

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus for the Semester System Examination for M.Sc. Part - I (Semester I & II) and for M.Sc. II (Semester III & IV)

1. A candidate who has obtained the degree of Bachelor of Science (Botany) of this University or of any other University recognized as equivalent there to, may after successful completion of the course work etc. prescribed for the M.Sc. degree examination, be admitted to the examination for the degree of M.Sc. in the respective subject as per the regulation prescribed in that behalf.
2. A candidate possessing a bachelor's degree in science with at least 40% marks in theory papers in external examinations will be held eligible for admission to the Master degree course in Botany offered by him/her at the Bachelors degree examination. However, if the number of eligible applications, as in above, is less than available seats, then a candidate possessing bachelor's degree in science with three subjects (optional-equal weightage) with at least 40% marks in theory papers in external examinations will be held eligible for admission to the Masters degree course in Botany.
The degree of Master of Science will be taken by papers, practicals and Project work only.
3. M.Sc. examination in the subject of Botany shall consist of four semesters - (M.Sc. semester I to IV). For each examination, there shall be four written papers and three practical. Each theory paper shall be 70 marks and 3 hour duration and three practical of 140 marks, each of 5 hours duration. 30 marks are for Botanical excursions, records, submissions and Viva-Voce examination. Students have to attend the compulsory botanical excursions tour as and when scheduled by the department and have to submit the tour report (for final examination).
4. The examination for the various theory papers and laboratory work will be conducted under semester system. For this purpose each academic year will be divided into two semesters.
5. For deciding result of M.Sc. examination at each semester, the ratio between the internal assessment and external assessment will be 30:70. For the purpose of internal assessment, the Department concerned will conduct at least one test in each semester. The Department will also arrange Assignments, Quiz, Seminar etc. for internal assessment in theory course work and the Practical.
6. (i) The Head of the department, in consultation with other teachers of the department, will prepare in the beginning of the year a detailed scheme of Assignments, seminars, home work, quizzes, etc, and the Programme for the test examinations and the same will be announced to the candidates.
(ii) The records of the test examinations as well as Assignments, seminars, home work, quizzes etc. will be maintained by the department concerned.
(ii) Every candidate shall maintain a regular record of his/her practical work that shall be duly certified by his/her teacher(s) from time to time.

SEMESTER I

| Theory/Practical | External Evaluation | Internal Evaluation | Total |
|---|----------------------------|----------------------------|--------------|
| Paper BOT -101 | 70 | 30 | 100 |
| Paper BOT -102 | 70 | 30 | 100 |
| Paper BOT -103 | 70 | 30 | 100 |
| Paper BOT -104 | 70 | 30 | 100 |
| Practical BOT 105 (Pra. I - III) | 140 | 60 | 200 |
| Total | 420 | 180 | 600 |

SEMESTER II

| Theory/Practical | External Evaluation | Internal Evaluation | Total |
|---|----------------------------|----------------------------|--------------|
| Paper BOT -201 | 70 | 30 | 100 |
| Paper BOT -202 | 70 | 30 | 100 |
| Paper BOT -203 | 70 | 30 | 100 |
| Paper BOT -204 | 70 | 30 | 100 |
| Practical BOT 205 (Pra. I - III) | 140 | 60 | 200 |
| Total | 420 | 180 | 600 |

SEMESTER III

| Theory/Practical | External Evaluation | Internal Evaluation | Total |
|---|----------------------------|----------------------------|--------------|
| Paper BOT -301 | 70 | 30 | 100 |
| Paper BOT -302 | 70 | 30 | 100 |
| Paper BOT -303 | 70 | 30 | 100 |
| Paper BOT -304 | 70 | 30 | 100 |
| Practical BOT 305 (Pra. I - III) | 140 | 60 | 200 |
| Total | 420 | 180 | 600 |

SEMESTER IV

| Theory/Practical | External Evaluation | Internal Evaluation | Total |
|---|----------------------------|----------------------------|--------------|
| Paper BOT -401 | 70 | 30 | 100 |
| Paper BOT -402 | 70 | 30 | 100 |
| Paper BOT -403 | 70 | 30 | 100 |
| Paper BOT -404 | 70 | 30 | 100 |
| Practical BOT 405 (Pra. I - III) | 140 | 60 | 200 |
| Total | 420 | 180 | 600 |

