

Appendix to UO No. Acad/C2/2471/2007 Dt. 22/08/2007

KANNUR UNIVERSITY
B.Sc. BOTANY (MAIN) 2007 Admission

SCHEME OF EXAMINATION

YEAR	PAPER	HOURS/WEEK		DURATION OF EXAMINATION	EVALUATION		TOTAL
		THEORY	PRACTICAL		ALLOTMENT OF MARKS		
					EXTERNAL	INTERNAL	
I	I	2	2	3	55	10	65
II	II	3	2	3	55	10	65
III	III	4	3	3	55	10	65
	IV	4	2	3	55	10	65
	V	5	1½	3	55	10	65
	VI	4	1½	3	55	10	65
TOTAL	6	22	12	18	55 X 6 = 330	60	390

LIST OF DISTRIBUTION OF MARKS FOR PRACTICAL EXAMINATIONS			
PAPER	TOPICS	TIME	MARKS EXTERNAL
I	PHYCOLOGY, MYCOLOGY, LICHENOLOGY, BRYOLOGY, MICROBIOLOGY, PTERIDOLOGY, PALAEOBOTANY & PLANT PATHOLOGY.	3 HOURS	45
II	PLANT MORPHOLOGY, SYSTEMATIC BOTANY, APPLIED BOTANY, REPRODUCTIVE MORPHOLOGY AND ANGIOSPERM ANATOMY.	3 HOURS	45
III	GYMNOSPERMS, PLANT PHYSIOLOGY, BIO-CHEMISTRY, ENVIRONMENTAL SCIENCE, CYTOLOGY, GENETICS AND PHYTO GEOGRAPHY.	3 HOURS	45
TOTAL		9 HOURS	135

DETAILS OF INTERNAL ASSESSMENT - THEORY		PAPER- WISE - 10 Marks
ATTENDANCE	90% TO 100% - 2 Marks 75 % TO 89% - 1 Mark LESS THAN 75% - 0 Mark	
ASSIGNMENT	1 – ASSIGNMENT = 2 Marks	
SEMINAR	1 – SEMINAR = 2 Marks	
2 CLASS TESTS/TERMINAL OR MODEL EXAMINATIONS (AVERAGE OF TWO TEST PAPERS MAY BE CONSIDERED)	2 X 2 = 4 MARKS. Above 75 % - 4 Marks 60 % to 74% - 3 Marks 40% to 59% - 2 Marks Below 40% - 1 Mark	

DETAILS OF INTERNAL ASSESSMENT- PRACTICAL	
ATTENDANCE	2 Marks
REGULARITY IN SUBMITTING RECORDS	1 Mark
PERFORMANCE IN LAB: WORK.	2 Marks
TOTAL – 5 x 3	15 Marks
RECORD PAPER WISE - 10 x 3	30 Marks
HERBARIUM SUBMISSION	7 Marks
FIELD BOOK WITH TOUR REPORT	3 Marks
COLLECTION, IDENTIFICATION, SUBMISSION OF LOWER GROUPS OF PLANTS (10 Numbers)	5 Marks
TOTAL	60 Marks

PROJECT AND VIVA-VOCE EXTERNAL EVALUATION	
PROJECT (Minimum Two Projects From Third B.Sc Botany)	10 Marks
VIVA-VOCE	5 Marks
TOTAL	15 Marks

ELIGIBILITY TO APPEAR FOR PRACTICAL EXAMINATION

1. Certified and bonafide Record
2. Herbarium & Field Book
3. Certified and bonafide Project Report
4. Collection of Lower groups with a Brief Report

(verify this report on the first day of practical examination)

Specimens preserved in Formaldehyde Acetic Alcohol (FAA) or Herbarium sheets of Algae, Fungi, Lichen, Bryophytes, Pteridophytes, Gymnosperms and Pathology

DISTRIBUTION OF HOURS IN DIFFERENT PAPERS

PAPER - I:		
PHYCOLOGY, MYCOLOGY, LICHENOLOGY, BRYOLOGY AND PLANT PATHOLOGY		
TOPICS	THEORY	PRACTICAL
PHYCOLOGY	20	20
MYCOLOGY & LICHENOLOGY	15	15
BRYOLOGY	15	20
PLANT PATHOLOGY	10	05
TOTAL	60	60

PAPER - II: PTERIDOLOGY, GYMNOSPERMS, ANGIOSPERM ANATOMY, PALAEO BOTANY AND EVOLUTION		
TOPICS	THEORY	PRACTICAL
PTERIDOLOGY	20	15
GYMNOSPERMS	15	10
PALAEOBOTANY	10	05
ANGIOSPERM ANATOMY	35	30
EVOLUTION	10	--
TOTAL	90	60

PAPER – III: ANGIOSPERM MORPHOLOGY, SYSTEMATIC BOTANY, APPLIED BOTANY, REPRODUCTIVE BOTANY, PALYNOLOGY, ETHNO BOTANY, PHARMACOGNOSY, BIO INFORMATICS AND MICRO TECHNIQUE		
TOPICS	THEORY	PRACTICAL
ANGIOSPERM MORPHOLOGY	10	10
SYSTEMATIC BOTANY	45	60
APPLIED BOTANY	10	10
REPRODUCTIVE BOTANY	15	08
PALYNOLOGY	05	02
ETHNOBOTANY	05	--
PHARMACOGNOSY	05	--
BIO- INFORMATICS.	15	10
MICROTECHNIQUE.	15	05
TOTAL	125	105

PAPER – IV: PLANT PHYSIOLOGY, BIOCHEMISTRY, BIOPHYSICS AND BIOTECHNOLOGY		
TOPICS	THEORY	PRACTICAL
PLANT PHYSIOLOGY	60	40
BIO-CHEMISTRY	30	10
BIO-PHYSICS	10	05
BIO-TECHNOLOGY	30	05
TOTAL	130	60

PAPER – V: ENVIRONMENTAL SCIENCE, PHYTOGEOGRAPHY, BIOMETRICS, PLANT BREEDING, MICROBIOLOGY AND RESEARCH METHODOLOGY		
TOPICS	THEORY	PRACTICAL
ENVIRONMENTAL SCIENCE	60	15
PHYTOGEOGRAPHY	10	05
BIO-METRICS	15	05
PLANT BREEDING	15	10
MICROBIOLOGY	30	5
RESEARCH METHODOLOGY.	05	--
TOTAL	135	40

