\alpha 1 \rightarrow 6$ c. $\beta 1 \rightarrow 6$ d. $\beta 1 \rightarrow 4$
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 quaternary 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. Abscissic 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..Phosphatidyl choline.
17. Breaking the seed dormancy by low temperature treatment is called
 a. Scarification b. Stratification c. Vernalization d. Lyophilization
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

21. Emerson enhancement effect.
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
- 31. Define nastic movements. Briefly explain seismonastic movement.
- 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 – 126 Hrs. Theory – 90 Hrs., Practicals- 36 Hrs.

Distribution of Hours	Theory	Practicals
1) Cell Biology	18	9
2) Genetics	63	18
3) Plant Breeding	9	9
Total	90	36

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.**
3. Nucleus - Nuclear membrane, Nuclear pore complex, organisation of interphase nucleus, Euchromatin and heterochromatin, Nucleolus. **2 hrs.**
4. Chromosomes - Morphology, Telomere and its significance, Chemical composition, Ultrastructure (Nucleosome model) Chromosome banding C-banding, G-banding Q-banding **2 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 aberrations deletion, duplication, inversion, translocation - their meiotic consequences and significance **2 hrs.**

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

3 hrs.

Practicals 9 Hrs.

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

References

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

MODULE- II. CLASSICAL GENETICS

Theory -36 Hrs., Practicals-18 Hrs.

1. Mendel's experiments - symbols terminology. Mendelian Laws, monohybrid dihybrid, test cross and backcross. **5 hrs.**
2. Modification of Mendelian ratios.

Incomplete dominance - *Mirabilis*

(1 : 2 : 1, 1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1, 3 : 6 : 3 : 1 : 2 : 1

Co-dominance - Blood groups in man

Lethal genes - coat colour in mice **4 hrs.**
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 hrs.**
4. Multiple alleles - self sterility in *Nicotiana*. **3 hrs.**
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 **7 hrs.**
6. Sex linked inheritance - X - linked , Y-linked, Morgan's experiment eg. eye colour in *Drosophila*, sex limited and sex influenced inheritance, pedigree analysis. **5 hrs.**
7. Extra-nuclear inheritance - Plastid inheritance in *Mirabilis*, Coiling pattern in snails. **3 hrs.**
8. Mutation - types - mutagens - Physical, Chemical molecular mechanisms of gene mutation **4 hrs.**

Practicals -18 hours

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

MOLECULAR GENETICS

Theory -27 Hrs.

Module – III.

1. Nucleic acids - DNA - The genetic material, discovery of bacterial transformation (Griffith's & Avery's experiments), Hershey and Chase experiment. **4 hrs.**
DNA - structure, Watson & Crick's Model, Types of DNA-(A,B,Z) **3 hrs.**
- Replication - Semi conservative replication – Meselson and Stahl's experiment - Molecular mechanism of Replication **4 hrs.**
RNA - structure, types and properties. **2 hrs.**
2. Genetic code - Characters of genetic code **3 hr.**
3. Central dogma - - protein synthesis Transcription, post-transcriptional modification of RNA, translation; Teminism. **4 hrs.**
4. Gene regulation in prokaryotes - operon concept Lac operon, trp. operon). Gene regulation in eukaryotes (brief account) **3 hrs.**
5. One gene - one enzyme hypothesis, one cistron one polypeptide hypothesis, modern concept of gene-cistrons, recones and mutons **3 hrs.**
6. Human Genome Project - brief account. **1 hrs.**

References

1. Gunther, S. Spend & Richard Calender 1986 - Molecular Genetics CBS Publishers - Delhi.
2. Gupta, P.K. Text Book of Genetics. Rastogi Publications, Meerut.
3. John Ringo 2004- Fundamental Genetics Cambridge University Press.
- 3 Lewin B 2000 Genes VII Oxford University Press.
- 4 Rastogi V.B. 2008, Fundamentals of Molecular Biology, Ane Books, India.

6. Sinnot, W.L.C. Dunn & J. Dobzhansky 1996. Principles of Genetics. Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
7. Taylor, D.J., Green, N.P.O. and Stout, G.W. Biological Science 3rd edn. Cambridge University Press.
8. Verma, P.S. & Agarwal 1999. Text book of Genetics. S. Chand & Co., New Delhi.

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
1 hr.
3. Breeding techniques -
 - a. Plant introduction
 - b. Selection - mass selection, pureline selection and clonal selection. **1 hr.**
 - c.. Hybridization (techniques only) hybrid vigour inbreeding depression
1½ hrs.
 - d. Mutation breeding
 - e. Polyploidy breeding **1½hr**
 - f. Breeding for disease resistance **1 hr.**
4. Breeding techniques and achievements with reference to the following crops in India:
 - a. Rice
 - d. Coconut**3 hrs.**

Practicals	9 Hrs.
-------------------	---------------

Techniques of emasculation and hybridization of any bisexual flower.

References

1. Allard. R.W. 1960. Principles of Plant breeding, John Wiley & Sons, Inc, New York.
2. Chaudhari. H.K. Elementary Principles of Plant breeding, Oxford & IBH Publishers.

3. Singh, B.D. 2005. Plant Breeding - Principles & methods , Kalyani Publishers, New Delhi.
4. Sinha U. & Sunitha Sinha 2000 - Cytogenetics, Plant breeding & Evolution, Vikas Publishing House.
5. Swaminathan, Gupta & Sinha - Cytogenetics of Crop plants

Subjectwise Distribution of Questions

Cellbiology	- 31%
Genetics	- 55%
Plant Breeding	- 14%

Type of questions	No. of Questions			Weightage
	Cellbiology	Genetics	Plant Breeding	
Multiple choice	8	8	4	5x1=5
Short Answer	2	3	3	6x1=6
Short Essay	2	3	1	3x2=6
Essay	1	1	-	2x4=8
Total Weightage				25

SEMESTER VI
MODEL QUESTION PAPER I

CORE COURSE X -CELL BIOLOGY GENETICS AND PLANT BREEDING

Time 3 Hours

Total Weightage - 25

PART A

(Answer all the questions)

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 head quarters 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. **3x2 = 6 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 x 4 = 8 weightage

SEMESTER VI
MODEL QUESTION PAPER II
CORE COURSE X. CELL BIOLOGY GENETICS AND PLANT BREEDING
Time 3 Hours **Total Weightage - 25**

PART A

(Answer all the questions)

1. F_2 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) G_1 phase c) G_2 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 \AA b) 24 \AA c) 45 \AA d) 34 \AA
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 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

5x1 = 5 weightage

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

6x1=6 weightage

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

3x2 = 6 weightage

Part D

(Answer any two of the following)

35. Give an account of structural aberration 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 x 4 = 8 weightage

SEMESTER VI
CORE COURSE ELECTIVE – CHOICE-1
BIOTECHNOLOGY AND RESEARCH METHODOLOGY
Total 54 Hrs. Theory -36; Practicals -18 Hrs.

