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University of Poona

Syllabus for Three-Year Integrated B.Sc. Degree Course

(" 85 Pattern " Non-Semester)

BOTANY

(From June 1989) (Revised Syllabus)

Paper I—Cryptogams, First Term—Cryptogams—I

A. Algae :

A-1 Introduction, general characters, classification. (1)

A-2 Studies of life history of *Chara* and *Batrachospermum* with reference to :

Systematic position (according to G.M. Smith), occurrence, structure of the thallus, structure of a typical cell, growth of the thallus, reproduction-asexual, vegetative, sexual, structure and development of sex organs, fertilization, post-fertilization changes, alternation of generations. (6)

A-3 Range and evolution of thallus in algae.

(i) Unicellular thallus.
(ii) Colonial thallus.
(iii) Filamentous thallus.
(iv) Pseudoparenchymatous thallus.
(v) Siphonaceous thallus.
(vi) Parenchymatous thallus. (4)

A-4 Origin and evolution of sex in algae.

(i) Sexual and asexual methods of reproduction.
(ii) Origin of gametes-relative sexuality, evidances for zoosporic origin of gametes.
(iii) Evolution of sex sex organ differentiation, isogamy, anisogamy, cogamy. (2)

A–5 Patterns of life cycle in algae.

(i) Introduction.

(ii) Haplontic.

(iii) Diplontic.

(iv) Diplohaplobiontic-Isomorphic, heteromorphic.

(v) Haplobiontic.

(vi) Triphasic diplobiontic. (2)

A–6 Economic importance of algae.

(i) Positive importance with respect to Food, Fodder, Piscicutture, Industries, sevrage disposal, water purification, as a source of petroleum, space travel, research.

(ii) Negative importance with respect to :

Toxins, problems of water purification and supply, pollution, damage due to blue-green algae, parasitic algae. (3)

B. Fungi:

B–1 Introduction, general characters, classification. (1)

B–2 Study the life history of *Puccinia graminis*, The black stem rust of wheat with respect to :

Systematic position (according to G.M. Smith), occurrence, structure of primary and secondary mycelium; development, structure and germination of uredospores, teleutospores, basidiospores, spermatia or pycnospores and aecidiospores. (2)

B–3 Wheat rust diseases-symptoms and control measures.

B–4 Wheat rust problem in India. (1)

B–5 Study of Myxomycetes with respect to :

Habit and occurrence, nature of the thallus, nutrition, locomotion, reproducaion, fruit bodies, spores, columella, capillitum, myxamoeba, economic importance. (3)

B–6 Study of Deuteromycetes with respect to :

Systematic position, vegetative structure, reproduction, fruiting bodies, parasexuality, classification, economic importance. (3)

B–7 Economic importance of fungi :

(i) Positive importance with respect to :

Food, industries, medicines, biodegradation of cellulose, lignin; biological control, as a tool in research work.

(ii) Negative importance with respect to :

Food spoilage; plant, animal and human diseases, tropical deterioration, destruction of timber (wood deterioration), mushroom poisoning. (3)

B–8 *Lichens*

General account with reference to :

Occurrence, structure of the thallus-external and internal; nature of association in a lichen thallus, reproduction-vegetative, asexual and sexual, economic importance. (3)

Total Periods 36

Paper I—Second Term, Cryptogams—II

A. **Bryophyta :**

A–1 Introduction, general characters and classification. (1)

A–2 Studies of life history of *Marchantia*, *Anthoceros* and *Polytrichum/Pogonatum* with respect to :

Systematic position (according to G.M. Smith), habit and habitat, occurrence, external and internal morphology of the gametophyte, vegetative reproduction, sexual reproduction; position, structure and development of sex organs, fertilization, post-fertilization changes, structure and development of the sporophyte, dehiscence of capsule and dispersal of spores, structure and germination of spores, alternation of generations. (Affinities of *Anthoceros* and evolutionary features in its sporogonium to be emphasized). (13)

A–3 Evolution of Bryophytic gametophyte according to the regressive and the progressive theory. (2)

A–4 Evolution of Bryophytic sporophyte according to the theory of sterilization and the theory of reduction. (2)

B. Pteridophyta :

B–1 Introduction, general characters and classification. (1)

B–2 Studies of life history of *Psilotum* and *Lycopodium* with respect to :

Systematic position (according to G.M. Smith), distribution and occurrence, external and internal morphology of sporophyte, vegetative reproduction; position, structure, development and dehiscence of sporangia, (morphology of sporangium in *Psilotum* to be emphasized), structure and germination of spores, development of gametophyte, mature prothallus, structure and development of sex organs and gametes, fertilization, post-fertilization changes leading to formation of embryo, alternation of generations. (8)

B–3 Study of life history of *Marsilea* with respect to :

Systematic position, habit and habitat, external and internal morphology of the sporophyte, vegetative reproduction, external and internal structure of the sporocarp and its morphological nature, dehiscence of sporocarp, structure, development and germination of microspores and megaspores; male and female gametophytes; position, sturcture and development of sex organs, fertilization, development of embryo, alternation of generations. (5)

B–4 *Stelar evolution :*

Concept, definition, types of steles in *Pteridophyta* evolution of stele in Pteridophyta. (2)

B–5 *Heterospory and seed habit.*

Definition, causes, Physiological aspects, heterospory as precursur to seed habit. (2)

Total Periods ..36

Reference Books

(1) Botany for Degree Students Part-I ALGAE—B. R. Vashista.
(2) Botany for Degree students Part-II FUNGI—B. R. Vashista.
(3) A Text Book on Algae—D. C. Pandey.
(4) FUNGI—Dr. J. N. Rai and Dr. B. B. Sharma.
(5) An Introduction to FUNGI—J. P. Shrivastava.
(6) Systematic Botany for Degree Students-Part-I—Jagjit Singh.
(7) A Text Book of Botany Vol. I—Saxena and Sarabhai.
(8) A Text Book of Fungi—Dr. Govind Prakash.
(9) A Text Book of Botany-Vol. I ALGAE and FUNGI—S. N. Pandey and P. S. Trivedi.
(10) General Microbiology-Vol. II—C. B. Powar, Danginawala.
(11) Cryptogamic Botany-Vol. I—G. M. Smith.
(12) Introduction to Mycology—C. J. Alexopolus.
(13) A Text book of FUNGI—G. L. Chopra and V. Verma.
(14) Text Book of FUNGI—O. P. Sharma.
(15) College Botany-Vol. II—Gangulee and Kar.
(16) Botany for Degree students Bryophytes-Vol. III—B. R. Vashishta.
(17) A Text Book of Bryophyta—G. L. Chopra and D. I. Yadav.
(18) The Structure and Life of Bryophytes—E. V. Watson.
(19) Cryptogamic Botany Vol. II—G. M. Smith.
(20) An Introduction to Embryophyta Bryophyta-Vol. I—N. S. Parihar.
(21) A Text Book of Botany Vol. II—Saxena and Sarabhai.
(22) An Introduction to Embryophyta Pteridophyta-Vol. II—N. S. Parihar.
(23) Pteridophyta-Vascular Cryptogams—Vashishta.
(24) The Morphology of Pteridophytes—K. R. Sporne.
(25) Comparative morphology of Vascular plants—A. S. Foster, E. M. Gifford.
(26) Bryophyta, Pteridophyta and Gymnosperms—K. P. Saxena.
(27) Pteridophyta—Rashid.

Paper II—Gymnosperms and Palaeobotany, Environmental Biology and Plant Geography, First Tearm: Gymnosperms and Palaeobotany

A. Gymnosperms :

A-1 Introduction, review of characters, evolutionary importance. (1)

A-2 Classification of Gymnosperms according to :

(*a*) Birbal Sahni.

(*b*) D. D. Pant.

(*c*) Sporne. (1)

A-3 Study of life history of *Pinus* with respect to :

Distribution in India, habit, external morphology of root, stem and leaf; primary internal structure of stem and root, secondary growth and secondary structure in stem and root, internal structure of leaf;

Asexual reproduction—

structure of male cone and microsporophylls, microsporangia and microspores, structure of female cone, morphological nature of the bract scale and the ovuliferous scale, structure of the ovule, structure and development of female gametophyte, pollination and development of male gametophyte, structure of archegonium, fertilization, post-fertilization changes and polyembryony, structure and germination of seed, alternation of generations, economic importance of *Pinus*. (7)

A-4 Study of life history of *Gnetum* with respect to :

Distribution in India, habit, external morphology of root, stem and leaf, primary internal structure of root and stem, anatomy of leaf, normal secondary growth and secondary structure in root and stem, anomalous secondary growth and secondary structure in stem of *G. ula*, asexual reproduction—structure of male and female strobili, structure of male flower structure of ovule and morphological nature of its envelops, pollination and development of male gametophyte. development of female gametophyte, fertilization, post-fertilization changes and polyembryoni, structure and germination of the seed, economic importance, alternation of generations, affinities of *Gnetum*. (7)

B. Palaeobotany :

B–1 Introduction, scope and objectives.

B–2 Applications of palaeobotany in oil and coal exploration :

(*a*) Oil and coal as fossil fuels.

(*b*) Role of micro-fossils in exploration.

(*c*) Biotic origin of oil and coal.

(*d*) Oil excavation. (2)

B–3 Fossils—

(*a*) Definition.

(*b*) Process of fossil formation.

(*c*) Conditions favourable for fossilization.

(*d*) Different types of fossil formations, impression, compression, petrifacation, casts, coal balls, amber, chemical fossils, pseudofossils and microfossils. (3)

B–4 Concept of form genera and nomenclature. (1)

B–5 Techniques used in studying fossils : Ground thin sections, film or peel technique, transfer techniques, maceration treatment of opaque petrifation, acetolysis method, chemical methods, X–ray technique. (3)

B–6 Plant life through ages :

(*a*) Geological time scale—eras, periods andepochs.

(*b*) major plant groups of paleozoic, mesozoid and cenozoic era.

(*c*) Climatic conditions during major era and their impact on plant life.