PAPER – VI: CYTOLOGY AND GENETICS		
TOPICS	THEORY	PRACTICAL
GENETICS	90	30
CYTOLOGY	30	05
TOTAL	120	35

TOTAL DURATION OF B. Sc. BOTANY (MAIN) DEGREE COURSE	
THEORY	660 HOURS
PRACTICALS	360 HOURS

SCHEME OF EXAMINATION B.Sc BOTANY MAIN- THEORY

Year of study	Hours of study		Name of Paper	Duration of examination	Marks		Total
	Theory	Practical			External	Internal	
I	60	60	Paper I Phycology, Mycology, Lichenology, Bryology and Plant Pathology	3 Hours	55	10	65
II	90	60	Paper II Pteridology, Gymnosperms, Angiosperm Anatomy, Palaeobotany and Evolution	3 Hours	55	10	65
III	125	100	Paper III Angiosperm Morphology, Systematic Botany, Applied Botany, Reproductive Botany, Palynology, Ethno botany, Pharmacognosy, Bio informatics and Micro technique	3 Hours	55	10	65
	130	60	Paper IV Plant Physiology, Biochemistry, Biotechnology, Biophysics	3 Hours	55	10	65
	135	45	Paper V Environmental Science, Phytogeography, Biometrics, Plant Breeding, Microbiology and Research Methodology	3Hours	55	10	65
	120	35	Paper VI Cytology and Genetics	3 Hours	55	10	65
TOTAL				18	330	60	390

SCHEME OF EXAMINATION B.Sc BOTANY MAIN - PRACTICAL

Year of study	Name of Practical Paper	Duration of Examination	Marks		Total
			External	Internal	
I	No Practical Examination				
II	No Practical Examination				
III	Paper I Phycology, Mycology, Lichenology, Bryology, Pteridology, Palaeobotany and Plant pathology	3 Hours	45	05	50
	Paper II Angiosperm Anatomy, Angiosperm Morphology, Systematic Botany and Reproductive Botany.	3 Hours	45	05	50
	Paper III Gymnosperm, Plant Physiology, Biochemistry, Environmental science, Microbiology, Cytology And Genetics	3Hours	45	05	50
	Record 3x10		-	30	60
	Herbarium		-	07	
	Field Book with Tour Report		-	03	
	Collection and submission of Lower groups of plants		-	05	
	Project		10	-	
	Viva -Voce		05	-	
TOTAL			150	60	210

PAPER I

PHYCOLOGY, MYCOLOGY, LICHENOLOGY, BRYOLOGY AND PLANT PATHOLOGY

Distribution of Hours

	Theory	Practical
Phycology	20	20
Mycology and Lichenology	15	15
Bryology	15	20
Plant pathology	10	05
Total	60	60

PHYCOLOGY - [Theory 20 Hours; Practical 20 Hours]

1. Introduction – Range of thallus structure – Phylogenetic trends – Pigments – Reproduction – Life cycle – Classification based on F .E Fritsch 2 Hours
2. General characteristics of the following major groups stressing the structure, reproduction and life cycle of the types given below (*Developmental details are not required*) –
 - a. Cyanophyceae - *Nostoc*
 - b. Chlorophyceae - *Chlorella, Volvox, Ulothrix, Cladophora, Zygnema, Oedogonium* and *Chara*
 - c. Xanthophyceae - *Vaucheria*
 - d. Bacillariophyceae - *Pinnularia*
 - e. Phaeophyceae - *Sargassum*
 - f. Rhodophyceae - *Polysiphonia* 15 Hours
3. Economic importance
 - a. Role of algae in soil fertility- Fertilizer – Nitrogen fixation- Symbiosis
 - b. Commercial products of algae – Agar, Alginates, Carrageenin, Diatomaceous earth
 - c. Algae - medicinal aspects, algal blooms and red tides 3 Hours

Practical – 20 Hours.

1. Make micro preparations of vegetative and reproductive structures of the types mentioned in the syllabus.
2. Identify the algal specimens up to the generic level and make labelled sketches of the specimens observed.

MYCOLOGY AND LICHENOLOGY - [Theory 15 Hours; Practical 15 Hours]

1. Introduction, structure, reproduction, life cycle, evolutionary trends, Classification based on AINSWORTH 2 Hours.
2. Distinguishing characters of different classes of fungi representing the following genera (*Developmental details are not required*).
 - a. Myxomycotina - General characters.
 - b. Zygomycotina - *Rhizopus*
 - c. Ascomycotina
 - Hemiascomycetes - *Saccharomyces*
 - Plectomycetes - *Penicillium*
 - Pyrenomycetes - *Xylaria*
 - Discomycetes - *Peziza*
 - d. Basidiomycotina
 - Teliomycetes - *Puccinia*
 - Hymenomycetes - *Agaricus*
 - e. Deuteromycotina - *Cercospora* 10 Hours.
3. Economic importance of Fungi; Mycorrhiza. 1 Hour.

LICHENOLOGY

General account and economic importance; the structure, reproduction and life cycle of *Usnea* 2 Hours.

Practical- 15 Hours.

1. Make micro preparation of vegetative and reproductive structures of the types mentioned in the syllabus.
2. Identify the specimens up to generic level.
3. Make labelled sketches of the specimens observed.

BRYOLOGY - [Theory 15 Hours; Practical 20 Hours]

1. Introduction and Classification 2 Hours.
2. Study of the habit, thallus organization, vegetative and sexual reproduction and alternation of generation of the following types (*Developmental details are not required*).
 - Riccia, Marchantia, Funaria* 12 Hours.
3. Economic Importance of Bryophytes 1 Hour.

Practical - 20 Hours

1. *Riccia* – Habit - Internal structure of thallus – V. S. of thallus through archegonia, antheridia and sporophyte
2. *Marchantia* –Habit- thallus T. S., thallus with Archegonial receptacle, Antheridial receptacle, Male receptacle V. S., Female receptacle e VS., T.S. of thallus through gemma, Sporophyte V. S.
3. *Funaria* – Habit, V. S. of archegonial cluster, V. S. of antheridial cluster, Sporophyte V. S.

PLANT PATHOLOGY – [Theory 10 Hours; Practical 5 Hours]

1. History of plant pathology – Classification of plant diseases on the basis of causative organisms and symptoms – Host parasite interaction – Defence mechanism in host, Mechanism of infection, transmission and dissemination of diseases **2 Hours**
2. Control of plant diseases – Quarantine and seed certification –remedial and biological control. **2 Hours**
3. Study of the following diseases with emphasis on symptoms, disease cycle and control measures of Leaf mosaic of Tapioca, Citrus Canker, Bunchy Top of Banana, Quick wilt of Pepper, Soft rot of Ginger (*Pythium aphanidermateum*), Blast disease of Paddy, Abnormal leaf fall of Rubber **5 Hours**
4. Brief account of the following fungicides-
Bordeaux mixture , Tobacco decoction , Neem cake & oil. **1 Hour**

Practical - 5 Hours

1. Identify the Diseases mentioned with respect to causal organism and symptoms
2. Students should be trained to prepare the fungicide Bordeaux mixture & Tobacco decoction.