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-Agrobacterium 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

- 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 and Bioremediation
- d. Industrial Biotechnology - Large scale production of beverages, pharmaceuticals, hormones.
- e. 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

1. Brown TA (2006) Gene cloning and DNA analysis; Blackwell scientific publishers
2. Sobti RC & Pachauri SS (2009) Essentials of Biotechnology; Ane Books, New Delhi
3. Dubey RC Introduction to Plant Biotechnology; S Chand & Co
4. Purohit SS (2003) Agricultural Biotechnology, Agrobios (India)
5. Chawla HS (2000) Introduction to Plant Biotechnology
6. Dovstekel (2005) Microarray Bioinformatics; Cambridge University press
7. Ignacimuthu S (1997) Plant Biotechnology, New Hampshire Science Publishers
8. Muralidharan VS & Subramania A (2009) Nanoscience and Technology; Ane Books, New Delhi
9. Guozhong Cao (2004) Nanostructures and Nanomaterials – Synthesis, Properties and applications. Imperial college press
10. Razdan MK (1995) Introduction to Plant Tissue Culture. Oxford & IBH publishing Co. Pvt. Ltd.
11. Gupta PK (1996) Elements of Biotechnology; Rastogi and Company, Meerut
12. Lewin B (2004) Genes VIII. Oxford University Press

13. Primrose SB, Twyman RM & Old RW (2001). Principles of gene manipulation : An Introduction to genetic engineering. 6th Edn. Blackwell Oxford
14. Smith JE (2005) Biotechnology; Cambridge University press, UK
15. Wilson K & Walker J (2008) Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press
16. Brown TA (2002) Genome , Black well
17. Ignacimuthu S (2008) Biotechnology : An introduction, Alpha science International Ltd.
18. Ahmed N, Qureshi FM, Khan OY (2001) Industrial and Environmental Biotechnology. Horizon Press
19. Omasa K, Saji H, Youssefian S, Kondo N (2002) Air Pollution and Plant Biotechnology. Springer – Verlag, Tokyo

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

1. Holmes D, Moody P, Dine D (2006) Research methodology for the biosciences; Oxford university press
2. Krishna Kumar K. (1981). An Introduction to Cataloguing Practice.
2. Riker A.J. & Riker R.S. (1936). Introductionto Researrch on Plant diseases, John Swift & Co. USA. P. 177.

SEMESTER VI
MODEL QUESTION PAPER I
CORE COURSE ELECTIVE - CHOICE 1. BIOTECHNOLOGY & 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 d) 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

SEMESTER VI
MODEL QUESTION PAPER II
CORE COURSE ELECTIVE – CHOICE 1. BIOTECHNOLOGY & RESEARCH
METHODOLOGY

Time 3 Hours

Total Weightage - 25

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) cry2 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 Fluorescent Protein b) Gene Finger Printing
- c) Grey Fluorescent Protein d) Green Fluorescent 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 x 4 = 8 weightage

SEMESTER - VI
CORE COURSE ELECTIVE – CHOICE 2: GENETICS AND CROP
IMPROVEMENT

(Total - 54 hrs., Theory - 36 hrs., Practical - 18 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

(ii). Mineral stress resistance – General account – Resistance to mineral deficiency stress - Genetics of mineral deficiency resistance – Sources of mineral deficiency 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.

(ii). Insect resistance – Introduction, Mechanism, Nature and genetics of insect resistance – Oligogenic, Polygenic and cytoplasmic resistance – sources of insect resistance – Breeding methods for insect resistance – Problems in breeding for insect resistance – Achievements – Breeding for resistance to parasitic weeds

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. Singh, B D. 2000. Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
2. Sharma, J R. 1994. Principles and Practice of Plant Breeding. Tata Mcgraw – Hill Publishing Company, New Delhi.
3. Benjamin Levin. 2007. Genes VIII.
4. Allard, R W. 1960. Principles of Plant Breeding. John Wiley & Sons, New York.
5. Chahal, G S & S S Gosal, 1994. Principles and procedures of Plant Breeding. Narosa Publishing House, New Delhi.
6. Chrispeels M J and Sadava, D E. 1994. Plants, Genes and Agriculture. Jones and Bartlet Publishers, Boston, USA.
7. Gupta P K. 1998. Genetics and Biotechnology in crop Improvement. RAstogi Publications, Meerut
8. Hayes, H K., F R Immer and D C Smith. 1955. Methods of Plant Breeding. Mc Graw Hill Company, New York
9. Kuckuck, H., G. Kobabe and G Wenzel. 1991. Fundamentals of Plant Breeding. Narosa Publishing House, New Delhi.
10. Mandal, A K., P K Ganguli and S P Banerjee. 1991. Advances in Plant Breeding. Vol. I. & II. C B S Publishers and Distributers, New Delhi.
11. murray D R. 1991. Advanced methods in Plant Breeding and Biotechnology. Panima Publishing Corporation, New Delhi.
12. Richards , A J. 1986. Plant Breeding Systems, Chapman Hall, London.

SEMESTER VI
MODEL QUESTION PAPER I
CORE COURSE ELECTIVE - CHOICE 2. GENETICS AND CROP
IMPROVEMENT

Time 3 Hours

Total Weightage - 25

PART A

(Answer all the questions)

1. Headquarters of NBPGR is at
a. Lucknow b. Calcutta c. New Delhi d. Mumbai
2. International rice research Institute is located at
a. Manila b. London c. Newyork d. Canada
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
a. Colchicine b. Quinoline c. Acetocarmine d. Nitric oxide
7. Raphanobrassica is an example for
a. Autotriploid b. Aneuploid c. Allopolyploid d. Autopolyploid
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
a. Genetic load b. Gene balance c. Chromosome load d. Allelic load
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
a. Rome b. Mexico c. Philippines d. Netherlands
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
a. Cashew b. Pepper c. Ginger d. Rubber
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

31. Give an account of the floral biology of coffee.
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

(Answer any two of the following)

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 x 4 = 8 weightage

SEMESTER - VI
CORE COURSE ELECTIVE - CHOICE 3: ADVANCES IN FLOWERING
PLANT SYSTEMATICS

(Total - 54 hrs., Theory - 36 hrs., Practical - 18 hrs.)

MODULE 1 PRINCIPLES OF ANGIOSPERM TAXONOMY

Scope and importance of Taxonomy. Brief account on pre-Darwinian and post – Darwinian theories of classification – Essentialism, Nominalism, Empiricism, Evolutionary and Phylogenetic Systematics. Conceptual basis of classifications of Linneaus, Bentham & Hooker and Takthajan and Cronquist.

Defenition 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. Heywood, V H & Moore, D M. (Eds) 1984. Current concepts in Plant Taxonomy
2. Lawrance, G H M. Taxonomy of vascular plants. Oxford & IBH
3. Sivarajan, V V. 1991. Introduction to principles of plant Taxonomy. Oxford & IBH.
4. Vasishta, P C. Taxonomy of Angiosperms. R. Chand & Co. New Delhi.
5. Singh, V & D K Jain. 1997. Taxonomy of Angiosperms. RAstogi Publications, Meerut.
6. Stace, C A. 1989. Plant Taxonomy and Biosystematics. Edward Arnold, London

7. Henry & Chandrabose.1997. An aid to International code of Botanical Nomenclature. BSI.

SEMESTER VI
MODEL QUESTION PAPER I
CORE COURSE ELECTIVE – CHOICE 3. ADVANCES IN FLOWERING PLANT
SYSTEMATICS

Time 3 Hours

Total Weightage - 25

PART A

(Answer all the questions)