B–7 Study of following fossil groups :

(*a*) *Psilopsida :*

distinguishing characters of the order psilophytales; external and internal morphology of *Rhynia*, different views regarding the gametophyte of *Rhynia*. (1)

(*b*) *Lycopsida :*

External and internal morphology of *Lepidodentron selagi*, *Stigmaria*, *Lepidophyllum*, *Lepidostrobus* and *Lepidocarpon*. (2)

(c) *Sphenopsida :*

External and internal morphology of *Calamites, Annularia, Asterophyllites, Calamostachys*, and *Paleostachya.* (2)

(d) *Pteridosperms :*

External and internal morphology of *Lyginopteris oldhamia* (stem, microsporophylls, megasporophylls) *Lagenostoma.* (2)

(e) *Bennettitales :*

Distinguishing characters, external and internal morphology of *Cycadeoidea* (stem, leaf and strobius i.e. fructification). (2)

Total periods ..36

Reference Books

(1) Essentials of Paleobotany by A. C. Sh[illegible] and S. P. Mi[illegible] (Vikas Publishing House, Sahibabad, dist. Gaziabad (U.P.)
(2) An Introduction to Paleobotany by C. R. Arnold.
(3) Studies in Paleobotany by H. N. Andrews.
(4) College Botany Vol. II by H. C. Gangulee and A.K. Kar.
(5) Botanical monograph on *Gnetum* by P. Maheshwari and V. Vasil (CSIR, New Delhi).
(6) Botany for Degree students, Vol. V Gymnosperms by P. C. Vashishta.
(7) *Pinus*—by Maheshwari and Konar.
(8) Gymnosperms—Chopra and Verma.
(9) A Text book of Botany Vol. II—Saxena and Sarabhai.
(10) Morphology of Gymnosperms—Coulter and Chamberlain.
(11) Gymnosperms—structure and reproduction—Chamberlain.
(12) Morphology of Gymnosperms—Sporne, K. R.
(13) Comparative morphology of vascular plants—A. S. Foster and A. M. Gifford.

Paper II—Second Term

Environmental Biology and Plant Geography

A Environmental Biology

A–1 (*a*) Introduction—Review of scope and importance of environmental biology, subdivisions of ecology; Review of organisation of biosphere (Biosphere ecosystems communities and populations) 1

(*b*) *Role of ecology*—in solving some of the major problems such as—

food production and organic farming; climatic changes, natural calamities, deforestation and desertification, energy crisis, conversion of wastes into resources, salinity and water logging. 2

A–2 *Population Ecology*—

Definition characteristics–population density, Natality, Mortality, population fluctuations and dispersal, territoriality social orders 4

A–3 *Community ecology* :

(*a*) Definition,

(*b*) Qualitative characters–physiognomy (external appearance); phenology, periodicity and aspection, stratification (distribution of plants in vertical space).

(*c*) Quantitative characters–Density, frequency, dominance. (normal frequency diagram and Raunkiaer's law of frequency).

A–4 *Community dynamics*

(*a*) Succession—(i) Definition, (ii) causes, (iii) Types.

(*b*) Process as occurs in xerosere and Hydrosere.

(*c*) Climax concept—Monoclimax, Polyclimax, biotic potential

(*d*) Microbial succession. 4

A–5 *Ecological Indicators* :

Introduction, indicators of soil pH, altitude, water, minerals and pollution. 2

A–6 *Conservation :*

(*a*) Concept;

(*b*) Necessity of conservation;

(*c*) Conservation of soil, plants and animals;

(*d*) Endangered habitats;

(*e*) Mention of protected areas such as sanctuaries, national parks and biosphere of reserves.

(*f*) Importance of conservation of gene pool. 6

A–7 *Pollution Concept :*

Kinds and causes of pollution. Study of air and water pollution with reference to causes, hazards and remedial measures. 5

B Plant Geography :

B–1 *Endemism :*

(*a*) Concept definition,

(*b*) Types, with suitable examples, pan endemics, poly-endemics, relic endemics, pseudoendemics, ecological endemics. 2

B–2 *Botanical Regions of India :*

(*a*) Main Botanical regions of India.

(*b*) Detailed study of vegetational types in Maharashtra with suitable examples. 4

B–3 *Continental Drift :*

(*a*) Concept,

(*b*) Evidences from different fields.

(c) Hypothesis regarding mechanism (plate tectonics) 4

Total periods 36

List of Books

(1) Bharucha, F. R.—A Text Book of Plant Geography of India.
(2) Brij Gopal and N. Bharadwaj—Elements of Ecology.
(3) Clark, G. L.—Elements of Ecology.
(4) Kormondy, E. J.—Concepts of Ecology.
(5) Kochhar, P. L.—Plant Ecology.
(6) Etherington, J. R.—Environment and Plant Ecology.
(7) Kotpal and Bali N. P. R. L.—Concepts of Ecology.
(8) Sharma, P. D.—Elements of Ecology.
(9) Vashishta, P. C.—Text Book of Plant Ecology.
(10) Kumar, H. D.—Modern concepts of Ecology.

Paper III—Angiosperms, Taxonomy, Economic Botany, Anatomy and Embryology

First Term—Angiosperms, Taxonomy, Economic Botany

A Angiosperms

A–1 Study of the following families :

(according to Bentham and Hooker's system) with respect to geographical distribution, morphological characters, distinguishing features, Floral variations (if any), ecological and economic importance and phylogenetic significance (if any) and with suitable examples :

Magnoliaceae, Meliaceae, Cucurbitaceae, Compositae, Sapotaceae, Asclepiadaceae, Casuarinaceae, Orchidaceae, Scitaminae Graminae, **16**

A–2 *Origin of angiosperms :*

(*a*) Time of origin.
(*b*) Place of origin,
(*c*) Probable ancestors
—Pteridosperms,
—Bennettitales,
—Gnetales. **4**

A–3 Post Darwinian systems of classification.

assumptions and outline of Engler and Prantl's and Hutchinson's system of classification, merits and demerit comparison of these systems of classification. 4

B Economic Botany

General account with reference to Botanical source, plant part(s) and product(s) and uses of :

B–1 Cereals—Wheat Rice Jowar.
B–2 Pulses—Gram Tur Soyabean.
B–3 Spices and Condiments—Clove Pepper, Cinnamons.
B–4 Fibres—Cotton, Hemp, Coconut Fibers.
B–5 Beverages—Tea, Coffee, Cocoa.
B–6 Timber—Teak, Sisam, Babul.
B–7 Dyes—Anato, Indigo, Turmeric.
B–8 Sugar Sugarcane, Beet Date.
B–9 Paper—Bamboo, Bagase, Salai. 12

Total Periods 36

Paper III—Second Term—Anatomy and Embryology

A Anatomy

A–1 Concept of tissue systems.

A–2 Meristematic tissues.
(*a*) Apical cell theory.
(*b*) Histogen theory.
(*c*) Tunica corpus theory. 2

A–3 Epidermal tissue system.
(*a*) Definition.
(*b*) Structure.
(*c*) Function.
(*d*) Cutinisation, lignification, suberisation and silicification.
(*e*) Epidermal outgrowths—trichomes, peltate, glandular.

A–4 Mechanical tissue system

(*a*) Necessity in plants.

(*b*) Types of mechanical tissues.

(*c*) Principles involved in : inflexibility, incompressibility, inextensibility shearing stresses.

(*d*) Distribution of mechanical tissues in—

(i) stem—Maize, *Coleus*, *Aristolochia*.

(ii) Leaf—Maize, *Eucalyptus*.

(iii) Root—Maize. 4

A–5 Secondary growth

(*a*) Definition.

(*b*) Significance.

(*c*) Process in stem of

(i) an annual, (ii) a perennial.

(*d*) Development and structure of periderm and bark.

(*e*) Wood—elements of wood, structure and arrangement of the elements, ring porous and diffuse porous wood, tyloses, growth rings.

(*f*) Variation in secondary growth. 5

A–6 Anomalous Secondary Growth.

(*a*) Definition.

(*b*) Causes of variations.

(i) Unusual origin of the cambium.

(ii) Unusual behaviour of the cambium.

(*c*) Study of secondary growth in

(i) Stem—*Aristolochia*, *Bignonia*, *Combretum*, *Dracaena*

(ii) Root—Carrot, Beet. 4

B Embryology :

B–1 Definition and scope.

B–2 Descriptive, comparative and experimental embryology. 1

B–3 (*a*) Microsporangium—structure of tetrasporangiate another.

(*b*) Tapetum—types and functions.

(*c*) Microsporogenesis—types of divisions—successive and simultaneous—types of microspore tetrads.

(*d*) Structure and germination of pollen grain, formation of male gametophyte. 4

B-4 (*a*) Megasporangium (Ovule) structure integuments—Unitegmic and bitegmic ovules; necellus—Crassinullcente and tenuinnucellate ovules; type of ovules—Orthotropous amphitropous, campylotropous and circinotropous.

(*b*) Megasporogenesis—types of megaspore tetrads.

(*c*) Female gametophyte—structure of embryo sac development and organization of monosporic (*Polygonum*) bisporic (*Allium*) and tetrasporic (*Peperomia*) embryo sacs. 6

B-5 Fertilization—

(*a*) Definition.

(*b*) Entry of the pollen tube.
—porogamy Mesogamy and Chalazogamy.

(*c*) Union of male and female gametes,

(*d*) Double fertilization and its significance.

(*e*) Post-fertilization changes.

(*f*) In vitro fertilization.

B-6 Endosperm : 2

(*a*) Triple fusion and its significance.

(*b*) Types of endosperm—nuclear, cellular and helobial. 2

B-7 Embryo :

(*a*) Development and structure of nature embryo in *Capsella* and *Sagittaria*.

(*b*) Embryo culture. 3

Total Periods 36

Reference Books

(1) Lawrence, G. H. M.—Taxonomy of vascular plants.
(2) Mathur and Chauhan—Systematic Botany Agra Book House
(3) Naik, V. N.—Taxonomy of Angiosperms,
(4) Vashishta, P. C.—Taxonomy of Angiosperms, R. Chand Publication.
(5) Pandeya, B. P. —Angiosperms Taxonomy, Anatomy Embryology, Economic Botany, S. Chand Publication.

(6) Shukla Priti and Mishra Shital—An Introduction to Taxonomy of Angiosperms.
(7) Sporne, K. R.—The morphology of Angiosperms, B. I. Publication.
(8) Sporne, K. R.—The mysterious origion of flowering plants.
(9) Eames, A. J.—Morphology of Angiosperms M. G. Hill Publication.
(10) Esau, K.—Anatomy of seed plants.
(11) Esau, K.—Plant Anatomy.
(12) Pandeya, B. P.—Plant Anatomy—S. Chand Publication.
(13) Maheshwary, P.—An Introduction to Embryology of Angiosperms, M. G. Hill Publication.

Paper IV—Plant Physiology and Genetics

First Term—Plant Physiology

A Mineral nutrition

A–1 General role of essential elements.
A–2 Major and minor elements.
A–3 Criteria for essentiality of elements.
A–4 Techniques used for assessing essentiality :
(*a*) Sand culture.
(*b*) Solution culture.
A–5 Occurrence, availability, role and deficiency symptoms of : S, N, P, K, Ca, Mg, Fe, Mn, Zn, Cu, Bo, Mo.
A–6 Foliar nutrition.
A–7 Ion antagonism. 4

B Translocation of organic solutes :

B–1 Path of translocation—evidences from
(*a*) Structure of phloem.
(*b*) Ringing experiment.
(*c*) Chemical analysis of Phloem.
(*d*) Use of tracer techniques.
B–2 Direction and rate of transport.