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1. BHATIA K. N. - A treatise on Algae New Delhi - S. Chand and Co.
2. BILRAMI K. S. & DUBE -A Text book on modern Plant Pathology - Vikas Publishing House, New Delhi
3. CHOPRA R.N. & KUMAR P. K. – Biology of Bryophytes - Wiley Eastern Ltd. New Delhi
4. DUBE - A Text Book of Fungi, Bacteria, and Virus - Vikas Publishing House, New Delhi
5. DUBE H. C. – An Introduction to Fungi -Vikas Publishing House, New Delhi
6. FRITSCH, F. E. - Structure and reproduction of Algae Vol .1 and 11,Cambridge University Press London

7. GANGULEE DAS AND DUTTA - College Botany Vol.1 Central Book Depot., Calcutta
8. KUMAR H .D and SINGH A.N. - A Text Book on Algae
9. PANDEY AND TRIVEDI - A Text Book of Fungi, Bacteria and Virus –Vikas Publishing House New Delhi
10. PARIHAR N .S . – An introduction to Bryophyta - Central Book Depot. Alahabad
11. PREMPURI –Bryophytes –a broad perspective - Athmaram and Sons
12. RENGASWAMY G . - Disease of Crop plants in India - Prentice Hall of India New Delhi
13. SHARMA O .P . - A Text Book of Algae
14. SMITH K. M. - A Text Book of Plant Diseases.
15. TRAINOR F. R. - Introductory Phycology- John Wiley and sons Inc. New York
16. VASISHTA B. R. - Bryophyta - S. Chand and Co. New Delhi

PAPER II

PTERIDOLOGY, GYMNOSPERMS, ANGIOSPERM ANATOMY, PALAEO BOTANY AND EVOLUTION

Distribution of Hours	Theory	Practical
Pteridology	20	15
Gymnosperms	15	10
Angiosperm Anatomy	35	30
Palaeo botany	10	05
Evolution	10	00
Total	90	60

PTERIDOLOGY – [Theory 20 Hours; Practical 15 Hours]

1. Introduction: General characters morphological and phylogenetic classification. 2 Hours.
2. Study of the habitat, habit, internal structure, reproduction and life cycle of the following types
(Developmental details not required).
Psilotum, Lycopodium, Selaginella, Equisetum, Adiantum and Marsilea. 15 Hours
3. General Topics: Stellar evolution in Pteridophytes, heterospory and seed habit, relationships of pteridophytes with bryophytes and gymnosperms, economic importance of pteridophytes. 3 Hours

Practical - 15 Hours

1. *Psilotum*: External features, stem T.S., synangium T.S.
2. *Lycopodium*: Habit, stem T.S., strobilus V.S.
3. *Selaginella*: Habit, rhizophore T.S., stem T.S., axis with strobilus, V.S. of strobilus, Megasporophyll and microsporophyll.
4. *Equisetum* - Habit, rhizome and stem T.S. and V.S. of strobilus.
5. *Adiantum* - Habit, Petiole T.S., sporophyll T.S., prothallus
6. *Marsilea* - Habit, Rhizome and petiole T.S., sporocarp T.S., V.S. and R.L.S.

GYMNOSPERMS – [Theory 15 Hours; Practical 10 Hours]

1. Introduction and classification of gymnosperms. 2 Hours.
2. Study of the Habit, Anatomy, Reproduction and life cycle of the following types
(Developmental details are not required) -
Cycas, Pinus and Gnetum. 10 Hours

3. Evolutionary trends in gymnosperms - Relationship of gymnosperm with pteridophytes and angiosperms - Economic importance of gymnosperms. 3 Hours.

Practical - 10 Hours

- 1 *Cycas* – seedling , coralloid root and coralloid root T. S ., T . S . of leaflet and petiole ,micro and mega sporophyll, male cone V. S ., micro sporophyll T. S . , entire and V. S . of ovule.
- 2 *Pinus* - Branch of indefinite growth ,spur shoot, T. S of old stem and needle R .L .S and T. L . S. of stem , male and female cone, V .S . of male and female cone.
- 3 *Gnetum* -: Habit, stem T. S (young and mature), leaf T. S, male and female strobilus, V . S . of male and female cone, ovule V. S . and seed

Angiosperm Anatomy – [Theory 35 Hours; Practical 30 Hours]

- 1 Objective and scopes of plant anatomy 1 Hour
- 2 Cell wall organization - Gross structure - Primary and secondary wall pits – plasmodesmata - microscopic and sub microscopic structures – Extra cell wall material. Non living inclusions of the cell – Reserve food - secretory products, by products. 5 Hours
- 3 Tissues – Meristems, Definition , Classification based on origin, position, growth patterns, functions. 2 Hours
- 4 Apical meristems & theories on apical organization - Apical cell theory, Histogen theory, Tunica -Corpus theory. Organization of root apex in dicots & monocots. 5 Hours
- 5 Permanent tissues – Definition, classification - simple, complex and secretory. 5 Hours
- 6 Tissue systems – Epidermal tissue systems, Ground tissue systems & Vascular tissue systems. Different types of vascular arrangements. 3 Hours
- 7 Primary structure – Root, stem and leaf [Dicot & Monocot]. Secondary growth - Root and stem, Anomalous secondary growth - *Bignonia, Boerhaavia, Dracaena*. 12 Hours
- 8 Origin of lateral roots, Nodal Anatomy, Abscission of leaf. 2 Hours

Practical – 30 Hours

- 1 Non living inclusions - Cystolith , Raphide , Sphaero-raphide, Aleurone grains.
- 2 Starch grains (Eccentric, concentric, compound)
- 3 Apical meristem (Root apex and Stem apex)

- 4 Simple permanent tissue – Parenchyma, Chlorenchyma , Aerenchyma , Collenchyma and Sclerenchyma
- 5 Primary structure – Dicot stem : *Hydrocotyle, Coccinia, Eupatorium* or any dicot stem.
- 6 Monocot stem : Bamboo, Grass , *Asparagus* or any monocot stem.
- 7 Dicot root : *Tinospora, Ficus, Pea*.
- 8 Monocot root : *Colocasia, Hedychium, Pandanus* or any monocot root .
- 9 Secondary structure - Stem [Normal type]- *Tinospora, Thithonia, Vernonia* or any normal type
- 10 Secondary structure - Root [Normal type]- *Tinospora, Ficus, Carica papaya, Ricinus* or any normal type
- 11 Secretory tissue : Resin canal, Nectary, Latex vessel, Lysigenous and Schizogenous cavities. Laticifers – Articulated and non articulated.
- 12 Epidermal structures – Trichomes, Hairs, Glands, Stomata.
- 13 Anomalous secondary thickening - *Bignonia, Dracaena, Boerhaavia*
- 14 Leaf anatomy - Dicot leaf : *Ixora*. Monocot leaf : Grass

PALAEO BOTANY – [Theory 10 Hours; Practical 5 Hours]

- 1 Objectives of palaeo botany. Fossil formation – Techniques of study.
- 2 Geological time scale. Evolutionary trends
- 3 Primitive land plants - Precambrian flora - Algae, Fungi and Bryophyta.
- 4 Fossil pteridophytes – *Rhynia, Lepidodendron, Lepidocarpon* . Fossil Gymnosperm - *Lygenopteris*.
- 5 Applied aspects of Palaeobotany - Exploration of fossils – Exploration of fuels.