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 Darwinian 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
a. Rutaceae b. Meliaceae c. Bignoniaceae d. Apocynaceae
17. Monadelphly is present in
a. Meliaceae b. Sterculiaceae c. Euphorbiaceae d. Acanthaceae
18. Spiral arrangement of floral whorls is seen in
a. Poaceae b. Amaranthaceae c. Ranunculaceae d. Bignoniaceae
19. *Azadirachta indica* is in the family
a. Sterculiaceae b. Meliaceae c. Euphorbiaceae d. Amaranthaceae
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

Practical Paper I

UNIVERSITY OF CALICUT

B.Sc. BOTANY CORE COURSE PRACTICALS BO4BO4 (P1-4)

**(Methodology, Microtechnique, Horticulture, Bioinformatics, Microbiology,
Phycology, Mycology, Lichenology and Plant pathology)**

Time : **3hrs**

Max. weightage : **50**

1. Construct a histogram / pie diagram with the data provided in A
(weightage 4)
2. Work out the problem B. (weightage 4)
3. Calibrate the given Micrometer and measure the width of the specimen C.
(Calibration 4, Measurement 2) (weightage 6)
4. Comment on D. (weightage 2)
5. Gram stain the bacterial culture E. Identify and write down the procedure. Leave the preparation for valuation.
(preparation 2, procedure 1, identification 1) (weightage 4)
6. Identify any one genus from the given mixture F.
(preparation ½, identification ½, diagram ½, reason ½) (weightage 2)
7. Prepare a vegetative propagule by layering/ grafting/budding method using the material G. Write the procedure.
(preparation 2, procedure 2) (weightage 4)
8. Find the pH of the given buffer solution (Acetate/Phosphate) in H. Record the pH. Change the pH to And write the procedure.
(Procedure 2, Report 2 + 2) (weightage 6)
9. Make suitable micropreparation to bring out the structure of I. Draw cellular diagram and label the parts. Identify giving reasons. Leave the preparation for valuation. (preparation 1, identification 1 diagram 1 reason 1) (weightage 4)
10. Spot at sight J, K, L, M and N. (5 x 1 = weightage each 1)

Submission a. 2 permanent slides

(weightage 4)

b. 5 Plant Pathology herbarium sheets

(weightage 5)

Total weightage 50

Record weightage 5

Total weightage 55

=====

SCHEME FOR THE SUPPLY OF SPECIMENS

CORE COURSE PRACTICAL PAPER I

- A. Data for constructing histogram / pie diagram.
- B. Problem for χ^2 or standard deviation.
- C. Any one microscopic Alga/fungus.
- D. Photocopy of web page NCBI/EMBL/3D Diagrams of proteins
- E. Curd.
- F. Mixture of algae containing *Volvox*, *Oedogonium*, *Spirogyra*, *Vaucheria* and *Polysiphonia*. Identify and show one alga.
- G. Layering/ grafting/ budding (selected by lot).
- H. Give a buffer solution of known pH. Provide buffer components to change the pH as required by the examiner. The change should fall within the Ph range of buffer concerned.
- I. *Sargassum/Puccinia/Albugo/Cercospora*.
- J. Parts of microscope/camera lucida/ fixative/horticulture implements.
- K. Growth curve/inoculation loop/cavity slide/coupling jar/cavity dish or cavity block.
- L. One pathology specimen included in the practical syllabus
- M. & N. any algae/ fungi mentioned in the syllabus of prtacticals, slide/specimen.

MODEL QUESTION PAPER 2009

Time 3 hrs
Max Weightage 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 $\frac{1}{2}$, reasons 1 $\frac{1}{2}$,) (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 f 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 - $\frac{1}{2}$, adaptations, 1 $\frac{1}{2}$) (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 grass land. species may be limited
- J - Outline map of India
- K - Physiology apparatus (Any one of the following)
Willmott's bubbler, TLC spreader
Gonong's potometer, Water balance, Clinostat.
- L - Ecological group
- M, N, O, P, Material or slide from Bryophyta, Pteridophyta and Gymnosperm (representing all groups)

PRACTICAL MODEL QUESTION PAPER 2009

Time 3 hrs
Max Weigtage 50+5

PRACTICAL PAPER III

**(Morphology, Systematics, Anatomy, Economic Botany, Reproductive Botany,
Palynology, Cell Biology, Genetics and Plant Breeding)**

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	-	$\frac{1}{2}$		
Diagram	-	$1\frac{1}{2}$		
Reason			Total	5 weigtage
2. Prepare an acetocarmine squash preparation of the material **B**

Preparation	-	2		
Identification	-	$\frac{1}{2}$		
Diagram	-	1		
			Total	$3\frac{1}{2} \times 2 = 7$ weigtage
3. Describe **C** in technical term and derive up to the respective family.

Family	-	$\frac{1}{2}$		
Taxa up to spp.	-	$1\frac{1}{2}$		
Description	-	3		
			Total	5 weigtage
4. Analyse the morphological features of **D₁, D₂, D₃, D₄, D₅, D₆**. Construct a dichotomous key.

5 weigtage $\frac{1}{2}$ 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	-	$\frac{1}{2}$		
Diagram	-	1		
Fl. diagram	-	1		
Fl. formula-	$\frac{1}{2}$			
			Total	3 weigtage
6. Identity and bring out the embryological features of specimen **F**. Draw labelled diagram.

Identification	-	$\frac{1}{2}$		
Diagram	-	1		
Features	-	$\frac{1}{2}$		
			Total	2 weigtage
7. Determine the viability of specimen **G**. Write down the procedure leave the preparation for valuation

Procedure	-	1		
Preparation	-	2		
			Total	3 weigtage
8. Demonstrate the emasculation and hybridization in specimen **H**.

Emasculation	-	1		
Hybridization	-	1		
Baggenyl labelling	-	1		

- | | | |
|--|--------------|-------------------|
| | Total | 3 weigtage |
|--|--------------|-------------------|
9. Give the binomial and morphology of useful part of **I₁ & I₂**
- | | | |
|---------------------------|---|----------------------------|
| Binomial | - | $\frac{1}{2} \times 2 = 1$ |
| Morphology of useful part | - | $\frac{1}{2} \times 2 = 1$ |
| | | 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 | - | <i>Ficus, Tinospora</i> |
| Monocot Root | - | <i>Rheo, Colacasia</i> |
| Dicot Stern | - | <i>Centella</i> |
| Normal & Bicollateral- | | <i>Cephalandra</i> (Primary) |
| Monocot stern | - | Grass, <i>Asparagus</i> , Bamboo |
| Anomalous Secondary Growth | - | <i>Boerhaavia, Bignonia</i>
(<i>Amaranthus, Piper</i>) |
| Monocot stern | - | <i>Dracaena</i> |

(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, Tabernaemontana, 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.*
- (I₁) One Economic Botany material submitted by the student
- (I₂) Any Economic Botany material mentioned in the syllabus supplied by the Examiner.
- (J₁) One Morphology specimen submitted by the student.
- (J₂) Any Morphology specimen mentioned in the syllabus supplied by the Examiner.
- (K) Genetics Problem :- Incomplete/Dihybrid/Modified Ratio
- (L) Chromosome Mapping – 3 point cross.

Spot at sight Specimens

M	Anatomy	M } N }	-	Tissue or Vascular Bundles (included in the Syllabus)
			-	Cell inclusions (included in the syllabus)
O	Cytology	O	-	Stages of meiosis – Metaphase I, Metaphase II Anaphase I, Anaphase II
P →		P } Q }	-	Campus Plants
Q →				
P →		P } Q }	-	Herbarium plants
Q →				

MODEL QUESTION PAPER 2009
OPEN COURSE II- PRACTICAL
Biotechnology and Research Methodology

Time -1½ Hrs.