B–3 Mechanism of translocation.

Discussion on the following :—

(*a*) Diffusion and activated diffusion.

(*b*) Streaming of protoplasm,

(*c*) Pressure flow (Mass flow).

(*d*) Interfacial flow.

(*e*) Electro-osmosis. 5

C Photosynthesis :

C–1 Photosynthetic apparatus—ultrastructure of the chloroplast, grana and stroma, thylakoids, quantasomes as functional unit, photosynthetic pigments, their distribution, electron carriers and enzymes.

C–2 Light reaction—Hill reaction, Two pigment system, cyclic and non cyclic phosphorylation,

Red drop, Emerson effect.

C–3 Dark reaction—

C_3 pathway (Calvin cycle).

C_4 HSK pathway.

CAM Pathway.

Comparison between C_3 and C_4 plants 7

D Respiration :

D–1 Respiration as an energy releasing process.

D–2 Respiratory substrates and respiratory quotient .

D–3 Mechanism of respiration.

(*a*) Glycolysis, Kreb's cycle.

(*b*) Respiratory chain (ETS), terminal oxidation.

(*c*) PP Pathway.

(*d*) Balance sheet of ATP. generation.

(*e*) Anaerobic respiration (alcoholic, Lactic and Acetic acid fermentat on).

(*f*) Pasteur's effect.

D–4 Comparison between photosynthesis and respiration. 7

E Fat metabolism :

E–1 Synthesis of fatty acid.

E–2 Synthesis of Glycerol.

E-3 Condensation of fatty acids. and glycerol to produce lipid.
E-4 α and β oxidation.
E-5 Glyoxylate cycle. (4)

F **Nitrogen metabolism :**

F-1 N_2 fixation.
(*a*) Symbiotic,
(*b*) non-symbiotic.
F-2 Ammonification and nitrification.
F-3 Reductive amination and transamination. (4)

G. **Metabolic pool** (1)

H. **Tissue culture :**

H-1 Introduction.
H-2 General techniques, nutritional and hormonal requirements; cultural conditions.
H-3 Types of culture.
H-4 General applications with reference to studies in plant physiology. (4)

Total periods ..36

List of Books

(1) Devlin, R. M.—Plant Physiology Van Nostrand Reinhold co.
(2) Devlin, R. M. & A. V. Barker—Phitosynthesis Affiliated East West Press.
(3) Leopold A. C. and P. E. Kriedemann—Plant Growth & Development Tata McGrew Hill Publication.
(4) Noggle R., and G. F. Fritz—Introductory Plant Physiology, Prentice Hall India.
(5) Salisbury, F. B. & C. W. Ross—Plant Physiology, C.B.S. Publishers.
(6) Wilkins, M. B.—Physiology of Plant Growth and Development T.M.H. Edition.
(7) Wilkins, M.B.—Advanced Plant Physiology, Pitman Publishers.
(8) Pandey & Sinha—Plant Physiology.
(9) Malik—Plant Physiology.
(10) Koohher—Plant Physiology.

Paper IV—Second Term—Genetics

A. **Neo-Mendelism :**

A-1 15 : 1 ratio.

A-2 9 : 6 : 1 ratio.

A-3 13 : 3 ratio.

A-4 Polygenic inheritance.

A-5 Trihybrid ratio. (4)

B. **Multiple alleles :** ( )

B-1 Concept and characteristics.

B-2 Explanation of multiple alleles with the help of examples in Chinese primrose. (2)

C. **Linkage :**

C-1 Discovery of linkage.

C-2 Concept of linked genes with the help of example in maize.

C-3 Detection of linkage from F_2 data and test cross. (2)

D. **Crossing over :**

D-1. Meaning of crossing over

D-2 Meiosis and crossing over, stage at which crossing over takes place.

D-3 Number of strands involved in crossing over.

D-4 Cytological basis of genetic cross over.

D-5 Single and double cross over.

D-6 Concept of chromosome map by three point test cross.

D-7 Theories of crossing over :

(*a*) Classical.

(*b*) Torsion. ( )

(*c*) Copy choice.

(*d*) Uhl theory. (4)

E. Structural organization of prokaryotic and eukaryotic chromosomes. (3)

F. **Microbiol genetics :**

F-1 Transformation.

F-2 Transduction.

F-3 Conjugation. (4)

G. Evidences to prove DNA as genetic material-transformation-Transduction. (4)

H. **DNA :**

H-1 Molecular organization.

H-2 Types—A, B, & Z.

H-3 D N A replication :
conservative semi-conservative and dispersive.

H-4 Experimental evidence for semi-conservative replication. (4)

I. **Genetic code :**

I-1 Concept.

I-2 Singlet, duplex, triplex codons. Evidence for triplet codon, work of Nirenberg and Khorana.

I-3 Properties of genetic code (with exception) university, commaless. Non-overlapping, Degeneracy, Ambiguity, stop and start signals. (4)

J. **Protein synthesis :**

J-1 Salient characters of t-RNA, r-RNA and m-RNA.

J-2 Role of following in protein synthesis.
(*a*) D N A.
(*b*) t-RNA, m-RNA and ribosomes.
(*c*) A T P.
(*d*) Enzymes.

J-3 Transcription and translation. (3)

K. **Gene action :**

K-1 Relation of genes and enzymes-one gene one enzyme hypothesis.

K-2 Discussion of Lac operon model of gene action.

K-3 Tryptophan synthesis. (3)

L. **Concept of gene :**

L-1 Classical gene.

L-2 Molecular nature. (2)

Total periods 36

Reference of Books

(1) Burns, G. W.—Science of Genetics. The Macmillan company.
(2) Pai Anna, C.—Foundations of Genetics T. M. H. India.
(3) Sarin, C.—Genetics T. H. M. India.
(4) Herskowitz—Molecular Genetics Thoms Nelson & Sons.
(5) Gardner, E. J.—Principles of Genetics.
(6) Strickberger, M. W.—Genetics. Macmillan Publishing Co.
(7) Cherayil, J. D.—Gene & Genetic code, T. M. H. India.
(8) Verma, P. S. and V. K. Agarwal—Cell Biology, Genetics and ecology, S. Chand and Co.
(9) Swanson, Merz & Young—Cytogenetics. Prentice Hall India.
(10) Klug & Cummings—Concepts of Genetics. Merril Publishing Co.
(11) Ahluwalia—Genetics.

Paper—V (Horticulture, Plant Breeding and Evolution) First Term

Horticulture

A. **Introduction :**

A-1 Definition.

A-2 Scope and importance

A-3 Branches of Horticulture :

(*a*) Pomoculture.
(*b*) Olericulture.
(*c*) Floriculture.
(*d*) Ornamental horticulture.
(*e*) Landscape gardening. (3)

B. **Propagation of horticultural plants :**

B-1 Sexual (seed) Propagation :

(*a*) merits and demerits.
(*b*) selection of seeds.
(*c*) pre-germination treatment.
(*d*) sowing of seeds.
(*e*) transplanting of seedlings.

B-2 Asexual (vegetative) propagation :

(*a*) merits and demerits. (2)

C. **Cutting :**

C–1 Definition.
C–2 Advantages and disadvantages.
C–3 Types :
(i) stem-cuttings-herbaceous, semi-hard wood, hard wood and soft wood.
(ii) root-cutting.
(iii) leaf cuttings.
(iv) leaf-bud cuttings.
C–4 Anatomical basis of rooting in cutting-origin of adventitious roots.
C–5 Physiological basis of rooting in cutting-role of various factors :
(*a*) Auxins.
(*b*) Carbohydrates.
(*c*) Nitrogenous compounds. and
(*d*) Vitamins and co-factors in initiating adventitious roots (work of Hartman and Fadl.) (3)

D. **Layering :**

D–1 Definition.
D–2 Advantages.
D–3 Factors affecting for root-formation.
D–4 Special treatments for root-formation.
D–5 Kinds of layering :
(*a*) simple. (*b*) tip (*c*) serpentine
(*d*) Trench (*e*) Mound (*f*) Gootee. (2)

E. **Graftage :**

E–1 Definition.
E–2 Advantages.
E–3 Limitations.
E–4 Stock-scion incompatibility.
E–5 Root-stock-scion-relationship.
E–6 Raising of root-stocks.
E–7 Selection of scion. (2)

F. **Grafting :**

F-1 Types of grafting :

(i) whip (ii) Tongue (iii) cleft (iv) bark
(v) side (vi) veneer (vii) Approach(viii) stone. (2)

G. **Budding :**

G-1 Types of budding :
(i) 'T' or shield-budding and
(ii) Patch-budding. (1)

H. **Training and Prunning of plants :**

H-1 Definitions.
H-2 Difference between training and prunning.
H-3 Objectives of training and prunning.
H-4 Advantages of training and prunning.
H-5 Methods of training :
(i) Central leader system.
(ii) Open centre system.
(iii) Modified central leader system.
H-6 Methods of prunning
(i) Heading back.
(ii) Thinning out. (3)

I. **Pomology :**

I-1 Introduction, scope and importance.
I-2 Problems of unfruitfulness, differences between fruitfulness and unfruitfulness.
I-3 Factors affecting unfruitfulness :
(*a*) External factors :
(i) Nutrient-supply
(ii) Irrigation.
(iii) Locality and soil type.
(iv) Season.
(v) Temperature.
(vi) Rain
(vii) Wind.
(viii) Insect pests and diseases.

(*b*) Internal factors :
(i) Evolutionary.
(ii) Genetic.
(iii) Physiological. (3)

J. Methods of controlling unfruitfulness :

J-1 Bahar treatment :
(i) Definition.
(ii) Types of Bahar-Ambe-bahar, Mrig-bahar and Hast-bahar.
(iii) Steps in Bahar treatment :
(*a*) Withholding of water.
(*b*) Cultivation of land.
(*c*) Manuring.
(*d*) Resumption of watering.
(*e*) choice of bahar.

J-2 Root pruning and exposure.
J-3 Ringing/Girdling.
J-4 Notching.
J-5 Bending. (3)

K. General principles of fruit and vegetable preservations. (1)

L. Study of Mango :

L-1 Soil and climatic conditions.
L-2 Cultural practices.
L-3 Suitable varieties.
L-4 Special treatments including in situ plantation.
L-5 Diseases and pests.
L-6 Harvesting and Marketing.
L-7 Uses and by-products. (5)

M. Study of Rose :

M-1 Soil and climatic conditions.
M-2 Cultural practices.
M-3 Suitable varieties.
M-4 Special treatments.
M-5 Diseases and pests.