Practical - 5 Hours.

- 1 Fossil pteridophytes – *Rhynia* Stem , *Lepidodendron, Lepidocarpon*.
- 2 Gymnosperm - *Lygenopteris*

EVOLUTION – [Theory 10 Hours]

- 1 Progressive and Retrogressive.
- 2 Parallel and Convergent evolution.
- 3 Micro and Macro evolution .
- 4 Theory of Lamarck, Wiesman and De vries, Darwinism, Neo- Darwinism
- 5 Isolation, Mutation, Genetic drift, Speciation

- 6 Variation and Evolution – Hybridization and Evolution – Polyploidy and evolution – Mutation and evolution.

REFERENCES

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2. Arnold C . A (1947) - Introduction to Palaeobotany - McGraw Hill Co. New Delhi.
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4. Coutler E. G. (1969) Plant Anatomy – Part I Cells and Tissues – Edward Arnold , London.
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PAPER III

ANGIOSPERM MORPHOLOGY, SYSTEMATIC BOTANY, APPLIED BOTANY, REPRODUCTIVE BOTANY, PALYNOLOGY, ETHNO BOTANY, PHARMACOGNOSY, BIO INFORMATICS AND MICRO TECHNIQUE

Distribution of Hours

	Theory	Practical
Angiosperm Morphology	10	10
Systematic Botany	45	60
Applied botany	10	10
Reproductive Botany	15	08
Palynology	05	02
Ethno botany	05	--
Pharmacognosy	05	--
Bio informatics	15	10
Micro technique	15	05
Total	125	105

ANGIOSPERM MORPHOLOGY – [Theory 10 Hours; Practical 10 Hours]

1. Inflorescence: Racemose, Cymose & Mixed / Special types with examples
2. Flower-as a modified shoot, Flower parts, their arrangements, relative position, numeric- plan, cohesion, adhesion, symmetry of flower, aestivation types, placentation types, floral diagram & floral formula.
3. Classification of fruits with examples 10 Hours.

Practical - 10 Hours.

Identify, describe the different types of Inflorescence, flowers, fruits,& placentation types.

SYSTEMATIC BOTANY – [Theory 45 Hours; Practical 60 Hours]

1. Objectives, Importance of Systematics. 1 Hour.
2. A Brief History of Angiosperm classification. 5 Hours.
3. Detailed study of Bentham & Hooker 's System of classification 3 Hours.
4. Plant Nomenclature 2 Hours.
5. Herbarium technique-Important Herbaria, Botanical Gardens. 2 Hours.
6. Origin of Angiosperms - Brief account. 2 Hours.
7. Study of the following families with special reference to morphology of modified parts if any and plants of economic importance.

Annonaceae, Nymphaeaceae, Capparidaceae, Malvaceae, Rutaceae, Anacardiaceae, Leguminosae [Fabaceae – 3 Sub families], Myrtaceae, Combretaceae, Cucurbitaceae, Apiaceae.

Rubiaceae, Asteraceae, Sapotaceae, Apocynaceae, Asclepiadaceae, Convolvulaceae, Solanaceae, Scrophulariaceae, Acanthaceae, Verbenaceae, Lamiaceae.

Amaranthaceae , Euphorbiaceae .

Orchidaceae , Scitaminae , Lilliaceae , Arecaceae , Poaceae . 30 Hours.

Practical - 60 Hours.

Study of representative members [at least two] of all the prescribed families as evidenced by the record of practical work.

A minimum of 30 herbarium specimens giving representation to all the prescribed families with field notes of at least 50 plants collected.

Identification of herbarium specimens and campus plants.

Fieldwork for the study of plants of different climatic conditions under the supervision of teacher's for at least 7 days. Visit of any tribal colony to study the plants used by them in their daily life.

(Field study is compulsory for appearing practical examinations).

APPLIED BOTANY - 10 Hours.

Study of the Botanical name, Family, Morphology of useful parts, and utility of the following;

- 1 Cereals & millets - Rice, Wheat, Maize, Ragi.
- 2 Legumes - Horse gram, Ground nut, Bengal gram, Black gram, Green peas.
- 3 Sugar yielding plants - Sugarcane, Sweet potato.
- 4 Spices & condiments - Cinnamon, Cumin, Clove, Cardamom, Pepper.
- 5 Fibre – Cotton, Coir, Jute.
- 6 Dyes - Indigo, Henna.
- 7 Rubber - Para rubber.
- 8 Gums & resins - Gum Arabic, Asafoetida.
- 9 Tuber crops - Tapioca, Yam, Carrot, Potato, *Colocasia*.
- 10 Tropical Fruits - Banana, Jack Fruit, Pineapple.
- 11 Oil yielding - Sesame oil, Palm oil, mustard oil.
- 12 Medicinal plants - *Ocimum* , *Acorus* , *Adhatoda* , *Sida* , *Phyllanthus* , Turmeric.
- 13 Beverages - Coffee, Tea, Cocoa .

Practical - 10 Hours.

Study of the raw materials or direct products mentioned in the syllabus with study of common plants used by tribals as mentioned in ethnobotany.

ETHNO BOTANY - 5 Hours.

- 1 Definition – importance, scope, categories and significance.
- 2 Study of various methods to collect Ethno botanical data.
- 3 Plant parts used by tribes in their daily life: as food, clothing, shelter, agriculture and medicine.
- 4 Study of common plants used by tribes. *Aegle marmelos*, *Ficus religiosa*, *Curcuma longa*, *Cynadon dactylon*, *Ocimum sanctum* and *Mangifera indica*.

REPRODUCTIVE BOTANY - [Theory 15 Hours; Practical 8 Hours]

- 1 Introduction to angiosperm embryology with special reference to Indian embryologists.
- 2 Micro sporogenesis - structure and functions of wall layers.
- 3 Development of male gametophyte - Dehiscence of anther.
- 4 Megasporogenesis - Development of female gametophyte - Embryo sac - Development and types - Monosporic – *Polygonum* type, Bisporic - *Allium* type, Tetrasporic - *Adoxa* type.
- 5 Pollination - Fertilization - Barriers of fertilization - Germination of pollen grains - Double fertilization.
- 6 Structure of Embryo- Dicot [*Capsella*], Monocot [*Triticum*]
- 7 Endosperm types, its development and functions.

PALYNOLOGY - [Theory 5 Hours; Practical 2 Hours]

Pollen structure, pollen morphology, pollen allergy - viability test for pollen grains, Economic importance and its importance in taxonomy.

Practical - 10 Hours.