20 weigtage, Record – 5 weigtage

1. Isolate DNA from the given Sample **A**
Procedure – 4
Isolation - 6
10 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
5 weigtage
3. Read the sequence from the given data **C**
3 weigtage
4. Identify the specimens **D & E**
Pictures/graphs/parts/equipments/chemicals from biotechnology and nanobiotechnology)
2 x 1 = 2 weigtage

SEMESTER II
Core Course II - Methodology and Microtechnique
Internal Practical Examination

Time: 1 hr

Maximum : 15 weightage

Record : 5

Attendance : 2

Viva : 3

Total : 25 weightage

1. Determine the pH of given sample A. Write procedure. 4 weightage
pH determination : 2
Procedure : 2
2. Measure the width of the filament B using micrometer. 3 weightage
3. Calculate standard deviation of given data C.
OR
Test of hypothesis 9:3:3:1 using chi-square test. 5 weightage
4. Prepare single stained permanent slide of material D. 2 weightage
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 weigtage

Record : 5

Attendance : 2

Viva : 3

Total : 25 weigtage

1. Microbiology – Gram staining Positive & Negative	5 weigtage
2. Phycology – Identification of 2 algae from algal mixture	3 weigtage
3. Identification, giving reasons (Algae)	2 weigtage
4. Mycology & Lichenology – Sectioning fungal specimen	3 weigtage
Critical notes – Lichen	1 weigtage
5. Plant pathology – submission 5 herbarium specimens	1 weigtage
Identification of one pathology specimen	1 weigtage

Semester- V
Core Course V – Angiosperm Morphology, Plant Anatomy, Reproductive Botany & Palynology

Internal Practical Examination

Time: 1 hr

Maximum : 15 weigtage

Record : 5

Attendance : 2

Viva : 3

Total : 25 weigtage

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	$\frac{1}{2}$	
V.S. Diagram	1	
Floral Diagram	1	
Floral formula	$\frac{1}{2}$	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

V Semester
Core Course VI: Bryology Pteridology, Gymnosperms and Palaeobotany
Internal Practical Examination

Time: 1 Hr.

Maximum : 15 weightage

Record : 5

Attendance : 2

Viva : 3

Total : 25 weightage

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 – $\frac{1}{2}$; identification – $\frac{1}{2}$; Reasons – 1)
(3x3 = 9 weightage)
2. Identify D giving important features. Draw a labelled diagram.
(Identification – $\frac{1}{2}$; Diagram – $\frac{1}{2}$; Features – 1) (1 x 2 = 2 weightage)
3. Spot at sight E, F, G, H, I, J, K, L ($\frac{1}{2}$ 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 $\frac{1}{2}$
 Derivation of taxa upto family : 1 $\frac{1}{2}$
 Description 3 **5 weigtage**
2. Analyse the morphological features of B₁ B₂ B₃ B₄ B₅ B₆. Construct a dichotomous key.
 3 weigtage ($\frac{1}{2}$ for each step)
3. Give the binomial and morphology of useful part of C₁ and C₂.
 Binomial ($\frac{1}{2}$ + $\frac{1}{2}$) 2 = 2
 Morphology of useful part ($\frac{1}{2}$ + $\frac{1}{2}$) 2 = 2

Total 4 weigtage
 ===
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

Total 9 weigtage
 ==

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**

SEMESTER VI
Core Course IX : Plant Physiology, Metabolism and Biochemistry
Internal Practical Examination

Time: 1 Hr.

Maximum : 15 weightage

Record : 5

Attendance : 2

Viva : 3

Total : 25 weightage

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 weightage.
- II. By conducting appropriate tests identify the presence of any two compounds given below.
1. Starch, 2. Monosaccharides, 3. Ketoses, 4. Reducing disaccharides, 5. Protein, 6. Amino acids with aromatic R-groups. 7. Tyrosine, 8. Tryptophan. 6 weightage.
- III. Identify the instrument and mention its use. 2 weightage.
- Key to specimens.
- I. 1. Invertase enzyme
2. Glucose
3. Egg white.
4. Leaf extract.
5. Potato
- II. 1. Starch
2. Glucose
3. Fructose
4. Lactose/Maltose
5. Egg white
6. tyrosine
7. Tryptophan
8. Phenylalanine
- III.
1. Wilmot's bubbler
2. Water balance apparatus
3. TLC spreader.
4. Ganong's photometer.
5. Klinostat.

SEMESTER VI
Core Course X : Cell Biology, Genetics & Plant Breeding
Internal Practical Examination

Time: 1 Hr.

Maximum : 15 weightage

Record : 5

Attendance : 2

Viva : 3

Total : 25 weightage

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**

OPEN COURSE -I

Horticulture and Nursery Management Practical Model Question Paper Internal Practical exam – 15 weigtage

Time: 1 hr.

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

OPEN COURSE -II

Biotechnology, Nanotechnology & Research Methodology Practical Model Question Paper Internal Practical exam – 15 weightage

Time: 1 hr.

1. Isolate DNA from the given Sample **A**
Procedure – 3
Isolation - 5
8 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
4 weightage
3. Read the sequence from the given data **C**
2 weightage
4. Identify the specimens **D & E** **2 x ½ = 1 mark**
(D,E- Pictures/graphs/parts/equipments/chemicals from biotechnology and nanobiotechnology)

UNIVERSITY OF CALICUT

B.Sc. BOTANY COMPLEMENTARY COURSE PRACTICALS MARCH/APRIL 2011 - BO4CO4 (P)

Time: 3 hrs

Maximum Weightage: 45

1. Prepare a T.S. of specimen **A**. Stain and mount in glycerine. Draw cellular diagram and label the parts. Identify giving reasons. Leave the preparation for valuation.
(Preparation – 3;
Diagram – 2; Reasons 2; Identification – 1) weightage 8
2. Refer specimen **B** to its family, giving diagnostic vegetative and floral characters.
(Identification 1 + Reasons 3) weightage 4
3. Take a V.S. of flower **C**. Draw a labelled diagram. Construct the floral diagram and give the floral formula.
(Diagram - 1 ½, Floral diagram - 1 ½, Floral formula - 1) weightage 4
4. Make suitable micropreparations of **D**. Draw labelled diagram. Identify giving reasons. Leave the preparation for valuation.
(Preparation – 1, Diagram – 1, Identification – 1, Reasons – 1) weightage 4
5. Give the ecological group of specimen **E**, with important adaptations.
(Identification - ½ + Adaptations - 1 ½) weightage 2

6. Set up the experiment **F**. Explain the working and state its aim.
(Set up 2; Working 1; Aim1) weightage 4
 7. Give the binomial, family and morphology of useful parts in **G & H**. (Binomial – 1; Family - $\frac{1}{2}$; Morphology - $\frac{1}{2}$) 2x weightage 2
 8. Name the disease, pathogen and important symptoms in **I**.
(Name -1, Pathogen -1, Symptoms - 2) weightage 4
 9. Spot at sight, specimens **J, K, L, M** and **N**. 5x weightage 1
 10. Genetics problem – **O**. weightage 6
-
- weightage 45
- Record weightage 5
- Herbarium weightage 5
-

UNIVERSITY OF CALICUT

B.Sc. BOTANY CORE COURSE PRACTICALS BO4BO4 (P1-4)