M–6 Harvesting and Marketing.
M–7 Uses and by-products. (3)

N. **Study of Brinjal :**

N–1 Soil and climatic conditions.
N–2 Cultural practices.
N–3 Suitable varieties.
N–4 Special treatments. (1)
N–5 Diseases and pests.
N–6 Harvesting and marketing. (3)

Total periods .. 36

Paper—V Second Term—Plant Breeding and Evolution

A. **Plant Breeding :**

A–1 Introduction :
(*a*) Definition.
(*b*) Aims and objectives.
(*c*) Scope and importance (2)

A–2 Methods of reproduction in relation to plant breeding :
(*a*) Autogamy (self-pollination).
(*b*) Allogamy (cross pollination).
(*c*) Geitonogamy.
(*d*) Vegetative reproduction. (2)

A–3 Methods of crop improvement :
(*a*) Selection (natural, artificial, mass, pure-line, clonal).
(*b*) Hybridization (Intraspecific, Interspecific and Inter generic).
(*c*) Introduction and acclimatization.
(*d*) Mutation-breeding (gene, chromosomal, genome and somatic). (4)

A–4 Plant introduction and acclimatization :
(*a*) Definition.
(*b*) Objectives.
(*c*) Advantages, disadvantages and achievements. (1)

A–5 Selection :

(*a*) Definition.

(*b*) Types-Mass, pureline, clonal.

(*c*) Advantages and disadvantages.

A–6 Hybridization :

(*a*) Definition and objectives.

(*b*) Prerequisites.

(*c*) Hybridization procedure.

(*d*) Difficulties and precautions.

(*e*) Achievement with suitable examples. (4)

A–7 Methods of hybridization :

(*a*) Pedigree method.

(*b*) Bulk method.

(*c*) Single cross method.

(*d*) Double cross method.

(*e*) Three-way cross method.

(*f*) Top cross (Inbred variety cross).

(*g*) Synthetic cross.

(*h*) Back-cross method. (4)

A–8 Heterosis and Hybrid vigour :

(*a*) Definition.

(*b*) Effects of hybrid vigour.

(*c*) Causes of heterosis (Dominance and overdominance hypothesis).

(*d*) Utilization and limitations. (3)

A–9 Polyploidy :

(*a*) Definition.

(*b*) Types.

(*c*) Characters of polyploidy.

(*d*) Role of polyploidy in evolution of new species.

(*e*) Achievements in cotton, *Nicotiana*, Wheat and Raphanobrassica. (3)

A-10 Mutation breeding :

(*a*) Definition.

(*b*) Enlisting of mutagenic agents.

(*c*) Gamma gardens.

(*d*) Achievements with suitable examples. (2)

B. Evolution :

B-1 Introduction, definition and review. (1)

B-2 Variation :

(*a*) Environmental.

(*b*) Heritable variations :

(i) gene mutation.

(ii) chromosomal aberration.

(iii) recombination.

(iv) Polyploidy. (2)

B-3 Natural selection :

(*a*) Natural selection as an operative force in adaptive evolution as demonstrated by Peppered mouth experiment

(*b*) Harby-Weinberg's law of genetic equilibrium

(*c*) Genetic drift. (3)

B-4 Mechanism of Isolation :

(*a*) Spatial isolation.

(*b*) Genetic isolation :

(i) Premating isolation-ecologic, ethologic and morphologic.

(ii) Post-mating isolation-zygotic mortality, hybrid inviability and hybrid sterility).

(*c*) significance of isolation. (3)

B-5 Speciation :

(*a*) Origin of deme.

(*b*) Origin of race.

(*c*) Origin of species. (2)

B-6 Synthetic Theory of evolution. (1)

Total periods .. 36

List of Books

(1) Fruit culture in India by Sham Singh, S. Krishnamurthy and S. Katyal.
(2) Fruit growing in India by W. B. Hayes.
(3) Introduction to Fruit culture and Fruit-physiology by Amar Singh.
(4) Tropical and sub-tropical fruit-culture Edited by T. K. Bose.
(5) Introduction and principles of Fruit growing by Kunte and Yawalkar.
(6) Vegetables by B. Choudhari.
(7) Vegetable production in India by D.V.S. Chauhan.
(8) Preservation of fruits and vegetables by Giridharilal, Tandon, and Siddappa.
(9) Gardening in India by T. K. Bose and Mukherjee.
(10) Elementary principles of plant breeding by H. K. Choudhary.
(11) Cytogenetics and plse-Breeding by Chandra Sekharan and Parthsarathy and Krishnaswamy.
(12) Introduction to Plant-Breeding by R. C. Choudhary.
(13) Cytogenetics, Plant-Breeding and Evolution by U. Sinha and Sunita Sinha.
(14) Breeding Asian field crops by John Milton Poehlman.
(15) Evolution by Savage J. M.
(16) Cytology, Genetics and Evolution by Verma and Agarwal.
(17) Mechanism of evolution—Stebbins.

Paper—VI, Gardening—I and II, First Term—Gardening—I

A. Gardening

A–1 Introduction. **(3)**

A–2 Types :

(*a*) Formal.
(*b*) Informal.
(*c*) Botanical.
(*d*) Terrace.
(*e*) Park.

A–3 Importance of gardens : (3)

(*a*) Academic.

(*b*) Aesthetic.

(*c*) Economic. (2)

B. **History of Gardens :**

B–1 Salient features of oriental and western style of gardening.

B–2 Ancient Indian Gardens :

(*a*) Hindu.

(*b*) Buddhist.

(*c*) Moghul. (3)

C. **Planning of Gardens :** (3)

C–1 Consideration of following in planning :

Privacy, comfort, beauty, safety, convenience, and flexibility.

C–2 Importance of following in planning :

(*a*) Unity and variety.

(*b*) Rhythm and balance.

(*c*) Accent and contrast.

(*d*) Scale and proportion.

C–3 Study of physical, structural and biological features of garden :

(*a*) Hedge and border .

(*b*) Path and avenue .

(*c*) Pond .

(*d*) Rockery.

(*e*) Lawns.

(*f*) Glass house.

(*g*) Pergolas.

D. **Soil and soil management :**

D–1 Soil-Nature and types.

D–2 Irrigation.

D–3 Manures and fertilizers.

D–4 Compost and composting.

D–5 Agro-chemicals. (6)

E. **Garden tools and implements :**

E–1 Implements-Sickle, trowel, rake, hoe, secateurs, prunning shears, grafting and budding knife.

E–2 Use and upkeep of the following :
(*a*) mower.
(*b*) sprayer.
(*c*) duster.
(*d*) prunning shears. (3)

F. **Garden practices :**
F–1 Preparation of seed beds.
F–2 Collection and sowing of seeds.
F–3 Seedling transplantation.
F–4 Preparation of pits and use.
F–5 Prunning.
F–6 Training of vines.
F–7 Methods of propagation of garden plants-cutting, layering, grafting and budding (Home assignment).
F–8 Weeding. (6)

G. **Indoor plants :**
G–1 Characters.
G–2 Methods to mantain indoor plants.
G–3 Examples. (3)

H. **Pot-culture :**
H–1 Containers.
H–2 Media for growth.
H–3 Selection of plants.
H–4 Maintenance and care.
H–5 Importance.
H–6 Hydroponics. (3)

I. **Bonsai :**
I–1 Principle.
I–2 Containers.
I–3 Selection of plants.
I–4 Technique.
I–5 Styles.
I–6 Maintenance and care. (3)

Total Periods .. 36

Paper—VI, Second Term, Gardening—II

A. Study of Ornamental plants :

A-1 *Annuals*—List of plants suitable for planting in monsoon' winter and summer.

(*a*) Colour scheme for annuals.

(*b*) Discussion of atleast 10 annuals with respect to Botanical names, flowering time, method of cultivation, varieties special features. (4)

A-2 Shrubs and Shrubberies :

(*a*) Importance of shrubberies.

(*b*) Discussion of atleast five shrubs with resepect to botanical names, choice of place, method of cultivation and ornamental value. (3)

A-3 Climbers :

Botanical names, method of cultivation, ornamental value, training and prunning of different climbers. (3)

A-4 Trees :

Botanical names of atleast ten trees used for ornamental or shade purpose. The discussion with respect to selection, cultivation and care. (3)

A-5 Hedges and Borders :

Botanical names of suitable plants. Method of plantation, prunning, trimming, use. (2)

A-6 Lilies, bulbs, perrenials :

Botanical names of Lilies, perrenials and bulbaceous plants (two each). Method of plantation, propagation and ornamental value. (3)

A-7 Cacti and succulents :

Botanical names of five species. Discussion about plantation, after care, ornamental value. (3)

A-8 Roses :

Origin, Types-Hybrid Tea, floribunda and miniatures. Method of plantation, propagation, soil, manure, aftercare and salient features of atleast 10 varieties. (4)

B. **Rockeries :**

B–1 Design.
B–2 Selection of site.
B–3 Selection of plants.
B–4 Maintenance and care. (2)

C. **Lawn :**

C–1 Preparation of soil.
C–2 Selection of grass.
C–3 Plantation and care.
C–4 Importance. (2)

D. **Green House :**

D–1 Importance of green-house.
D–2 Salient features of green-house.
D–3 Climatron. (2)

E. General account of *pests and diseases* in garden with respect to pathogen, host, symptoms, damage and control. (4)

F. **Garden Calander :**

Review of the activities to be carried out in garden thfoughout the year. (1)

Total Periods .. 36

Submission :

Student is to submit living, maintained specimens (any *four*) from following at the time of practical examination.

(1) Hanging basket.
(2) Plant on moss-stick.
(3) Grafted plant.
(4) Propagation by cutting.
(5) Propagation by layering.
(6) Successful budding.
(7) *Bonsai.*

List of Books

(1) Gardening in India—Lancaster, revised by Bose and Mukerjee.
(2) " Beautifying India "—M. S. Randhava.
(3) ' Gardens through ages '—M. S. Randhava.
(4) Beautiful Gardens—M. S. Randhava.
(5) Landscape gardening—Time-Life book.
(6) Prunning and grafting—Time-Life book.
(7) How to grow Roses ?—A Sunset book.
(8) Tropical Bonsai—Jyoti Parekh.
(9) Hydroponics—Bengal system—Sholto Douglas.
(10) Pushpa Bharati—Bhujbal.
(11) Rose in India—B. P. Pal.
(12) Everyday Gardening in India—E. W. Grindal.
(13) Climbers in India—B. P. Pal.
(14) Home gardening—Pratibha Trivedi.
(15) Lawns and Gardens—S. C. Jindal.
(16) Complete gardening in India—Gopal wani Jengair

Paper VI. Plant Protection- I and II First Term

Plant Protection—I Disease Development

A. **Plant Pathology :**

Introduction, Definition.

A–1 A short historical account of plant Pathology with reference to the work of the following pathologists : Theophrastus, Prevost, Robert Koch, Millardet, de Bary, Biffen, and Orton, Butler, Mundkur, K. C. Mehta.