Identify C. S. of anther; Dicot embryo, Monocot embryo & 8 nucleated embryo sac.

Study of pollen grains of any 3 plants.

PHARMACOGNOSY - [Theory 5 Hours]

- 1 Historical development of pharmacognosy, Definition & scope of pharmacognosy, Relation to allied fields of study, Systematic scheme of pharmacognosic studies, Systems of classification of drugs.
- 2 Sources of crude drugs - roots, rhizome, bulb, corm, leaves, stem, flowers, fruits & seeds.
- 3 Source of tannins & dyes.

BIO-INFORMATICS – [Theory 15 Hours; Practical 10 Hours]

- 1 History and development of computers – digital computers, analog computers, hybrid computers. 2 Hours
- 2 Business & scientific computers, micro, mini, mainframe, super computers. 2 Hours
- 3 General awareness of computer hardware - CPU and other peripheral devices - input, output, computer memory, and auxiliary storage devices. 2 Hours
- 4 Basic knowledge of computer systems- Software-types, Programming languages - machine language, assembly language & high level language. 2 Hours
- 5 General awareness of popular commercial & scientific software packages. 2 Hours
- 6 Introduction to the Web – Biology home page. 2 Hours
- 7 Information retrieval system – WEB search engines – Biological Abstracts. 2 Hours
- 8 General account of applications of computers. 1 Hour

Practical -10 hours

- 1 All theory classes should be conducted with the aid of personal computers.
- 2 Students are expected to work with at least any one of the commercial / scientific software packages, to explore the web and to be able to find, recognize, download, install & use software in various areas useful to the research of biology.

MICRO TECHNIQUE - [Theory 15 Hours; Practical 5 Hours]

1. Introduction - microscopy - simple and compound – phase contrast; dark field illumination and electron microscopes. 3 Hours
2. Microtome – rotary and sledge 1 Hour
3. Killing and fixation agents – Carnoy's formula, Farmer's formula, F.A.A 1 Hour
4. Dehydration - reagents 1 Hour
5. Sectioning - hand and microtome 2 Hours
6. Stains and staining techniques - double staining. General account; Stains: safranin, hematoxylin, acetocarmine. 3 Hours
7. Mounting media: D.P.X and Canada balsam 1 Hour
8. Whole mounts - cytological methods: maceration, smear and squash preparation. 3 Hours

Practical - 5 Hours

General awareness of Micro technique - maceration, smears

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PAPER IV

PLANT PHYSIOLOGY, BIOCHEMISTRY, BIOPHYSICS AND BIOTECHNOLOGY

Distribution of Hours

	Theory	Practical
Plant Physiology	60	40
Bio chemistry	30	10
Biophysics	10	05
Bio technology	30	05
Total	130	60

PLANT PHYSIOLOGY - [Theory 60 Hours; Practical 40 Hours]

1. General introduction: physiological processes, their significance and applications.

1 Hour.
2. Water relations of plants: Importance of water to plant life.
 - a. Absorption of water- organs of absorption, root and root hair. Physical aspects of absorption- imbibition, diffusion and osmosis. Plant cell as an osmotic system; osmotic pressure, turgor pressure, wall pressure and diffusion pressure deficit, water potential and osmotic potential. Plasmolysis and its significance, practical applications. Mechanism of water absorption – active and passive absorption, root pressure. Pathway of water across root cells.
 - b. Ascent of sap- vital and physical theories.
 - c. Loss of water from plants: transpiration - cuticular, lenticular and stomatal mechanism - theories – starch sugar hypothesis, potassium - ion theory. Significance of transpiration - guttation, anti - transpirants, factors affecting transpiration.
 - d. Water stress and its physiological consequences to drought. 10 Hours
3. Mineral nutrition: Gross chemical analysis of the plant body, ash analysis, criteria for essentiality of elements, macro and micro elements, role of essential elements and their deficiency symptoms. Culture methods - sand culture, hydroponics and aeroponics. Mechanism of mineral absorption (a) passive absorption- ion exchange and Donnan equilibrium (b) active absorption- carrier concept, Lundegardh hypothesis. 5 Hours
4. Photosynthesis: Introduction, significance and general equation. Photosynthetic apparatus, structure and function of chloroplast, quantasomes - solar spectrum and its importance - Fluorescence and phosphorescence. Red drop, Emerson effect- Two pigment systems- raw material for photosynthesis- Mechanism of photosynthesis- Light reaction - cyclic and non

cyclic photophosphorylation. Hill reaction - Dark reaction: Calvin cycle. Comparative study of C_3 , C_4 , and CAM plants. Photorespiration - Bacterial photosynthesis and chemosynthesis - Factors affecting photosynthesis - Law of limiting factor. **15 Hours.**

5. Respiration: Introduction, definition and significance and general equation. Respiratory substances, types of respiration- aerobic and anaerobic. Aerobic respiration - glycolysis, Krebs's cycle, terminal oxidation. Anaerobic respiration – fermentation: alcoholic and lactic acid fermentation. Energy relation of respiration - R.Q and its significance - Factors affecting respiration. **9 Hours.**
6. Translocation of solutes: Path way of movement, phloem transport, mechanism of transport - Munch hypothesis, protoplasmic streaming theory - activated diffusion hypothesis, electro osmotic theory. **4 Hours**
7. Nitrogen metabolism: Source of nitrogen - Biological nitrogen fixation - symbiotic and a symbiotic. Nitrogen fixation by blue green algae - rotation of crops. Reduction of nitrate - reductive amination and transamination. Nif genes - Leghaemoglobin. **3 Hours.**
8. Growth: Phases of growth - vegetative and reproductive growth - growth curve - plant growth regulators - Auxins, Gibberellins, Cytokinins, Ethylene, Abscissic acid - synthetic plant hormones - practical applications. Senescence and abscission. Photoperiodism and vernalization - phytochrome and its significance. Physiology of bud and seed dormancy, germination. **5 Hours.**
9. Plant movements: Tropic and nastic movements. Circadian rhythm and biological clock. **5 Hours.**
10. Stress physiology: water stress, salt stress. **3 Hours.**

Practical - 40 Hours.

- 1 Water potential of onion peel / *Rhoeo* peel by plasmolytic method.
- 2 Imbibition of water by different types of seeds.
- 3 Effect of temperature on permeability.
- 4 Papaya petiole osmoscope.
- 5 Determination of stomatal index.
- 6 Compare the rate of transpiration by the upper and lower surface of the leaf by cobalt chloride method.
- 7 Determination of water absorption and transpiration ratio.

- 8 Measurement of rate of transpiration using Ganong's potometer or Farmer's potometer.
- 9 Separation of plant pigments by paper chromatography.
- 10 Evolution of oxygen during photosynthesis.
- 11 Measurement of photosynthesis by Wilmot's bubbler.
- 12 Evolution of CO₂ during respiration.
- 13 Ganong's respirometer and measurement of R .Q .
- 14 Simple respiroscope.
- 15 Alcoholic fermentation using Kuhn en's fermentation vessel.
- 16 Geotropism using clinostat.
- 17 Measurement of growth using Arc auxanometer.