**(Methodology, Microtechnique, Horticulture, Bioinformatics, Microbiology,
Phycology, Mycology, Lichenology and Plant pathology)**

Time : **3hrs**

Max. weightage : **50**

1. Construct a histogram / pie diagram with the data provided in A
(weightage 4)
2. Work out the problem B. (weightage 4)
3. Calibrate the given Micrometer and measure the width of the specimen C.
(Calibration 4, Measurement 2) (weightage 6)
4. Comment on D. (weightage 2)
5. Gram stain the bacterial culture E. Identify and write down the procedure. Leave the preparation for valuation.
(preparation 2, procedure 1, identification 1) (weightage 4)
6. Identify any one genus from the given mixture F.
(preparation ½, identification ½, diagram ½, reason ½) (weightage 2)
7. Prepare a vegetative propagule by layering/ grafting/budding method using the material G. Write the procedure.
(preparation 2, procedure 2) (weightage 4)
9. Find the pH of the given buffer solution (Acetate/Phosphate) in H. Record the pH. Change the pH to And write the procedure.
(Procedure 2, Report 2 + 2) (weightage 6)
9. Make suitable micropreparation to bring out the structure of I. Draw cellular diagram and label the parts. Identify giving reasons. Leave the preparation for valuation. (preparation 1, identification 1 diagram 1 reason 1) (weightage 4)
10. Spot at sight J, K, L, M and N. (5 x 1 = weightage each 1)

Submission a. 2 permanent slides

(weightage 4)

b. 5 Plant Pathology herbarium sheets

(weightage 5)

Total weightage 50

Record weightage 5

Total weightage 55

=====

SCHEME FOR THE SUPPLY OF SPECIMENS

CORE COURSE PRACTICAL PAPER I

- A. Data for constructing histogram / pie diagram.
- B. Problem for λ^2 or standard deviation.
- C. Any one microscopic Alga/fungus.
- D. Photocopy of web page NCBI/EMBL/3D Diagrams of proteins
- E. Curd.
- F. Mixture of algae containing *Volvox*, *Oedogonium*, *Spirogyra*, *Vaucheria* and *Polysiphonia*. Identify and show one alga.
- G. Layering/ grafting/ budding (selected by lot).
- H. Give a buffer solution of known pH. Provide buffer components to change the pH as required by the examiner. The change should fall within the Ph range of buffer concerned.
- I. *Sargassum/Puccinia/Albugo/Cercospora*.
- J. Parts of microscope/camera lucida/ fixative/horticulture implements.
- K. Growth curve/inoculation loop/cavity slide/coupling jar/cavity dish or cavity block.
- L. One pathology specimen included in the practical syllabus
- M. & N. any algae/ fungi mentioned in the syllabus of prtactcals, slide/specimen.

B.Sc. PROGRAMME IN BOTANY

Complementary Course - Botany Course Structure, Mark Distribution, Scheme of Examination and Syllabus

Title of Paper	Instructional Hours		Duration of Exams	Weightage				Total
	Theory	Practical		Theory		Practical		
				EE	CIE	EE	CIE	
Ist Semester Angiosperm Anatomy & Micro technique	36	36	3 hrs	20	5	--	--	25
IInd Semester Plant Physiology & Ecology	36	36	3 hrs	20	5	--	--	25
IIIrd Semeser Cryptogams, Gymnosperms, Plant Pathology & Genetics	54	36	3hrs	25	10	--	--	35
IVth Semester Morphology, Systematic Botany, Economic Botany, Plant Breeding & Horticulture	54	36	3hrs	30	10	--	--	40
Practical Paper	--	--	3hrs	--	--	55	20	75
Total	180	144				55	20	20

Scheme of Evaluation

Theory paper

Ist Semester

Total	-	25 weightage
External	-	20 weightage
Internal	-	5 weightage

Distribution of internal weightage

Attendance	-	1
Test paper	-	2
Seminar	-	1
Assignment	-	1

IInd Semester

Total	-	25 weightage
External	-	20 weightage
Internal	-	5 weightage

Distribution of Internal weightage

Attendance	-	1
Test paper	-	2
Seminar	-	1
Assignment	-	1

IIIrd Semester

Total	-	35
External	-	25
Internal	-	10

Distribution of Internal weightage

Attendance	-	2
Test paper	-	4
Seminar	-	2
Assignment	-	2

IVth Semester

Total	-	40
External	-	30
Internal	-	10

Distribution of Internal weightage

Attendance	-	2
Test paper	-	4
Seminar	-	2
Assignment	-	2

Practical paper

Total	-	75
External	-	55
Internal	-	20

Distribution of Weightage for external evaluation

Practicals	-	45
Record	-	5
Herbarium	-	5

Distribution of weightage for internal evaluation

Attendance	-	5
Practical test	-	5
Viva-voce (internal)	-	5
Record (internal)	-	5

Total		20

B. Sc Programme in Botany
Complementary course I, II, III & IV Botany

1st Semester: Angiospermic Anatomy and Microtechnique

Total: 72 Hours (Theory: 36 hours, Practical: 36 hours)

Angiospermic Anatomy : 30 hours

Microtechnique : 6 hours

2nd Semester: Biochemistry, Plant Physiology and Ecology

Total: 72 Hours (Theory: 36 hours, Practicals: 36 hours)

Plant Physiology : 27 hours

Ecology : 9 hours

3rd Semester: Cryptogams, Gymnosperms, Plant Pathology and Genetics

Total: 90 Hours (Theory: 54 hours, Practicals: 36 hours)

Cryptogams & Gymnosperms : 32 hours

Plant Pathology : 11 hours

Genetics : 11 hours

4th Semester: Morphology, Systematic Botany, Economic Botany, Plant breeding and

Horticulture.

Total: 90 Hours (Theory: 54 hours, Practicals: 36 hours)

Morphology - Theory : 8 hours Practicals : 2 hours

Systematic Botany- Theory : 28 hours Practicals : 22 hours

Economic Botany- Theory : 8 hours Practicals : 5 hours

Plant breeding - Theory : 6 hours Practicals : 4 hours

Horticulture - Theory : 4 hours Practicals : 3 hours

54 hrs

36 hrs

B. Sc Programme in Botany

Complementary Course

Botany

Semester I

Angiosperm Anatomy and Micro technique

Total: 72 Hours (Theory: 36 hours, Practicals: 36 hours)

Angiosperm Anatomy

(Theory 27 Hours)

Module I

1. Tissues - Definition, Kinds - Meristematic & Permanent;
Meristematic tissues - Classification – based on origin & position;
Organisation of root apex and differentiation of tissue – Histogen theory;
Organisation of stem apex and differentiation of tissues - Tunica & corpus theory.
Permanent tissues - Definition - classification;
Simple tissues (Parenchyma, Collenchyma and Sclerenchyma),
Complex tissues (Xylem & Phloem)
Secretory tissues - Glandular tissues (Nectaries in *Euphorbia pulcherrima*,
Stinging hairs in *Tragia*)
Oil glands in *Citrus*, *Eucalyptus*; Digestive glands in *Nepenthes*;
Laticiferous tissues (Non-articulate latex ducts in *Euphorbia* and
articulate latex duct – latex vessels in *Hevea*).
Hydathodes
2. Vascular bundles – types: conjoint - collateral, bicollateral, concentric and radial.