A–2 Importance and scope of Plant Pathology. (3)

B. **Terminology :**

Definitions of the following terms :

Disease, Pathogen, Host, Parasite, Hyperparasite, Inoculum, penetration, infection, Pathogenesis, Pathogenicity, etiology, Incubation period, disease cycle, symptoms and epidemiology. (1)

C. **Causes of Plant diseases :**

Introduction :

C-1 Animate causes :

A brief survey of diseases caused by the following organisms with a few examples of each :

Bacteria, Viruses, Fungi, Algae, Nematodes and Mycoplasma.

C-2 Inanimate causes :

A brief survey of the diseases caused by the following :

(i) Adverse climatic conditions such as those of high and low temperature, unfavourable intensity of light, excess of water.

(ii) Deficiency and excess of minerals.

(iii) Chemical injuries caused by atmospheric pollutants, faulty application of fungicides, insecticides, weedicides etc. (4)

D. **Classification of Plant Diseases :**

Broad outline of the classification of plant diseases based on the following points :

(i) Nature of the causal agencies :
animate, inanimate.

(ii) Types of crops affected :
Cereals, pulses, etc.

(iii) Types of symptoms :
Necrotic, atrophic, hypertrophic, wilting, die-back, rusts, smuts, mildews etc.

(iv) In relation to occurrence :
Endemic, epithytotics, sporadic

(v) Type and sources of inoculum :
soil-borne, sed borne, air-borne.

(vi) Localised and systemic. (2)

E. **Symptoms and damage done :**

Various symptoms of plant diseases along with the kind of damage done. (4)

F. **Inoculum dispersal :**

(i) Active or autonomous :
Soil, seeds and plants.

(ii) Passive dispersal through :

(*a*) wind	(*b*) water
(*c*) insects	(*d*) fungi
(*e*) nematodes	(*f*) birds
(*g*) mammals	(*h*) man.

G. **Development of diseases** (Pathogenesis)

G–1 Infection :

Definition, landing of inoculum on the host.

G–2 Penetration :

Modes of penetration of viruses, bacteria, fungi and nematodes.

G–3 Mechanism of penetration :

(i) Through wounds.
(ii) Through natural openings-stomata, hydathodes, Lenticels.
(iii) Direct penetration-purely mechanical process partly chemical process evidences in support of both.
(iv) Establishment and colonization of host. (4)

H. **Host-Parasite relationship** : (Post penetration phase)

H–1 Host parasite interactions Leading to the establishment of nutritional parasitic relationship between the host and parasite.

H–2 Degree of Parasitism :

(i) Establishment of obligate parasites and facultative saprophytes.
(ii) Differences in their mode of nutrition.
(iii) Secretions of enzymes, toxins etc. by the host/parasite.
(iv) Invasion of the host tissue by the parasite.
(v) Interruption and alteration in host metabolism.
(vi) Development of symptoms. (4

I. **Epidemiology and disease forecasting :**

I-1 Introduction, simple interest and compound interest diseases, slow and rapid epiphytotics, their outbreak and decline.

I-2 Factors affecting rate of epiphytotics.

I-3 Broad idea of disease forecasting with one or two suitable examples. (3)

J. **Study of diseases :**

J-1 Inanimate diseases :

(*a*) Diseases caused due to nutritional deficiencies of the following elements :
Fe-chlorosis, Bo-Mango necrosis.

(*b*) Diseases due to unfavourable temperature-freezing injury to Potato, black-heart of Potato, sun scald of vegetables. (2)

J-3 Animate diseases :

(*a*) Viral diseases-TMV/PMV.

(*b*) Bacterial disease-Citrus canker.

(*c*) Fungal diseases :

(i) Powdery mildew of grapes/teak/Acacia.

(ii) Downy mildew of bajra (Green ear disease).

(iii) Ergot of bajra.

(iv) Tikka disease of ground nut.

(v) Loose smut of wheat. (6)

Total Periods .. 36

Paper—VI, Second Term, Plant Ptrotection—II

(Disease Control)

A. **Pland Protection :**

(i) Introduction. 1

(ii) Definition.

(iii) Importance.

(iv) Scope.

B. **Diease control :**

(i) Introduction.

(ii) Basic principles of disease control.

(iii) Control planning against :

(*a*) a disease (single disease control).

(*b*) a crop (multiple disease control).

(iv) Disease control on co-operative basis.

(v) Repeated use of control measures.

(vi) Use of preventive instead of curative measures.

(vii) Cost-benefit ratio.

C. **General principles of disease control :** (2)

(i) Preventive :

(*a*) Avoidance of the pathogen.

(*b*) Exclusion of the inoculumn.

(*c*) Eradication.

(*d*) Protection

(*e*) Disease resistance.

(ii) Curation-therapy.

D. (5)

D–1 Mechanical control :

D–2 Choice of geographic area, selection of field, proper time of sowing, use of disease escaping varieties, selection of seed and plating stock, high budding.

D–3 Control through cultural practices-crop rotation, mixed cropping, removal and destruction of diseased plants and plant organs, roguing, destruction of alternate and collateral hosts.

D–4 Field sanitation :

Destruction of crop residue, deep ploughing, improved soil drainage system, fallowing, flooding, crop-free period or crop-free zone, Depth of sowing of seeds, regulation of fertility level of soil.

D–5 Soil treatment :

(i) Heat.

(ii) Flooding.

(iii) Following.

(iv) Use of chemicals.

E. **Elimination of pathogen from infected plant material :** (1)

(i) Sorting.
(ii) drying and aging of seeds.
(iii) Thermal treatment.
(iv) Chemical treatment. (3)

F. **Biological control :**

F-1 (i) Introduction.
(ii) Definition.
(iii) Biocidal control and biostatic control.

F-2 Methods :
(i) Amendment of soil with organic matters.
(ii) Predaceous fungi methods.

F-3 Mechanism :
(i) Antibios's.
(ii) Exploitation.
(iii) Competition.

G. **Legal Control :** (2)

G-1 Introduction.

G-2 Plant quarantine-Introduction, definition, limitations and importance.

G-3 Plant quarantine organization in the world and in India.

H. **Chemical Control :**

H-1 Introduction, importance.

H-2 Classification of chemicals according to their :
(i) Chemical nature.
(ii) Mode of action-systemic-eradicants, protectants, therapeutants, non-systemic.
(iii) Plant part treated.
(iv) Nature of he pathogen against which used.

H-3 Criteria of a good fungicide and mechanism of action of fungicide.

H-4 Chemicals used in plant disease control-nature mode of action and uses.

Sulphur :

(1) *Inorganic compounds :*

(i) Sulphur powder.

(ii) Wettable sulphur.

(iii) Lime sulphur.

(2) *Organic compounds :* Disthiocarbomates.

(*b*) Copper :

(i) Bordeaux mixture.

(*c*) Mercury :

(1) Inorganic compounds :

(i) Mercuric chloride.

(ii) Mercurous chloride.

(2) *Organic compounds :*

(i) Ceresan.

(ii) Agrosan.

(iii) Aretan.

(*d*) Heterocyclic nitrogen compounds :

(i) Captan.

(ii) Glyodin.

(*e*) Quinone fungicides :

(i) Chlorinil.

(ii) Dichlone.

(iii) Ceredan.

(*f*) Benzene compounds :

(i) Dexon.

(ii) Deconil.

(iii) PCNB.

(*g*) Antibiotics-Introduction, definition, mode of action.

(i) Streptomycin.

(ii) Tetracycline.

(iii) Greseofulvin.

(iv) Aureofungin.

(*h*) Synthetic systemic fungicides :
(i) Oxathilins.
(ii) Dinocap.
(iii) Plantavax.
(iv) Benomyl.
(v) Bavistin.
(*i*) Soil fumigants.

-5 Methods of applying antipathogenic chemical. (6)

I. **Control through protective measures :** (2)
(i) Introduction.
(ii) Chemical treatment.
(iii) Chemical control of insect vectors.
(iv) Modification of host nutrition.
(v) Modification of environment.
(vi) Cross protection.

J. **Control through disease resistance :**

J–1 Introduction-use of resistant varieties, difference between disease escape, tolerance and disease resistance.

J–2 Inheritance of resistance : monogenic and polygenic resistance vertical and horizontal resistance.

J–3 Sources of resistnace :
(i) Selection and multiplication of resistant individuals from existing varieties.

J–4 Developing resistant varieties :
(i) Selection.
(ii) Hybridization.
(iii) Mutation.

J–5 Resistance through chemotherapy.

J–6 Resistance through host nutrition. (2)

K. **Curative methods-Therapy :**

K–1 Physical therapy :
(*a*) Surgery.
(*b*) Heat Treatment.

K–2 Chemotherapy-Introduction, systemicic fungicides, topical and systemic chemotherapy. (2)

L. **Defence of plant :**

L–1 Introduction.

L–2 Disease resistance in plants.

(i) *Protection :*

(*a*) Structural protection : epidermal, stomatal mechanical tissues.

(*b*) Chemical protection-Chemicals of the surface layer exudation of toxic chemicals.

(*c*) Absence of nutrients.

(*d*) Absene of common antigens.

(ii) *Defence :*

(*a*) Histological defence.

(*b*) Accumulation of toxic substances.

(*c*) Hypersensitive defence reaction

(*d*) Defence through growth substances and enzymes

(*e*) Tolerance to disease. (4)

M. **Entomology :**

(1) Introduction-Insect pests and their few examples.

(2) Pest control—

Pesticides : Introduction.

Types : stomach ontact and gaseous.

Inorganic-Lead arsenate.

Organic-DDT BHC.

Mode of action of pesticides. (4)

N. **Nematology :**

(1) Introduction :

Nematodes as plant pathogens.

(2) Study of the following nematodal diseases with respect to causal organism damage caused symptoms and control.

(i) Root-knot of vegetables.

(ii) Ear cockle of Wheat.

(iii) Molya disease of barley. (2)

Reference Books

(1) Introductions to Principles of Plant Pathology—R. S. Singh.
(2) Plant Diseases—R. S. Singh.
(3) Essentials of Plant Pathology—V. N. Pathak.
(4) A Text Book of Modern Plant Pathology—K. S. Bilgrami and H. C. Dube.
(5) An Introduction to Plant Diseases—B. E. J. Wheelar.
(6) Fungi and Plant Diseases—B. B. Mundkur.
(7) Diseases of Crop plants in India—G. Rangaswami.
(8) Introductory Plant Pathology—M. N. Kamat.
(9) Plant Diseases—R. S. Mathur.
(10) Outlines of Plant Pathology—Strobel and Mathre.
(11) Fundamentals of Plant Pathology—D. A. Roberts and C. W. Boorthroyd.
(12) Fungi and Diseases in Plants—E. J. Butler.
(13) Principles of Plant Pathology—Stakman and Harrar.
(14) Fungi—B. R. Vashishta.
(15) College Botany Vol. II—Gangule and Kar.
(16) Plant Pathology—Watker.
(17) Viruses and Mycoplasma diseases of plants—Raychaudhari and Nariani.
(18) Crop protection in the Tropics—Singh.
(19) Principles of plant Pathology—M. K. Dasgupta.
(20) Plant protection—Sill.
(21) Systemic fungicides—Yvas.
(22) Plant Pathology—Mehotra.
(23) Plant Protection–Principles and Taxonomy—Mukundan.
(24) Fungicides—Nene.
(25) Pest control in Agriculture—W. Rodewald and H. White.