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc. Botany (New Under Semester Scheme)
Teaching and Examination Scheme for Semester-I

| Paper | Teaching Schedule Hrs/ wk | University Exam Theory/Practical | | Internal Exam Theory/ Practical | Total Theory/ Practical |
|--------------------------------|---------------------------|----------------------------------|------------|---------------------------------|-------------------------|
| | | Duration | Marks | | |
| Theory | | | | | |
| BOT 101: | 3 | 3 | 70 | 30 | 100 |
| BOT 102: | 3 | 3 | 70 | 30 | 100 |
| BOT 103: | 3 | 3 | 70 | 30 | 100 |
| BOT 104: | 3 | 3 | 70 | 30 | 100 |
| | | | | | |
| Practical | | | | | |
| BOT 105: Practical I, II & III | 4×3=12 | 3×5 | 140 | 60 | 200 |
| TOTAL | 24 | | 420 | 180 | 600 |

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc. Botany (New Under Semester Scheme)
Teaching and Examination Scheme for Semester-II

| Paper | Teaching Schedule Hrs/ wk | University Exam Theory/Practical | | Internal Exam Theory/ Practical | Total Theory/ Practical |
|--------------------------------------|------------------------------|-------------------------------------|-------|---------------------------------------|-------------------------------|
| | | Duration | Marks | | |
| Theory | | | | | |
| BOT 201: | 3 | 3 | 70 | 30 | 100 |
| BOT 202: | 3 | 3 | 70 | 30 | 100 |
| BOT 203: | 3 | 3 | 70 | 30 | 100 |
| BOT 204: | 3 | 3 | 70 | 30 | 100 |
| Practical | | | | | |
| BOT 205: Practical I, II & III | 4×3=12 | 3×5 | 140 | 60 | 200 |
| TOTAL | 24 | | 420 | 180 | 600 |

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc. Botany (New Under Semester Scheme)
Teaching and Examination Scheme for Semester-III

| Paper | Teaching Schedule Hrs/ wk | University Exam Theory/Practical | | Internal Exam Theory/ Practical | Total Theory/ Practical |
|--------------------------------------|------------------------------|-------------------------------------|-------|---------------------------------------|-------------------------------|
| | | Duration | Marks | | |
| Theory | | | | | |
| BOT 301: | 3 | 3 | 70 | 30 | 100 |
| BOT 302: | 3 | 3 | 70 | 30 | 100 |
| BOT 303: | 3 | 3 | 70 | 30 | 100 |
| BOT 304: | 3 | 3 | 70 | 30 | 100 |
| Practical | | | | | |
| BOT 305: Practical I, II & III | 4×3=12 | 3×5 | 140 | 60 | 200 |
| TOTAL | 24 | | 420 | 180 | 600 |

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc. Botany (New Under Semester Scheme)
Teaching and Examination Scheme for Semester-IV

| Paper | Teaching Schedule Hrs/ wk | University Exam Theory/Practical | | Internal Exam Theory/ Practical | Total Theory/ Practical |
|--------------------------------------|------------------------------|-------------------------------------|-------|---------------------------------------|-------------------------------|
| | | Duration | Marks | | |
| Theory | | | | | |
| BOT 401: | 3 | 3 | 70 | 30 | 100 |
| BOT 402: | 3 | 3 | 70 | 30 | 100 |
| BOT 403: | 3 | 3 | 70 | 30 | 100 |
| BOT 404: | 3 | 3 | 70 | 30 | 100 |
| | | | | | |
| Practical | | | | | |
| BOT 405: Practical I, II & III | 4×3=12 | 3×5 | 140 | 60 | 200 |
| TOTAL | 24 | | 420 | 180 | 600 |

M.Sc. (BOTANY)**I SEMESTER****BOT - 101: Diversity & Classification of Bacteria and Algae****BOT - 102: Lichen & Bryophyta****BOT - 103: Plant Anatomy & Embryology****BOT - 104: Biostatistics, Computer Application & Botanical technique****II SEMESTER****BOT - 201: Diversity & Classification of Virus and Fungi****BOT - 202: Pteridophyta & Gymnosperms including Fossils****BOT - 203: Horticulture & Plant Pathology****BOT - 204: Taxonomy of Angiosperms****III SEMESTER****BOT - 301: Plant Physiology****BOT - 302: Economic Botany & Applied Botany****BOT - 303: Genetics, Biotechnology & Bioinformatics****BOT - 304: Cell Biology****IV SMESTER****BOT - 401: Ecology & Environment****BOT - 402: Phytogeography, Ethnobotany & Forest Botany****BOT - 403: Biochemistry & Phytochemistry****BOT - 404: Elective Special Paper: Angiosperms Systematics**

SEMESTER I

BOT 101

Diversity and Classification of Bacteria and Algae

Unit: 1 Bacteria

General characteristics of bacteria

Classification of bacteria

Structure of bacterial cell

Nutrition in bacteria

Reproduction of bacteria

Economic importance of bacteria

Unit: 2 Evolution and biodiversity of algae

Principal and modern trends of algae

Evolution of algae at morphological and ultra structural level

Algal diversity of different habitat and their conservation

Classification, pigments, reserve foods, flagella, thallus structure and its

Morphological variations.