Module II

3. Primary structure of root, stem and leaf in dicots and monocots.

Module III

4. Normal secondary thickening in dicot stem (*Eupatorium* and *Vernonia*)
Intra stelar thickening: formation of cambial ring, its structure, fusiform and ray initials, storied and non - storied cambium, activity of the cambium, formation and structure of secondary wood, secondary phloem and vascular rays.

Extra stelar thickening: formation, structure and activity of the phellogen, formation of periderm in stem and root; bark and lenticel.

Growth rings, ring and diffuse porous wood, sapwood and heart wood, tyloses.

Normal secondary thickening in dicot root (*Tinospora* and *Papaya*)

5. Anomalous secondary growth in *Boerhaavia*.

Angiosperm Anatomy (Practicals - 30 hours)

1. Identity simple and complex tissues and determine the type of vascular bundles using microscope.
3. Make suitable micro preparations to study the anatomy of the following:
 - A. Dicot stem: *Cucurbita*, *Centella* (Primary structure);
Eupatorium, *Vernonia* (secondary structure).
 - B. Monocot stem: *Bamboo*, *grass*
 - C. Dicot root: *Tinospora* –young (Primary);
Tinospora – mature (secondary sructure)
 - D. Monocot root: *Colocasia*, *Musa*
 - E. Anomalous secondary growth (*Boerhaavia*).
 - F. Dicot leaf: *Ixora* and Monocot leaf: paddy / grass

Microtechnique

(Theory -9 hours)

Module I

Microtechnique - Brief Introduction

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

. **Microtechnique – (Practicals - 6 hrs)**

1. Familiarise the structure and working of compound microscope
2. Demonstration of microtome serial sectioning, staining and mounting.
3. Preparation of Safranin, FAA and Acetocarmine

References: Anatomy

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

References:- Microtechnique

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

B. Sc. Programme in Botany

Complementary Course

Botany

Semester II

Plant Physiology and Ecology

Total: 72 Hours (Theory: 36 hours, Practicals: 36 hours)

Plant Physiology (theory 27 hours)

Module I

1. Structure of plant cell and cell organelles (Brief account only)
2. Water relations - Permeability, Imbibition, Diffusion, Osmosis and water potential
3. Absorption of water- Active and passive mechanisms
4. Transpiration -Types, mechanism of stomatal movement: K^+ ion theory, significance of transpiration, antitranspirants.
5. Ascent of sap -Root pressure theory, Transpiration pull or cohesion-tension theory.

(12 hours)

Module II

6. Photosynthesis-Introduction, significance, Two pigment systems, red drop, Emerson enhancement effect, action and absorption spectra.
Mechanism of photosynthesis - Light reaction, cyclic & non-cyclic photo phosphorylation,
Dark reactions–Calvin cycle, C_4 cycle, photorespiration (a brief account only).
Factors affecting photosynthesis.
7. Respiration-Definition, Kinds of respiration-aerobic and anaerobic; Glycolysis, Krebs cycle, Terminal oxidation, Fermentation (industrial uses)

(9 hours)

Module III

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

(6 hours)

Plant Physiology Practicals - 18 hours

Learn the principle and working of the following apparatus/experiments

1. Thistle funnel osmoscope
2. Ganong's potometer
3. Ganong's light-screen
4. Ganong's respirometer
5. Absorbo transpirometer .
6. Kuhne's fermentation vessel
7. Mohl's half-leaf experiment
8. Experiment to demonstrate suction due to transpiration
9. Experiment to show evolution of O₂ during photosynthesis

Plant Ecology (Theory 9 hours)

Module I

1. Ecology - Definition, Ecosystem: ecological factors – biotic and abiotic (climatic, edaphic, and physiographic).
2. Ecological adaptations: Morphological, anatomical and physiological adaptations of the following types: Hydrophyte (*Vallisneria*, *Hydrilla*), Xerophyte (*Opuntia*, *Nerium*), Halophyte (*Avicennia*), Epiphytes (*Vanda*) and Parasites (*Cuscuta*).
3. Ecological succession –Process of succession, types of succession, Hydrosere (9 hours)

Ecology Practicals- (18 hours)

Study the morphological and anatomical adaptations of the hydrophytes, xerophytes, halophytes, epiphytes and parasites mentioned in the theory part.

References:- Plant Physiology

1. William G. I-lopkins,(1999). Introduction to Plant Physiology, 2nd edition, John Wiley A Sons, Inc.
2. Frank B. Salisbury and Cleon W. Ross (2002). Plant Physiology 3rd edition. CBS publishers and distributors.

3. G. Ray Noggle and George J.Fritz Introductory Plant Physiology Prentice Hall.
4. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.

References:- Ecology

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

B. Sc Programme in Botany

Complementary Course

Botany

Semester III

Cryptogams, Gymnosperms & Plant pathology and Genetics

Total: 90 Hours (Theory: 54 hours, Practicals: 36 hours)

Cryptogams

Module I

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

Module II

4. Phycology: General characters, classification, evolutionary trends in algae.
5. Structure, reproduction, life history and economic importance of the following classes with suitable examples: a) Chlorophyceae (*Spirogyra*) b) Phaeophyceae (*Sargassum*) c) Rhodophyceae (*Polysiphonia*). (4 hours)
6. Mycology: General characters, classification (Alexopoulos, 1979). (brief mention only) and evolutionary trends in fungi. Important features of the following divisions: a) Mastigomycotina b) Ascomycotina c) Basidiomycotina. Structure and life history of *Puccinia* (developmental details not required) (3 hours)

Module III

7. Bryology: General account, morphology and life - history of *Riccia*. (4 hours)
8. Lichenology: General account and economic importance of Lichens with special reference to *Usnea*. (3 hours)
9. Pteridology: General account, morphology and life history of *Selaginella* (4 hours)
10. Gymnosperms: General account, morphology and life history of *Cycas* (Anatomy not required) (4 hours)

Module IV

11. Plant Pathology: Study the following plant diseases with special reference to pathogens, symptoms, method of spreading and control measures.

- 1) Leaf mosaic of Tapioca 2) Citrus canker 3) Blast of paddy (11hours)

Module V

12. Introduction and brief history of genetics

Mendel's experiments, symbolisation, terminology, heredity and variation.

Monohybrid cross, Dihybrid cross, Laws of Mendel, test cross and back cross.

Modified Mendelian ratios 1) Incomplete dominance in *Mirabilis jalapa*

2) Lethal genes in *Antirrhinum majus*.

Gene interactions: Complementary genes -flower colour in *Lathyrus odoratus* (9 : 7 ratio), Epistasis - Fruit colour in *Cucurbita pepo* (12 : 3 : 1 ratio).

(11 hours)

Practicals (36 hours)

Cryptogams & Gymnosperms (30 hours).

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

Plant pathology (3 hours)

1. Identify the diseases (mentioned in the theory syllabus) on the basis of symptoms and causal organisms.

Genetics (3 hours)

1. Work out the problems in monohybrid cross, dihybrid cross and incomplete dominance.

References: - Cryptogams

1. Fritsch, F.E. 1935. The structure and reproduction of the algae. Vol. 1 and II, Uni. Press. Cambridge.
2. Morris, I. 1967. An Introduction to the algae. Hutchinson and Co. London.
3. Papenfuss, G.F. 1955. Classification of Algae.
4. B.R. Vasishta. Introduction to Algae
5. B.P. Pandey Algae
6. Mamatha Rao, 2009 – Microbes and Non-flowering plants. Impact and applications. Ane Books, New Delhi.