Paper—VI, Medico-Botany—I and II

First Term—Medicl-Botany—I

A. Importance of plants in medicine with special reference to Ayurvedao. (2)

Bg. Common medicinal plants of different Botanical regions of India. (2)

C. Medicinal uses of the following plants from Maharashtra : *Aloe barbadensis* Mill. *Asparagus recemosus* Willd. *Azadirachta indica* *Bacopa monniera* *Boerhaavia diffusa* L. *Calotropis gigantea* (L) *R. Br. ex. Ait.*, *Centella Asiatica* (L) Urban., *Eclipta alba* Hassk, *Emblica officinalis* Gaertn., *Ficus bengalensis* L., *Ficus religeosa* L., *Moringa pterygasperma* Geertn., *Nyctanthes arbotristis* L., *Psoralea corylifolia* L. *Saraca indica* L., *Solanum xanthocarpum* Schrad., *Terminalia chebula* Retz., *Terminalia belerica* Roxb. *Terminalia arjuna* W., *Tribulus terrestris* Linn. *Vetiveria zinzanioides* Nash., *Vitex negundo* L., *Withania somnifera* Duna. (6)

D. **Cultivation of medicinal plants :**

D–1 Need and advantages.

D–2 Cultivation practices for following medicinal plants : *Allium sativum* Linn., *Mentha arvensis* Linn. *Piper nigrum* Linn. *Plantago ovata* Forsk.. *Rauwolfia serpentina* Benth exkurz *Zingiber officinale* Roscoe.

(*a*) Propagation methods.

(*b*) Requirements of soil, fertilizer-mannures.

(*c*) Irrigation.

(*c*) Weeding, pasts, and disease control.

(*d*) Harvesting (collection).

(*e*) Processing, storage and marketing. (9)

E. **Crude drugs :**

E–1 Morphological classification.

E–2 Macroscopic and microscopic diagnostic characters (in accordance with skeleton plan). of :

(*a*) Root, rhizome	(*b*) Bulb, corm
(*c*) Aerial stem	(*d*) Bark
(*e*) Wood	(*f*) Leaf
(*g*) Flower	(*h*) Fruit, seed. (10)

F. **Therapeutic classification of crude drugs :**

F–1 Definition.

F–2 Types, Analgesic astringent cathartic carminative cardiotonic demulcent, emollient emetic, expectorant febri Fuge, Haematinic laxative, purgative refrigerent, sedetive stomachic, stimulent. (2)

G. **Active ingradients of medicinal plants :**

G–1 Concept of active ingradient.

G–2 Different active ingradients.

Alkaloids, glycosides, tannins, resins, essential oils, gums, latex. (3)

H. Ayurvedic concept of preparation of crude drugs : churn, kadha, Asaya, Arishta, Guti. (2)

Total Periods ..36

Second Term, Medicobotany—II

A. **Techniques of characterization of crude drugs :**

A–1 Sectioning–t.s. and L.S.

A–2 Maceration.

A–3 Peeling.

A–4 Clearing.

A–5 Quantitative microscopy :

(*a*) Stomatal number.

(*b*) Stomatal index.

(*c*) Palisade ratio.

(*d*) Vein islet number. (4)

B. Study of drugs-macroscopic and microscopic characters, active principle(s) therapeutic action and uses of following drugs :.

B–1 Root and rhizome drugs Benth.

(*a*) *Rauwolfia serpentina Benth*-root.

(*b*) *Zingiber officinale Roscoe*-rhizome.

(*c*) *Allium sativum* L.-bulb.

B-2 Stem drug :

Tinoaspora Cordifolia Miers.

B-3 Wood drug :

Santalum album Linn.

B-4 Bark drugs :

(*a*) *Holarrhena antidysenterica* Wall.

(*b*) *Punica granatum* Linn.

B-5 Leaf drug :

Cassia angustifolia Vahl.

B-6 Flower drugs :

(*a*) *Eugenia caryophyllata* Thurb.

(*b*) *Rosa* sp.

B-7 Fruit drug.

Aegle marmelos Coorr.

B-8 Seed drugs :

(*a*) *Plantago ovata* Forsk

(*b*) *Ricinus communis* L.

B-9 Whole Plant :

Datura metei Linn.

B-10 Drugs of non-angiospermic plants :

(*a*) Gymnosperm-*Ephedra* sp.

(*b*) Pteridophyte-*Lycopodium* sp.

(*c*) Bryophyte-*Sphagnum* sp.

(*d*) Fungus-*Claviceps purpurea*.

B-11 Unorganised drugs :

(*a*) Resin-Asafoetida.

(*b*) Latex-Opium.

(*c*) Gum-*Acacia*. (20)

C. Medicinal properties of following : spices and condiments-*Amomum sunbulatum* Roxb., *Allium sativum* Linn. *Carum copticum* Benth., *Cinnamomum tamala* Nees and Ebrm. *Cinnamomum zeylanicum* Blume, *Coriandrum sativum* L. *Cuminum cyminum* Linn., *Elettaria cardamomum* Maton. *Myristica fragrans Houtt Nigela sativa* Linn. *Piper nigrum* Linn. *Vanila planifolia Parmelia* sp. (5)

D. Medicinal uses of common household crude drugs. *Acorus calamus* L. *Adhatoda vasica* Nees *Embelia ribes* Barm *Gardenia gummifera* Linn. *Glycyrrhiza glabra* Linn. *Helicteris isora* Linn. *Piper longum* Lihnn. *Ocimum sanctum* Linn. (2)

E. Ayurvedic concept of food and stuffs suitable or unsuitable during healthy and or unhealthy state of human body in different seasons. (3)

F. Importance of folk medicine. (2)

Total Periods ..36

Reference Books

(1) Shah and Quadri—Pharmacognasy.
(2) Trease and Evans—Pharmacognasy.
(3) Gokhale S. B.—Pharmacognasy.
(4) Maharashtra State Gazetter—Medicinal plants.
(5) Wallis—Pharmacognasy.
(6) Jain S. K.—Medicinal Plants.
(7) Dymock—Materia medica.
(8) Kirtikar and Basu—Indian Medicinal plants.
(9) Dash—Ayurvedic treatment for common Diseases.
(10) कुडचडकर शास्त्री—द्रव्य गुण शास्त्र
(11) सावंत—वनौषधी संग्रह
(12) डॉ. सहस्त्रबुद्धे—आपल्या भवतीचे गुणवर्म

FORESTRY

First Term—Forestry—1

A. **Introduction :**

A–1 Definition importance and scope.

A–2 Functional classification of forests.

A–3 Forest types in Maharashtra.

A–4 Forest Law : some important sections viz. 1927 1972.

A–5 National forest policy (NFP) (a brief account) NFP 1952 NFP 1982 NFP 1988 and New forest policy recommended by NCEP (National council of Environmental Protection). (4)

B. **Forest environment :**

B–1 Forest as an ecosystem.

B–2 Biotic components :

plants animals and microbes.

B–3 Abiotic components :

Topography climate and soil. (4)

C. **Wild life Management :**

C–1 Introduction importance and scope.

C–2 A general account of the following with reference to Maharashtra :

(*a*) National parks.

(*b*) Forests parks.

(*c*) Sancturies. (3)

D. **General silviculture :**

A brief account of the following silvicultural systems :

D–1 High forest systems :

(*a*) Clear felling.

(*b*) Shelterwood.

(*c*) Selection.

D–2 Coppice systems :

(*a*) Simple.

(*b*) Coppice with standard system.

(*c*) Coppice with reserve system. (4)

E. **Forest Nursaries :**

E–1 Essential features.

E–2 Types of nursaries :

(*a*) Raise bed nursery.

(*b*) Sunken bed nursery.

(*c*) Polypot nursery.

E–3 Seeds :

(*a*) seed collection methods and seed storage.

(*b*) seed purity and germination test.

(*c*) Embryo-viability test.

(*d*) Pre-germination treatments.

E–4 A brief account of the following used in forest nurseries :

(*a*) Fertilizers.
(*b*) Weedicides.
(*c*) Insecticides.
(*d*) Silvicides.
(*e*) Fungicides. (7)

F. **Forest plantations :**

F–1 Afforestation and reforestation.

F–2 Natural and artificial regeneration.

F–3 Monoculture and mixed culture.

F–4 Exotics in forestry.

F–5 Wind-breaks and shelterbelts.

F–6 Silviculture of *any four* of following tree species :
Tectona grandis Terminalia sp. Acacia sp. Casuarina eqisetifolia. Axzadarachta indica and *Dalbergia sisso.* (10)

G. **Forest mensuration :**

G–1 Introduction

G–2 Knowledge and utility of the followings.
Tape Callipers and Abneys level.

G–3 Measurement of diameter and girth at breast height.

G–4 Measurement of height of a tree.

G–5 Measurement of volume of the wood.

G–6 Estimation of biomass of standing crop in a given plot.

G–7 Enumeration of growing stock. (4)

Total Periods ..36

Paper—VI, Forestry, Second Term, Forestry—II

A. **Forest management :**

A–1 Introduction.

A–2 Disforestation : Cultivation and developmental purposes.

A–3 Concept of working plan.

A–4 Managemental practices on various sites and terrains :

(*a*) Selection cum improvement.
(*b*) Coppices with reserves.
(*c*) Clearfelling and planting.
(*d*) After-care.

A–5 Improvement of grasslands and Pastures.

A–6 Rights and concessions. (6)

B. **Forest conservation :**

B–1 Meaning and needs.

B–2 Exposure to various dangers and correcting measures :

(*a*) grazing.
(*b*) fire.
(*c*) illicit cutting.
(*d*) pests and diseases.

B–3 Soil conservation :

A brief account :

(*a*) Definition and need
(*b*) Soil erosion and its causes.
(*c*) Types of soil erosion.
(*d*) Preventive measures. (4)

C. **Arboriculture :**

C–1 Introdution.

C–2 Methods of raising an arboratum :

(*a*) Monoculture.
(*b*) Mixedculture.
(*c*) Agri-silviculture.

C–3 Tree-crop husbandary of *any four* of the following trees species with reference to :

(*a*) Methods of propagation.
(*b*) Planting and aftercare.
(*c*) Harvesting and uses.

group (i) *Casuarina eqisetifolia, Acacia asp.*
group (ii) *Hardwickia/Leucaena sp.,*

group (iii) *Tectona grandis/Eucalyptus sp./Azadarchta indica.*

group (iv) *Eugenia jambolana.,/Terminalia* sp./*Emblica officinalis.* (6)

D. **Social forestry :**

D–1 Definition, aims and objectives.