BIOCHEMISTRY - [Theory 30 Hours; Practical 10 Hours]

1. Molecules and life. 2 Hours.
2. Carbohydrates - Classification, occurrence, structure and functions of monosaccharides (glucose and fructose), oligosaccharides (sucrose and maltose), polysaccharides (starch and cellulose), synthesis of glycosidic bonds - Enzymatic hydrolysis of glycosidic bonds - amylases and invertases. 4 Hours
3. Nucleic Acids - Chemistry of purines and pyrimidines. Structure of DNA & RNA. 4 Hours
4. Amino acids- classification based on polarity, structure - Amphoteric property of Amino acids - peptide formation – Amino acid metabolism - transamination and deamination. 3 Hours
5. Proteins – classification based on function – properties – structure - role of bonds in stabilizing protein structure - hydrolysis of proteins. 4 Hours
6. Lipids- classification - complex lipids, phospholipids, spingolipids, glycolipids. Simple lipids- fatty acids, fats, waxes, synthesis and degradation of fatty acids, Beta - oxidation. Cholesterol and its importance. 4 Hours
7. Metabolism – Basic metabolism - Energy metabolism – Intermediary metabolism – Interrelationships of metabolic pathways – Regulation of metabolism. 2 Hours
8. Enzymes - general account - structure, classification and nomenclature (recommended by Commission on Enzymes). Mechanism of enzyme action - inhibition of enzymes - regulation of

enzymes - allosteric inhibition - Iso - enzymes, coenzymes and cofactors - effect of temperature on enzyme action – effect of pH. 5 Hours

9. Secondary Plant Products – Introduction – classification and function [General account] 2 Hours

Practical-10 Hours

1. Qualitative test for carbohydrates - Molisch's test, Benedict's test (for reducing sugar)
2. Iodine test for starch; Seliwanoff's test.
3. Test for amino acids - Ninhydrin test, Xantho proteic test, Millon's test.
4. Test for proteins - Biuret test
5. Amylase activity on starch.

BIOTECHNOLOGY - [Theory 30 Hours; Practical 5 Hours]

1. Introduction – History – major achievements – Biotechnology in India. 2 Hours.
2. Plant Tissue culture - Culture media; composition, preparation and sterilization – Totipotency: definition and importance - Dedifferentiation and redifferentiation - Callus and suspension culture, meristem culture - Somaclonal variation - Somatic embryogenesis , Synthetic seeds - Anther culture and production of haploids - protoplast culture – somatic hybrids –cybrids . 6 Hours
3. Recombinant DNA technology: General account of cloning vehicles – plasmid, bacteriophages, cosmids and phagemids. Cutting and joining of DNA molecules- restriction endonucleases, ligases- Gene library and cDNA library - Isolation and sequencing of DNA. (Brief account). 8 Hours.
4. Gene transfer techniques in plants - Direct DNA uptake by protoplast – vector method- *Agrobacterium* mediated gene transfer – physical method - electroporation - shot gun method – microinjection. 5 Hours
5. Biotechnology of Nitrogen Fixation-Nitrogenases, nif - genes – Regulation of expression of nif-genes. Role of hydrogenases 4 Hours.
6. Application of Biotechnology in medicine, agriculture and human welfare - Bio-safety issues. Isolation and purification of DNA from plant cells- DNA sequencing. 2 Hours.
7. Cryopreservation – methods – plant cell bank – pollen bank & achievements. 2 Hours.
8. Methods in biotechnology - P C R, R F L P, E L I S A, SOUTHERN BLOTTING and I P R. 1 Hour

Practical - 5 Hours.

1. Use of equipments and glass wares- petridishes, flasks, culture tubes, Pasteur pipettes, forceps, knives, hot air oven, autoclave, shaker, pH meter, laminar airflow system.
2. Preparation of media, sterilization, inoculation and callus induction (Demonstration only).
3. Visit to a well equipped Biotechnology laboratory

BIOPHYSICS - [Theory 10 Hours; Practical 5 Hours]

1. Principles and applications of Colorimeter, Spectrophotometer and Centrifuge.
2. Basic knowledge of the separation methods: - Chromatography, Electrophoresis.
3. Buffers -their functions in biological systems -Uses of buffers in biological research, pH meter.
4. Cryobiology - Freeze drying (Lyophilisation) - its applications.

Practical 5 Hours.

1. Preparation of buffer.
2. Measurement of pH.

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PAPER V

ENVIRONMENTAL SCIENCE, PHYTO-GEOGRAPHY, BIOMETRICS, MICROBIOLOGY, PLANT BREEDING AND RESEARCH METHODOLOGY

Distribution of Hours

	Theory	Practical
Environmental Science	60	15
Phytogeography	10	05
Biometrics	15	05
Plant breeding	15	10
Microbiology	30	05
Research methodology	05	00
Total	135	40

ENVIRONMENTAL SCIENCE - [Theory 60 Hours; Practical 15 Hours]

Ecology

1. Definition- Scope and relevance to society and human environment. Need for public awareness. 3 Hour.
2. Ecosystems-Concept of an ecosystem- structure and function of an ecosystem- Biotic and abiotic components- Energy flow in an ecosystem. 3 Hours.
3. Ecological succession-Definition & types. 3 Hours.
4. Food chains -Food web & Ecological Pyramids-Introduction- types, characteristic features. 3 Hours.
5. Structure and functions of the following ecosystems.
 - A. 1. Forest ecosystem; 2. Grassland ecosystem; 3. Desert ecosystem; 4. Aquatic ecosystems- Ponds, Streams, Rivers, Oceans, Estuaries. 6 Hours.
 - B. Morphological, anatomical& physiological adaptations of –Hydrophytes, Xerophytes, Halophytes, Epiphytes, Parasites. 3 Hours.

Natural Resources

Renewable and non-renewable resources. Natural resources and associated problems.

- 1 Forest resources: Use and over exploitation. Deforestation, Timber extraction, mining, dams and their effects on forests and tribal people.
- 2 Mineral resources: Use and exploitation, Environmental effects of extracting and using mineral resources.

- 3 Water resources: Use and over exploitation of surface water and ground water, floods, drought, conflicts over - water, dams, benefits and problems.
- 4 Food resources: World food problems, Changes caused by agriculture and over grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging and salinity.
- 5 Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.
- 6 Land resources: Land as a resource, land degradation, Man induced landslides, soil erosion and desertification.
- 7 Role of an individual in conservation of natural resources.
- 8 Equitable use of resources for sustainable life styles. 5 Hours.