7. Sanders, W.B. 2001. Lichen interface between mycology and plant morphology. *Bioscience*, 51: 1025-1035.
8. B.R. Vasishta. Introduction to Fungi.
9. P.C. Vasishta Introduction to Bryophytes.
10. B.P. Pandey Introduction to Pteridophytes

References: - Gymnosperms

1. Chamberlain C.J., 1935, *Gymnosperms – Structure and Evolution*, Chicago University Press.
2. Sreevastava H.N. 1980, *A Text Book of Gymnosperms*. S. Chand and Co. Ltd., New Delhi.
3. Vasishta P.C. 1980, *Gymnosperms*. S. Chand and Co., Ltd., New Delhi.

References: - Plant Pathology

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

References: - Genetics

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

B. Sc Programme in Botany

Complementary Course

Botany

Semester IV

Morphology, Systematic Botany, Economic Botany,

Plant Breeding and Horticulture

Total: 90 Hours (Theory: 54 hours, Practicals: 36 hours)

Morphology

Module I

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

(8 hours)

Systematic Botany

Module II

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

(28 hours)

Economy Botany

Module III

1. Brief account on the various categories of plants based on their economic importance

2. Study the following plants with special reference to Botanical name, family and morphology of the useful parts.

- | | | |
|--------------|---|-------------------------|
| 1. Cereals | - | Paddy, Wheat |
| 2. Pulses | - | Black gram, Green gram |
| 3. Oil | - | Coconut, Gingelly |
| 4. Fibre | - | Cotton |
| 5. Latex | - | Rubber |
| 6. Beverages | - | Tea, Coffee |
| 7. Spices | - | Pepper, Cardamom, Clove |

8. Medicinal plants – *Rauvolfia serpentina*, *Justicia adhatoda*, *Santalum album* and *Curcuma longifolia*.

(4 hours)

Plant breeding

Module IV

1. Objectives of plant breeding
2. Methods of plant breeding: a) Plant introduction b) Selection - Mass, Pure line and clonal, c) Hybridization : intervarietal, interspecific and intergeneric hybridization. d) Mutation breeding e) Breeding for disease resistance and insect resistance

(6 hours)

Horticulture

1. Horticulture- introduction: definition, branches, significance
2. Methods of plant propagation: - Vegetative: Cutting – stem , Layering -air layering, Grafting –tongue grafting, Budding–T budding.

(8 hours)

Practicals - (36 hrs)

Morphology :

1. Identity the different types of inflorescence included in the syllabus

(2 hours)

Systematic Botany

1. Identity the families of local plants based on their vegetative and floral characters
2. Students should be able to describe the plants in technical terms and draw the L.S. of flower, construct the floral diagrams and write the floral formula.

3. Students should submit ten properly identified herbarium specimens belonging to families included in the syllabus.

(25 hours)

Economic Botany

1. Identify at sight the economically important plant produces and products mentioned in module III, and learn the binomial and family of the source plants, morphology of the useful parts and uses.

(6 hours)

Horticulture

1. Demonstration of Layering, budding and grafting.

(3 hours)

Reference:- Morphology

1. Sporne, K.R. 1974. Morphology of Angiosperms. New Delhi.

References:-Systematic Botany

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

References:- Economic Botany

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

References:- Plant Breeding

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

References:- Horticulture

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

B.Sc. Programme in Botany
Complementary Course
Botany
Semester II
Physiology and Metabolism
Model questions paper

Time: 3hrs

Part A

(Answer all questions)

1. When a cell is placed in hypotonic solution then
 - a. Cells shrinks
 - b. No change
 - c. Exomosis occurs
 - d. Endomosis occurs
2. During rainy season doors make up of were generally swell due to
 - a. Cosmosis
 - b. bad workmanship
 - c. Indeption
 - d. band quality of word
3. What will be the direction of movement of water. When a section 'A' having water potential of 9 bars an another solution B of 4 bars is separated by a some permeable membrane.
 - a. B to A
 - b. A to B
 - c. Both directions
 - d. No movement
4. The ultimate cause for the movement of water gravity in a tree is
 - a. Osmosis
 - b. Indeption
 - c. Transpiration
 - d. Photosynthesis
5. Wetting of plants occurs when
 - a. Dholem is blocked
 - b. Xylem is blocked
 - c. Both xylem and Dholem
 - d. Few old roots are removed.
6. The cohesion tension theory regarding ardent of sap was given by
 - a. J.C. Bose
 - b. Godbews ki
 - c. Chrotine wolf
 - d. Dixon & Jolly
7. Chlorophyl nucleus are green in colour because they
 - a. reflect green light
 - b. absorb green light
 - c. Transmit green light
 - d. Transform green light
8. In C₄ plants CO₂ fixation occurs
 - a. guard cells
 - b. spongy cells
 - c. Palpade cells
 - d. Bundle sheath cells
9. The last or terminal cytochrome in respiratory chain is
 - a. Cytochrome -a
 - b. Cytochrome a₃
 - c. Cytochrome - c
 - d. Cytochrome G
10. The link between glycolysis and ectric acid cycle is
 - a. NAD
 - b. FAD
 - c. Acetyl
 - d. ATP
11. The oxidation of NADH₂ yields
 - a. 18ATP
 - b. 6ATP
 - c. 3ATP
 - d. 2ATP

12. Young fruits are green but develop brilliant shade of colour towards ripening because
 - a. Amount of sugar increases in them
 - b. Amount of organic acids increases in them
 - c. Chloroplasts are degraded to carotenes and xanthophylls
 - d. If ageing
13. Ethylene gas is used for
 - a. Growth of plants
 - b. Ripening of fruits
 - c. Stopping the leaf abscission
 - d. delaying fruit abscission
14. Lactose is composed of
 - a. Glucose and fructose
 - b. Glucose and Sucrose
 - c. Glucose and Galactose
 - d. Fructose and Galactose
15. Starch and cellulose are compounds of
 - a. Amino acids
 - b. Fatty acids
 - c. simple sugars
 - d. Glycerol
16. The correct definition of biosphere is
 - a. All plants of earth
 - b. All animal on earth
 - c. All living organism
 - d. That part of earth and its atmosphere imbedded by living organisms
17. Vevepary is a condition where
 - a. Seed germinates within the fruit
 - b. Seed sports out when fruit is still attached to the tree
 - c. Seed germinates inside the fruit when it falls down
 - d. None of these
18. An aquatic plants with floating leaves have
 - a. Stomata
 - b. Stomata on petiole
 - c. Stomata on upper surface
 - d. Stomata on lower surface
19. Which is an Oligosaccharide
 - a. Ribose
 - b. Fructose
 - c. sucrose
 - d. Glycogens
20. Swollen spongy petioles are present in
 - a. Eichhronia
 - b. Pistiac. Hybrilla
 - c. Lamuarea

Part B

(Answer any Six of the following)

21. Define fermentation
22. Name the first stable product of C_3 pathway.
23. What is photolysis?
24. Name an antitranspirant
25. Mention the role of pneumatophore
26. What are the two types of decomposers?
27. Name the simplest amino acid
28. Which is the most common energy carrier in a cell.