D–2 Forms of social forestry.

(*a*) Farm forestry.

(*b*) Recreation forestry.

(*c*) Extension forestry.

(*d*) Degraded forests.

D–3 Coverage/Areas :

(*a*) Wastelands.

(*b*) Panchayat lands.

(*c*) Village commons.

(*d*) Side-lands '–Roads, Highways and Railways.

(*e*) Minor forests.

(*f*) Canal banks.

(*g*) Bunds.

(*h*) Recreation centres.

(*i*) Private lands.

(*j*) Institution's Lands.

D–4 Choice of species with reasonings, for planting on areas mentioned under D–3. (8)

E. **Forest Utilization :**

E–1 Improtant felling rules.

E–2 Logging and transport.

E–3 Industrial supply.

(*a*) Railway sleepers.

(*b*) Matchbox industry.

(*c*) Paper and pulp industry.

(*d*) Fire wood.

(*e*) Medicinal plants.

(*f*) Other commercial minor forest products.

E-4 Identification of important timber species on the basis of wood anatomy :

(*a*) Teak (*Tectona grandis*).

(*b*) Neem (*Axadarachta indica*).

(*c*) Babhul (*Acacia* sp.).

F. **Forest pathology :**

F-1 Introduction-meaning, importance and scope. ([illegible])

F-2 Major diseases of Teak, *Acacia* and *Terminalia* with reference to :

(*a*) causal organism.

(*b*) symptoms.

(*c*) damage done.

(*d*) control.

F-3 Wood-decay :

(*a*) types.

(*b*) deformities.

(*c*) care (4)

G. **Forest administration :**

G-1 Organ[illegible]al pattern.

G-2 Duties.

G-3 Training :

(*a*) Pre-service.

(*b*) In-service. (2)

Tortal Periods ..36

List of Books

(1) General Silviculture--Champion, Sets, Khanna.

(2) Social Forestry in India—Tiwari, K M., Natraj Publishers, Dehradun.

(3) Issues in Agriculture and Forestry--Desai Vasant.

(4) Forest ecosystem Waring R. H.

(5) Foresters companion (Indian Forestry handbook)--Maslekar, A. R.—Pub.-Jugal Kishor and Co. (Publ. Div.) 23-C, Rangpur Road, Dehradun, U.P.

(6) Introduction to Social Forestry—Sitaram Rao.
(7) Fire wood crops—Shrubs and trees species for energy production—National Academy of Science.
(8) Forest in India—Agarwal (I. B. A.).
(9) Nursery and Plantation techniques in Forestry—Chaudhari.
(10) Fodder tress of India—Singh.
(11) Flowering trees of India—by Randhawa (N. B. T.)
( ) Forestry in India—by Dewedi.
(13) Manual of Indian forest Botany.
(14) Hand book of social forestry—Negi, S. S.
(15) Forest Ecology—Negi, S. S.
(16) Forest Economics—Negi, S. S.
(17) Forest law—Negi, S. S.
(18) General Silviculture—Negi, S S.
(19) Scientific management of forests—Negi, S S.
(20) Silviculture of Indian Trees—Negi, S. S.
(21) Soil conservation—Negi, S. S.
(22) Environmental conservation—Negi, S. S.
(23) वनश्री आणि आणि वनविज्ञान—दशपुत्रे कॉंटिनेंटल प्रकाशन पुणे.

Book numbers 13 to 22 by International Book service—Dehradun.

Paper—VI, Genetics and weed Biology, Basic course in Genetics for T.Y.B.Sc. Botany Students who have not offered Zoology at F.Y.B.Sc. Level First Term—Genetics

Introduction, definition. (1)

B. Mende's law of inheritance :

B–1 Phenomenon of dominance.
B–2 Law of seggregation of characters and purity of gametes.
B–3 Law of independent assortment. (3)

C. Gene interaction and modified Mendelian ratio.

C–1 Incomplete dominance (1 : 2 : 1 ratio).
C–2 Complementary factors (9 : 7 ratio).
C–3 Recessive epistasis (9 : 3 : 4 ratio).
C–4 Dominant epistasis (12 : 3 : 1 ratio). (4)

D. Lethal genes :

D–1 Concept.
D–2 Albinism in corn (3 : 1 ratio).
D–3 Coat colour in mice, (2 : 1 ratio). (2)

E. Chromosomal basis of heredity and sex determination.

E–1 Sutton's hypothesis.
E–2 Discovery of sex chromosomes.
E–3 Sex linkage and sex determination in *Drosophila*. (white eyed mutant).
E–4 Chromosomal method of sex determination.
(*a*) XY–method, (*b*) XO method.
(*c*) ZW–method (*d*) Honey bee method.
E–5 Sex determination in *Melandrium*. (6)

F. Linkage and crossing over.

F–1 Concept
F–2 Coupling and repulsion.
F–3 Linkage in maize.
F–4 General idea of crossing over.
F–5 Significance of crossing over. (4)

G. Multiple alleles :

G–1 Concept and characteristics.
G–2 Discovery of blood groups by Carl Landsteiner.
G–3 Blood typing. (2)

H. Cytoplasmic inheritance :

H–1 Concept.
H–2 Inheritance of plastids.
H–3 Inheritance of Kappa particles-killer paramoecia.
H–4 Inheritance of mitochondria. (3)

I. Chromosomal aberrations :

I–1 Deletion.
I–2 Duplication.
I–3 Inversions.
I–4 Translocation. (3)

J. **Numerical changes in chromosomes :**
J–1 Aneuploidy.
J–2 Euploidy.
J–3 Significance of chromosomal variations. (4)
K. Simple examples based on topics 2, 3, 4 and 7. (3)

Total Periods ..36

Paper—VI, Second Term, Weed Biology

(Only for those students who have not offered Zoology at F.Y.B.Sc. level)

A. **Introduction :**
A–1 History of the term 'weed'.
A–2 Definition of 'weed'.
A–3 Origin of "weed".
A–4 Causes of plants becoming weeds. (2)

B. **The Classification of weeds :**
B–1 Taxonomic.
B–2 Habit.
B–3 Habitat.
B–4 System of Korsma, Anderson, Thellung. (2)

C. **Physiology of weeds :**
C–1 Parasitic weeds.
C–2 Dormancy of weed seeds.
C–3 Longevity of weed seeds.
C–4 Factors involved in germination of weed seeds.
C–5 Factors involved in seedling establishment.
C–6 Growth and development.
C–7 Water relation.
C–8 Temperature.
C–9 Photoperiodism.
C–10 Dispersal of weeds. (10)

D. Interaction of crop plants and weeds :

D-1 Competition.

D-2 Inter and intra-specific competition, competition for space, water, light and nutrients. (2)

E. Study of the weeds :

Study of following weeds with reference to their external morphology, seed structure, occurrence and associations. (6)

Striga, Parthenium, Alternenthera, Bichhornia, Cyperus, Cynod

F. Control of weeds :

F-1 Manual.

F-2 Non-chemical methods.

(*a*) soil cultivation.

(*b*) Mechanical clearing of land.

(*c*) Fire.

(*d*) Ecological method.

F-3 Chemical control.

F-4 Biological control. (8)

G. Genetic aspects of origin and evolution of weeds.

G-1 Hybridization.

G-2 Apomixis.

G-3 Relation between weeds and cultivated plants.

G-4 Evolution of resistance. (3)

H. Importance of weeds with respect to :

H-1 Losses due to weeds.

H-2 Effects on other plants and animals.

H-3 Pollution. ( )

H-4 Manure.

H-5 Paper and pulp.

H-6 Fuel and biogas.

H-7 Fodder. (3)

Total Periods .. 36

Reference Books

(1) N. C. Joshi—Manual of Weed Control 1974.

(2) Thakur, C.- Weed Science 1977.

(3) Lawrence J. King -Weeds of the World Wiley Eastern 1974.

PRACTICALS

Practical—I (Paper I and VI) Paper—I, Cryptogams

Lab. Exercise No.

1. Studies of life cycle of *Chara* and *Batrachospermum* with the help of material and permanent slides.
2. Study of life cycle of *Puccinia graminis* with the help of material and permanent slides.

3 & 4. Study of range of thallus structure in algae with the help of material and or permanent slides as per theory syllabus.

5. Study of myxomycetes and deuteromycetes. (at least two forms each).
6. Study of *Lichens*-observation of various forms of *Lichens*, V. S. of apothecium.
7. For identification, any five fungal forms from the following to be given :

   Synchytrium, *Saprolegnia*, *Erysiphe*, *Uncinula*, *Claviceps*, *Peziza*, *Taphrina*, *Clavaria*, *Geaster*, *Polyporous*, Smut, Rust (other than *Puccinia graminis*).

8 & 9. Culture, isolation and microscopic observations of algal forms (at least 5) by using Bold's basal medium.

10 & 11 (*a*) Isolation of fungal forms (at least 6) from soil, by P.D.A. medium.

(*b*) Isolation and microscopic observations of the above isolates by using slide culture method.

12. Study of life cycle of *Marchantia*.
13. Study of life cycle of *Anthoceros*.
14. Study of life cycle of *Polytrichum/Pogonatum*.
15. Study of life cycle of *Psilotum* with the help of material and/or slides.
16. Stud y of life cycle of *Lycopodium*.

Note : Students are expected to submit at least 25 specimens herbarium sheets from cryptogams at the time of practical examination.

17. Study of life cycle of *Marsilea*.
18. Study of stelar evolution in Pteridophyta with the help of sections of material and/or permanent slides.

Paper—VI, Gardening—I and II

19. (*a*) Techniques of pot culture.
    (*b*) Observation, listing and uses of :
        (i) mannures and fertilizers.
        (ii) Growth hormones.
        (iii) Chemicals used in control of diseases.
    (*c*) Observation, listing and uses of various garden tools.
20. Preparation and aftercare of a *Bonsai*.
21. Study of different indoor plants and preparation of a " Hanging Basket "/plant grown on a " moss-stick ".
22. Study of different ornamental plants such as annuals, perennials, shrubs, climbers, trees, cacti and succulants, hedge plants (*two examples of each*) with respect to botanical name, ornamental value and important features.
23. Plantation and observation of seasonal plants, their successful maintenance along with record (to be submitted at the time of examination).
24. Visit to a suitable garden to study various salient features such as lay-out, components, list of plants and special features (if any).

Note : Students should submit the following at the time of practical examination.

(*a*) Report of their visit to a garden.
(*b*) well-maintained specimens from the following (any *four*) :
    (i) Hanging basket.
    (ii) Plant on moss-stick.
    (iii) Grafted plant.
    (iv) Plant propagated by cutting.
    (v) Plant propagated by layering.
    (vi) Plant propagated by budding.
    (vii) *Bonsai*.