Biodiversity and it's conservation-

- 1 Introduction – Definition- genetic, species and ecosystem diversity.
- 2 Bio-geographical classification of India.
- 3 Value of bio-diversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- 4 Biodiversity at global, National and local levels. India as mega-diversity nation.
- 5 Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts.
- 6 Endangered and endemic species of India. Conservation of biodiversity :In-situ and Ex-situ conservation of biodiversity. Ecological niche, eco-types & ecological indicators. 8 Hours.

Environmental pollution

- 1 Definition causes, effects and control measures of –
 1. Air pollution
 2. Water pollution
 3. Soil pollution
 4. Marine pollution
 5. Noise pollution
 6. Thermal pollution
 - 7 Nuclear hazards.
- 2 Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- 3 Role of an individual in prevention of pollution. Pollution case studies.
- 4 Disaster management: Floods, earthquake, cyclone and land slides

8 Hours.

Social issues and the Environment

- 1 From unsustainable to sustainable development. Urban problems related to energy. Water conservation, Rain water harvesting and water shed management. Resettlement and rehabilitation of people: its problems and concerns.
- 2 Environmental ethics: Issues and possible solutions.
- 3 Climate change. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.
- 4 Wasteland reclamation. Consumerism and waste products.
- 5 Environment protection Act. Air [prevention and control of pollution] Act. Water [prevention and control of pollution] Act. Wildlife Protection Act. Forest conservation Act. Hill preservation Act.
- 6 Issues involved in enforcement of environmental legislation.
- 7 Public awareness. Forest Management.
- 8 Brief study of the major forests in India. Influence of forest on environment. Social forestry.
- 9 Mangrove vegetation of Kerala
- 10 Need of protection of mangrove vegetation. National parks & wildlife sanctuaries. 7 Hours.

Human Population and the environment.

- 1 Population growth, variation among nations.
- 2 Population explosion -Family welfare programme.
- 3 Environment and human health.
- 4 Human Rights. Value of education. HIV/AIDS. Women and Child Welfare.
- 5 Role of information technology in Environment and human health. 8 Hours.

Practical - 15 Hours.

- 1 Visit a local polluted site and documentation of major pollutants.
- 2 Study of ecological and anatomical modifications of Xerophytes, Hydrophytes, halophytes, epiphytes and Parasites.
- 3 Study of plant community by quadrat method.
- 4 Observation and study of different ecosystems mentioned in the syllabus.

PHYTOGEOGRAPHY - [Theory 10 Hours; Practical 5 Hours]

- 1 Importance of Phytogeography.
- 2 Continental drift. Age and area concept.

- 3 Aims and methods of migration and dispersal.
- 4 Vegetation types of India. 10Hours.

Practical - 5 hours

Preparation of map of India to show distribution of vegetation types.

BIOMETRICS - [Theory 15 Hours; Practical 5 Hours]

- 1 General introduction. Statistical terms and symbols. 2 Hours
- 2 Sample and sampling. Methods of sampling. Collection and representation of data. 1 Hour
- 3 Measures of central tendency –Mean, Mode, Median. [Exercise] 3 Hours
- 4 Measures of dispersion –Range, Quartile deviation, Mean deviation, Stand deviation, Standard error, Variance. 2 Hours
- 5 Distribution patterns-Normal distribution, Binomial distribution. 2 Hours
- 6 The Chi-square test-introduction, Definition. [Exercise] 1 Hour
- 7 Correlation- coefficient of correlation [Exercise]. 1 Hour
- 8 Regression analysis [Exercise] 2 Hours
- 9 Design of experiments- Randomized blocks, Latin square. 1 Hour

Practical- 5 hours.

Work out problems from mean, mode, median, chi-square test, correlation & regression analysis.

PLANT BREEDING - [Theory 15 Hours; Practical 10 Hours]

1. Introduction, objectives in plant breeding. 1 Hour
2. Plant introduction. Agencies of plant introduction in India, Procedure of introduction - Acclimatization - Achievements. 2 Hours
3. Selection - mass selection, pure line selection and clonal selection. Genetic basis of selection and methods. 2 Hours
4. Hybridization: Procedure of hybridisation, inter generic, inter specific, inter varietal hybridisation with examples. Composite and synthetic varieties. Heterosis and its exploitation in plant breeding. Polyploidy breeding. Breeding for disease resistance. 5 Hours
5. Methods of vegetative propagation: Cutting, grafting, layering, special methods of propagation - propagation by seeds. 2 Hours
6. Mutation breeding – methods - achievement in India. Breeding for pest, diseases and stress resistance. 3 Hours

Practical - 10 Hours

Demonstration of Grafting, Budding & Hybridization

MICROBIOLOGY - [Theory 30 Hours; Practical 5 Hours]

1. History & scope of microbiology. 1 Hour
2. **Bacterial classification:** Morphological classification, classification based on staining reaction: Ultra structure of bacteria, Reproduction, Economic importance. 4 Hours
3. Mycoplasma & Actinomycetes –General account. 1 Hour
4. General characteristics, nomenclature, classification, structure, chemical composition, properties and reproduction of bacteriophages and T. M. V. Transmission of viruses and role of vectors. Economic importance. 4 Hours
5. **Soil microbiology** – soil microorganisms, the rhizosphere, Biogeochemical activity of microorganisms in soil - N₂ cycle, Carbon cycle, sulphur cycle, Phosphorous cycle, Iron cycle. Decomposition of organic matter, microbial degradation of cellulose, lignin, starch & syntrophism in the soil, biogas production. 4 Hours
6. **Aquatic microbiology** - Sources of water, sources of water contamination, standards of water, testing suitability of water, importance of aquatic microbes, methods of water purification, microbiology of sewage or waste water. Methods of waste water treatment. 4 Hours
7. **General account of microbiology of air.** 1 Hour
8. **Food microbiology** - Food spoilage and preservation methods.[general account].Food born pathogens and food poisoning. 3 Hours
9. **Industrial microbiology:** Production of alcohol, vinegar, antibiotics, vitamins, vaccines, insulin, organic acids, bread, dairy products & single cell protein. 3 Hours
10. **Agricultural microbiology** - Objectives of green revolution, Role of microbes in soil formation, Role of microbes in soil fertility, Symbiotic microbes and crop production, Microorganisms as bio- fertilizers. Mycorrhiza & crop production, bio - pesticides, Harmful role of microorganisms. 3 Hours
11. **Medical microbiology** - Normal micro flora of human body-skin, conjunctiva, nose, mouth, upper respiratory tract. General awareness of microbial diseases of human beings. 2 Hours

Practical - 5Hours.

Gram staining of bacteria.

Test for the coliform bacteria in contaminated water.

Isolation of *Rhizobium* from root nodules of leguminous plants.

Examination of different forms of bacteria.

RESEARCH METHODOLOGY - [Theory 5 Hours]

Research methods-Introduction - types of research, descriptive, experimental types – collection, analysis and interpretation of data, report writing.