Part C

(Answer any four of the following)

29. Differentiate between ageing and senescence.
30. What is photorespiration? Explain its significance
31. Explain the role of Gibberellins in plant growth and development.
32. What is photoperiodism? Classify plants accordingly.
33. How is cactus adapted to live in deserts.
34. What are the functions of carbohydrates in plants.

Part D

Answer any two of the following

35. Discuss the mechanism and significance of Hatch and Slack pathway in Photosynthesis.
36. Describe the steps of citric acid cycle.
37. What is plant succession? Describe Hydrosere.

B.Sc. Programme in Botany
Complementary Course
Botany
Semester IV
Morphology, Systematic, Botany, Economics Botany,
Plant breeding and Horticulture
Model questions paper
Part A

(Answer all questions)

Time: 3hrs

1. Spadix is an inflorescence found only in
a. Monocots b. Dicots c. Poaceae d. Asteraceae
2. Leaves without petiole are called
a. Rachis b. Lamina c. Sessile d. Petiolate
3. Air-pollution effects are usually found on
a. Roots b. Stems c. Leaves D. All of these
4. Select the correct combination of inflorescence
a. Cyathium, Verticillaster, Hypanthodium, Catkin
b. Capitulum, globose head, verticillaster, Catkin.
c. Simple raceme, corymb, umbel, simple cyme
d. Simple raceme, spadix, spike, catkin.
5. Most of the cereals belong to:
a. Papilionaceae b. Malvaceae
c. Poaceae d. Solanaceae
6. A group of interbreeding organisms is referred to be belonging to:
a. species b. order c. genus d. family
7. The term systematics was introduced by
a. Linnaeus b. A.P. Candolle
c. Sir Julian Huxley d. Bentham and Hooker
8. Correct statement for Malvaceae is:
a. Zygomorphic flowers b. Inferior ovary
c. Stamens limited d. Monadelphous stamens
9. Cyathium inflorescence is characteristic of
a. Genus Oecumena b. Genus Euphorbia
c. Family Asteraceae d. Family Euphorbiaceae
10. In which family inferior ovary is present?
a. Malvaceae b. Poaceae
c. Solanaceae d. Rubiaceae

11. Which can be considered equivalent of a perianth?
 - a. Glume
 - b. Lodicule
 - c. Superior palea
 - d. Lemma
12. Presence of epicalyx and Monadelphous condition of stamens is a characteristic feature of family
 - a. Rubiaceae
 - b. Malvaceae
 - c. Solanaceae
 - d. Papilionaceae
13. Pulses are good sources of:
 - a. Protein
 - b. Carbohydrate
 - c. Fat and carbohydrate
 - d. Cellulose
14. Coffee and tea may be classified as:
 - a. Distilled beverage
 - b. Alcoholic beverages
 - c. Non alcoholic beverages
 - d. Fermented beverage
15. Poreline breeds referred to:
 - a. Homozygosity only
 - b. Heterozygosity
 - c. Heterozygosity and independent assortment
 - d. Heterosis
16. Which is the oldest breeding method?
 - a. Selection
 - b. Hybridisation
 - c. Mutation breeding
 - d. Introduction
17. The most useful part of cinnamon is
 - a. Flower
 - b. Bark
 - c. Wood
 - d. Leaves
18. The enzyme papain is obtained from any one of the following of carica papaya
 - a. Roots
 - b. Seeds
 - c. Lax
 - d. Leaves
19. The Botanical name of pomegranate is
 - a. Carica papaya
 - b. Punica granatum
 - c. Aloe vera
 - d. Trigonella
20. Commercial cloves are the _____ of Syzygium aromaticum
 - a. Leaf
 - b. Flower bud
 - c. Bark
 - d. Root

Part B

(Answer any Six of the following)

21. Define phyllotaxy. Mention different types.
22. Chemicals used to preserve herbarium sheets.
23. Why grafting is not successful in monocots?
24. Name the alkaloid extracted from Rauwolfia.

25. Write the floras formula of a papilionaceous member.
26. Expand ICBN.
27. Describe the fruit of Poaceae.
28. Assign the following plants to the respective families.
 1. Araceae
 2. Rubber

Part C

(Answer any four of the following)

29. Refer the following plants to the natural orders giving reasons for doing so.
 1. Cotton
 - b. Capsicum
30. Mention any two plants which flower during this season. Refer them to the respective families giving reason.
31. What is the importance of Quarantine in plant breeding technique?
32. What is meant by Doctrine of signature? Explain it by giving suitable examples.
33. Describe the spikelet of Poaceae with suitable diagrams.
34. What is placentation? Write different types.

Part D

(Answer any two of the following)

35. Give the characteristics of the family coming under sub class Polypetalae.
36. Discuss the modern trends in taxonomy giving suitable examples.
37. Define hybridisation and describe the process of hybridisation.

B.Sc. Programme in Botany
Complementary Course

Botany

Model Practical Examination
(External)

Time: 3 hrs

1. Prepare a T.S. of specimen A. Stain and mount in glycerine. Draw cellular diagram and label the parts. Identify giving reasons. Leave the preparation for valuation.
 (Preparation – 4; Diagram – 2; Reasons 2; Identification – 1) 9 weightage
2. Refer specimen B to its family, giving diagnostic vegetative and floral characters.
 (Identification 1 + Reasons 3) 4 weightage
3. Take a v.s. of flower C. Draw a labelled diagram. Construct the floral diagram and give the floral formula.
 (Diagram - 1 ½, Floral diagram - 1 ½, Floral formula - 1) 4 weightage
4. Make suitable micropreparations of D. Draw labelled diagram. Identify giving reasons. Leave the preparation for valuation.
 (Preparation – 2, Diagram – 1, Identification – 1, Reasons – 1) 5 weightage
5. Give the ecological group of specimen E, with important adaptations.
 (Identification - ½ + Adaptations -1 ½) 2 weightage
6. Set up the experiment F. Explain the working and state its aim:
 (Set up – 2; Working – 1; Aim – 1) 4 weightage
7. Give the binomial, family and morphology of useful parts in G & H.
 (Binomial – 1; Family - ½ ; Morphology - ½) 2x2 = 4 weightage
8. Name the disease, pathogen and important symptoms in I.
 (Name -1, Pathogen -1, Symptoms - 1) 3 weightage
9. Detect the major chemical content in J. 3 weightage
10. Spot at sight, specimens K, L and M.
 (1 + 1 + 1) 3 weightage
11. Genetics problem – N. 4 weightage

 45 weightage

Record 5 weightage

Herbarium 5 weightage

 Total 55 weightage

=====

Scheme of Specimens

1. A - Anatomy materials – root or stem (Primary or Secondary) and anomalous secondary thickening (*Boerhaavia* stem)
2. B - Twig with flower of dicot plants mentioned in the syllabus
3. C - A flower and flower buds belong to the families included in the
- Specimens from cryptogams included in the syllabus
5. E - Ecology materials given in their respective centres.
6. F - Physiological experiments mentioned in the syllabus
7. G - Economic botany materials included in the syllabus
8. H - Pharmacognosy.
9. I - Diseased specimens included in the syllabus
10. J - Biochemistry - Test for Sugar – Benedict's test
Test for starch – Iodine test
Test for protein – Biuret test
11. K - Specimens or slides from the Thallophyta, Bryophyta,
Pteridophyta and Gymnosperms
12. L - Microtechnique
13. M - Herbarium sheet from students' submission.
14. N - Genetics problem.