Paper—VI Plant Protection—I and II

Lab. Execise No.

19, 20. Study of the following plant diseases with reference to the causal organism, symptoms, nature of the damage done and control measures (any *eight*) :

(i) Powdery mildew, (ii) Downy mildew, (iii) Whip smut of sugarcane, (iv) Grain smut of jowar, (v) Citrus canker, (vi) Tikka disease of groundnut, (vii) Red rot of sugarcane, (viii) Wilting of seedlings by fusarium, (ix) Bunchy top of banana, (x) Yellow vein mosaic of lady's finger, (xi) Root knot of vegetables.

21,22 (*a*) Preparation and application of bordeaux mixture on diseased plants and observation of its effect.

(*b*) Demonstration of various chemicals used as fungicides, bactericides, insecticides, viricides, weedicides and nematicides and application of some of them on the diseased plants and observation of their effects.

(*c*) Demonstration of different types of sprayers and dusters used in diseased control.

(*d*) Study of some common pests and their control (any *five*) :

(i) Jowar stem borer, (ii) Bajara-Blister beetle (iii) Mango stem borer, (iv) *Rheonoceros* beetle on coconut, (v) Sugarcane stem borer, (vi) Pyrilla on sugarcane, (vii) Thrips, (viii) Ephids, (ix) Boll worms of cotton, (x) Caterpillars on vegetables.

23. Visit to a nearby agriculture college/university to observe various methods of disease control.

24. Field trips to collect samples of diasesed material.

Note : Students should submit at least ten diseased specimen along with the report of the field trips at the time of practical examination.

Paper—VI Medico Botany

Lab. Exercise No.

19. Dry preservation of part used and herbarium preparation of *at least ten* medicinal plants.
20. Propagation of *at least two* medicinal plants.
21. Study of macroscopic and microscopic characters of root and rhizome drugs.
22. Study of macroscopic and microscopic characters of aerial stem, bark and leaf drugs.
23. Study of macroscopic and microscopic characters of Flower, fruit and seed drugs.
24. Visit to the Ayurvedic college and garden.

Note : (*a*) Students are expected to submit. (*b*) at least ten medicinal plants and dry preservation of the parts used.

(*c*) Report of the visit at the time of practical examination.

Paper- VI Forestery- I and II

19. Study of seeds and seedlings of any *three* species of the following. with respect to :
    1.1 Seed grouping on the basis of size/weight.
    1.2 Calculating seed purity.
    1.3 Germination test (germination percentage).
    1.4 Embryo viability test.
    Acacia arabica; Acacia catechu; Cassia fistula; Leucena glauca; Pterocarpus marsupium; Tectona grandis; Terminalia chebula; Emblica officinalis.
20. Identification and collection of locally available forest products such as :
    2.1 *Food :*
    (*a*) Edible rhizome, bulbs and tubers.
    (*b*) Fruits of *Buchnania lanzan, Madhuca latifolia, Semicarpus anacardium, Carissa carandas, Myenia laxiflora.*

2.2 *Medicinal plants :*

Helicteres isora; Pongamia glabra.

(*a*) *Fruits :*

Terminalia chebula, Terminalia belarica, Emblica officinalis.

(*b*) *Seeds :*

Psoralea corylifolia; Eugenia jambolina; Strychnos nux-vomica.

(*c*) *Leaves :*

Seena/*Aloe*/Vasaka.

(*d*) *Roots :*

Asparagus/Rauwolfia/Gloriosa.

(*e*) *Bark :*

Mango / Babul / Neem / *Terminalia arjuna* / *Holarrhena antidysenteriga*

(*f*) *Wood :*

Pterocarpus marsupium / *Santalum album.*

2.3 *Commercial :*

(*a*) Leaves of *Diospyros melanoxylon, Bauhinia vahlii Butea monosperma; Cinnamonum tamala.*

(*b*) Gum arabic and Gum Karaya.

(*c*) *Acacia catechu* (Kath).

(*d*) Citronella oil.

(*e*) Tasar silk.

(*f*) Neem fruits.

(*g*) Fruits of *Acacia arabica.*

21. Identification of woods from material and or sections of the following :

Teak, Neema, Babul, Bija sal.

22. Identification and study of diseases as mentioned in the theory syllabus.

23. (*a*) Measurement of DBH/CBH and formulating girth classes.

(*b*) Measurement of the height of a tree using Abneys level (if available) or 'forester's method (geometric).

24. (*a*) Visit to a nearby forest and preparing forest profile of the area.

(*b*) Visit to a forest nursery to study nursery techniques.

Note : Students are expected to submit the herbarium sheets and the samples as mentioned in Lab. exercise No. 2 and 4 along with the report of the visits at the time of practical examination.

Paper--VI Basic Genetics and weed Biology

(Only for those students who have not offered Zoology at F.Y.B.Sc.Level)

Lab. Exercise No.

1. Identification of male and female *Drosophila* with respect to following genetic traits and an analysis of a genetic cross.
   (i) Eye colour (ii) Wings
   (iii) Birstles (iv) Abdominal colour.
2. Blood typing A. B. O Blood group system.

3,4. Listing of frequency and abundance of two different types of localities.

5,6. Study of life history and biology of weeds mentioned in the syllabus (any *one*) :

Practical—II (Paper II and IV)

Paper—II Gymnosperms and palaeobotany environmental Biology and plant Geography

Lab. Exercise No.

1,2. (i) Study of life cycle of *Gnetum* with the help of slides and specimens.
   (ii) Students should take T.S. of stem, T.S. of leaf.
   (iii) Mounting of male flowers and pollen grains.
   (iv) V.S. of ovule.

3,4,5. (i) Study of life cycle of *Pinus* with the help of slides and specimens.
   (ii) Students should take T.S., T.L.S., R.L.S., of stem, and T.S. of needle, double stained preparation;
   (iii) Mounting of pollen grains.

5,6. Study of different types of fossils-impression, compression, petrifaction, coal balls, pith cast, pseudofosils.
Study of *Rhynia* (stem T.S., sporangium.)
Study of *Lepidodendron* (stem T.S., *Lepidophyllum*, *Lepidostrobus*, *Lepidocarpon*, *stigmaria* rootlet T.S.)
Study of Calamites (*Calamite* pith cast, *Calamite* stem T.S., *Annularia*, *Calamostachys* and *Paleostachya*,
Study of *Cycadeoidea* fructification.
Study of *Lyginopteris oldhamia* (stem T.S.).

8. Study of vegetation by List count quadrat method. Students should calculate frequency, density, abundance, % frequency, frequency classes and graph.
9. Study of vegetation by line or belt transect method.
10. Study of soil with reference to :
(*a*) Soil texture,
(*b*) Water holding capacity, of different types of soils. and
(*c*) pH (by paper and pH meter).
(*d*) Tests for the presence of carbonates, sulphates, nitrates.
11. Demonstration and working of different instruments :
(*a*) Anemometer.
(*b*) Wet bulb and Dry bulb thermometer.
(*c*) Minimum and maximum thermometer.
(*d*) Soil thermometer.
(*e*) Hair Hygrometer.

Paper—IV, Plant Physiology and Genetics

Major Experiments

Lab. Exercise No.

12. Determination of R-Q values of fatty and starchy seeds.
13. Extraction and separation of leaf pigments by using solvent method.
14. Extraction and separation of amino-acids by ascending/circular paper chromatography.
15. Qualitative assessment of the macroelements in plant ash (P, K, Mg, Mn, Ca, nitrate).

16. Effect of light intensity, light quality and temperature on the rate of photosynthesis.
17. Study of enzyme activities, diastase/catalase.
18. Qualitative tests for carbohydrates in leaves/fruits by Molishe's test, Barfoed's test, Seliwanoff's test, Benedicts test and iodine test.
19. Extraction and separation of anthocyanin pigments by T.L.C.
20. In vitro culture of isolated roots of tomato (Demonstratid practical).
21. Induction of callus from seedling plants – effect of IAA, 2, 4–D and Kn on induction and growth of callus (Demonstration praetical).
22. Extraction of DNA from cauliflower/germinating seeds.
24. Study of polytene chromosomes from salivery glands of *Drosophila* larvae or Chironomous larvae.
23. Preparations of squash/smear to study stages of mitosis in *Allium* or any other suitable material.

Practical– -III (Paper III and IV) :

Paper – -III Angiosperm Taxonomy, Economic Botany

Lab. Exercise No.

1–5. Study of any *ten* families other than those studied at S.Y.B.Sc. class with respect to :

Morphological characters, systematic position with reasons, diagnostic characters, floral diagram and floral formula, economic importance (if any).

6. Preparation of artificial key for identification of plant families/ genera/species.
7. (*a*) Use of Flora to identify the specimens upto species.
   (*b*) Display and listing of floristic works like floras and monographs.

8,9. Study of diagnostic features of economically important plants, parts or products as mentioned in the theory syllabus.

10. Study of epidermal tissue system as per theory syllabus based on locally available material.

11. Study of mechanical tissue system with at least one example each of root, stem and leaf.
12. Study of stelar and extrastelar normal secondary growth in stem and root of woody dicot (double stained preparation).
13,14 Study of anomalous secondary growth in *Bignonia, Dracaena, Aristolochia* and Carrot. (double stained preparation).
15. *Embryology*—Study of the following with the help of permanent slide —

Micro-sporangium and microsporogenesis, Megasporogenesis, monosporic and bisporic embryo sacs, stages of embryo development in *capsella*.

Paper—IV Horticulture and Plant Breeding

16,17 Propagation of plants by :

(*a*) cutting (*b*) layering
(*c*) grafting (*d*) budding.

19, 20 21. Preparation of :

(*a*) Jam.
(*b*) Jelly.
(*c*) Squash and Ketchup.

21. (*a*) Technique of hybridization :

(i) Emasculation and bagging.
(ii) Collection of pollens.
(iii) Cross pollination and bagging.
(iv) Labelling.

(*b*) Identification of *at least two* improved varieties of each of the following :

(i) Wheat.
(ii) Cotton.
(iii) Sugarcane.

22, 23, 24. *Microtomy* :

(i) Preparation of material for microtomy.
(ii) Cutting sections, staining and making the slides permanent.

Note : Students should undertake :

(i) One compulsory Botanical excursion of long duration to an area other than their own and the one which is of different botanical characters.

(ii) One day excursions to local floras for collection of plants.

(iii) Submission of record of field observations during excursions mentioned above.

(iv) Submission of 25 identified herbarium sheets prepared by the candidate.

(v) Microtome permanent slides, prepared by the candidate (*at least five*) ;

(vi) Hand made double stained permanent slides prepared by the candidate (*at least three*) ;

Note : For all practicals, submissions and reports of the visits and field trips should be duly certified by the head of the department.

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