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PAPER VI
CYTOLOGY AND GENETICS

Distribution of Hours

	Theory	Practical
Cytology	30	05
Genetics	90	30
Total	120	35

CYTOLOGY - [Theory 30 Hours; Practical 5 Hours]

1. History and progress of cell biology- Structural organization of prokaryotic and eukaryotic cells- Evolution of prokaryotic and eukaryotic cells 3 Hours
2. Ultra structure and functions of the cell components and organelles
Cell wall; The cell membrane, Endoplasmic reticulum, Ribosomes, Golgi apparatus, Lysosomes, Peroxisomes, Vacuole, Mitochondria, Chloroplast, Nucleus. 10 Hours
3. The chromosomes- Chromosome morphology- Eukaryotic chromosomes and molecular organization. Chromatin - composition and structure - chemical organization .Nucleoproteins – histones and non – histones. Nucleosome model of DNA organization, satellite and repetitive DNA. 7 Hours
4. Special types of chromosomes- Salivary gland, Lamp brush and B chromosomes 2 Hours
5. Chromosome mutation Structural aberration - deletion, duplication, inversion and translocation. Numerical aberration-- aneuploidy , haploidy , polyploidy 3 Hours
6. Mitosis and Meiosis : Transmission of genetic information - cell cycle : Significance of mitosis and meiosis 5 Hours

Practical – 5 Hours

1. Make acetocarmine squash preparation of onion root tips and to identify different stages of mitosis.
2. Make squash preparation of the flower buds of any of the following plants. *Coix, Rhoea, Capsicum* (To identify Meiosis)

GENETICS - [Theory 90 Hours; Practical 30 Hours].**Classical Genetics** - 60 hours

- 1 Introduction -History of genetics, Scope of genetics, Genetic terminologies, Genes and environment. Heredity and variation. Genotype and Phenotype. Significance of genetics in society. 4 Hours
- 2 Mendelian Genetics- Mendel and his experiments, Mendel's success, Mendelian principles, Mendelian ratios, monohybrid and dihybrid crosses, back cross, test cross and reciprocal crosses. Relevance of Mendelian principles. 5 Hours
- 3 Probability factors in genetics - Segregation and probability; Independent assortment and probability; Pedigree analysis. 3 Hours
- 4 Genetics after Mendel- Modified Mendelian ratios; Allelic interaction; Co- dominance- Coat color in cattle. Incomplete dominance -Flower color in *Mirabilis* ; Interaction of genes- Comb pattern in poultry. 9:3:3:1. Epistasis - Recessive. Coat color in mice. 9:3:4; Dominant epistasis. Fruit color in summer squash. 12:3:1; Complementary genes. Flower color in *Lathyrus* 9:7; Duplicate gene with cumulative effect. Fruit shape in summer squash. 9:6:1; Duplicate dominant genes in shepherd's purse. 15:1; Inhibitory factor. Leaf color in Paddy. 13:3 12 Hours
- 5 Multiple alleles-General account. ABO blood group in man. MN and Rh factor. Self sterility in *Nicotiana*. Coat color in rabbits. 5 Hours
- 6 Lethal genes- Recessive lethal. Coat color in mice, albinism in Corn. 2 Hours
- 7 Quantitative characters- General characters of quantitative inheritance, Polygenic inheritance; Skin color in man, ear size in Maize. Transgressive variations, penetrance and expressivity, Pleiotropic genes. 4 Hours
- 8 Linkage and crossing over- Linkage and its importance, linkage and independent assortment. Complete and incomplete linkage. Crossing over – a general account, mechanism of crossing over. Cytological basis of crossing over, two point and three point test cross. Determination of gene sequence . Interference and coincidence. Mapping of chromosomes. 5 Hours
- 9 Sex determination- Sex chromosomes, chromosomal basis of sex determination XX- XY, XX-XO mechanism. Sex determination in Bryophyte, (*Sphaerocarpus*), sex determination in higher plants (*Melandrium album*) Genic balance theory of sex determination in

- Drosophila*. Sex chromosomal abnormalities in man. Klinefelter's syndrome, Turner's syndrome. Sex linked inheritance. Eye color in *Drosophila*, Hemophilia in man. Y- Linked inheritance. Sex limited and sex influenced inheritance. **10 Hours**
- 10 Extra nuclear inheritance- General account, maternal influence. Plastid inheritance in *Mirabilis*. Shell coiling in snails, kappa particle in *Paramecium*. **5 Hours**
- 11 Population genetics- Gene frequencies, genotype frequencies, Equilibrium of gene frequencies. Hardy –Weinberg law, Factors that alters gene frequencies in a population. Mutation, selection, migration, genetic drift, inbreeding and heterosis. **5 Hours**

Molecular Genetics- 30 HOURS

- 12 **DNA as genetic material**- Structure of DNA types, B, A and Z types. Replication of DNA, Circular and helical DNA. Semi conservative model, experimental support, Meselson and Stahl experiment. Enzymology of replication: topoisomerase, helicase, primase, polymerase and ligase. DNA repairing mechanism. **7 Hours.**
- 13 **RNA structure**- Properties and function of tRNA, mRNA and rRNA. Genetic code. Synthesis of protein, transcription, translation -Central dogma, reverse transcription, Teminism. **10 Hours**
- 14 **Mutation**- General account, types of mutations, molecular basis of mutation. Transition, transversion and frame shift mutation, tautomerism. Mutagenic agents, physical and chemical, Induced mutations, Significance of mutation. **5 Hours**
- 15 **Concept of gene**-Units of a gene, cistron, recon, muton; Split genes or introns, RNA splicing, ribozymes, overlapping gene. Gene regulation- transcriptional control- one gene one enzyme concept. The lac operon- the structural gene, operator gene, the promoter gene. The regulator gene, artificial synthesis of a gene .synthesis of gene for yeast alanine tRNA. Gene regulations in prokaryotes and eukaryotes (brief account only). The Britten & Davidson model of regulation. **6 Hours**
- 16 **Transposable genetic elements**- General account, Characteristic, Transposons, (Tn) and Insertion Sequences (IS), Cellular oncogenes, general account only. **2 Hours**

Practical- 30 Hours

Work out problems in

1. Monohybrid cross (Dominance and incomplete dominance)
2. Dihybrid cross (Dominance and incomplete dominance)

3. Gene interactions (All types of gene interactions mentioned in the syllabus)
 - a) Recessive epistasis 9 : 3 : 4 .
 - b) Dominant epistasis 12 : 3 : 1
 - c) Complementary genes 9 : 7
 - d) Duplicate genes with cumulative effect 9 : 6 : 1
 - e) Inhibitory genes 13 : 3
 - f) Duplicate dominant gene 15 : 1
 - g) Comb pattern in poultry 9 : 3 : 3 : 1
4. Linkage and crossing over
 - a) Two point and three point crosses
 - b) Construction of genetic map.

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