Unit: 3 Reproduction and life pattern in algae

Economic importance of algae

Types of phytoplankton, primary production, species diversity index, physical environment

phylogeny and affinities of Cyanophyceae

Nitrogen fixation by blue green algae

Unit: 4 Study of morphology, reproductive features and classification with reasons of the following types.

Cyanophyceae : (1) Gloeocapsa

(2) Lyngbya

Chlorophyceae : (1) Hydrodictyon

(2) Pandorina

Pheophyceae : (1) Laminaria

(2) Padina

Rhodophyceae : (1) Gelidium

(2) Porphyra

Reference Books:

- **Phycology by Annie Ragland; Saras publication**
- **An introduction to Algae by V.K. Gupta and Y. P. Varshneya; Kendarnath Ram Nath Publishers**
- **An Introduction to Algae by Suresh Kumar; Campus books.**
- **An Introduction to Algae by Ian Morris; Hutchinson University Library**
- **A text book of Algae by S.K. Sarkar; Central book depot**
- **A text book of Botany: The Algae by Brahma Prakash Pandey; Jai Prakash Nath and Co.**
- **A class book of Algae by G.L. Chopra; S. Hagin and Co.**
- **A text book on Algae by H.D. Kumar and H.S. Singh; East-west press.**
- **Fungi, bacteria and viruses by H.C. Dube; Vikas publishing house**

Note: All the Practical experiments of this paper are based on the text theory

SEMESTER I

BOT 102

Lichen and Bryophyta

Unit: 1 Lichen

- Occurrence, distribution, and classification of lichen
- Nature of association of phycobiont and mycobiont in lichens
- External and internal structure of lichen
- Reproduction of lichen
- Economic importance of lichen

Unit: 2 Bryophyta

- Distribution & Habitat
- Broad outline of classification and evolutionary trends among Bryophytes
- General characters of Bryophytes
- Reproduction in Bryophytes
- Comparative account of gametophytes
- Fossil Bryophytes

Unit: 3 Origin of Bryophytes

- Evolution of sporophytes in Bryophytes
- Alternation of generation in Bryophytes
- General account of Anthocerotopsida & Bryopsida
- Thalloid & leafy liverworts
- Economic importance of Bryophytes

Unit: 4 Study of morphology, reproductive features and classification with reasons of the following types.

- Hepaticae:**
- (1) Riccardia
 - (2) Lunularia
 - (3) Frullania
 - (4) Sphaerocarpos

Anthocerotopsida: (1) Nothothylas

(2) Anthoceros

Bryopsida: (1) Polytrichum

(2) Andrea

(3) Pogonatum

Reference Books:

- **Brayophyta and Pteridophyta by Proff. R.C. Mathur; Vardhman Pustak Bhandar**
- **Bryophyta, A treatise by O.P. Sharma and S.A. Siddiqui; K.K. Mittal for Pragati Prakashan**
- **A text book of Bryophyta by G.N. Chaudhuri; Vivekanand Kuity for the students friends and co.**
- **A class book of Bryophyta by G.L. Chopra; Hari Singh and Bros.**
- **Bryophyta – A broad prespective by Dr. (Mrs.) Prem Puri; Atma Ram and Sons**
- **The structure and life of Bryophytes by E.V. Watson; Hutchinson and co.**
- **Botany [for degree students] Bryophyta by B.R. vashishta; S.Chand and Co.**
- **Introduction to Bryophyta by P.D. Sharma; Ramesh book depot**

Note: All the Practical experiments of this paper are based on the text theory

SEMESTER I

BOT 103

Plant Anatomy and Embryology

Unit: 1

Cell Wall: Morphology, Origin, Ultra structure, Plasmodesmata, Chemistry, Chemical changes & thickening of the cell wall, growth & intercellular space; function of cell wall.

Shoot Apex: Introduction, Apical cell concept, Histogen concept, Tunica-Corpus concept, Hostogenic layer concept, Layer-Core concept, Meristeme D'attente concept, Newman's concept.

Root Apex: Introduction, Apical cell concept, Histogen concept, Korper-kappe concept, Quiescent centre concept.

Unit: 2

Xylem: Introduction, Components, structure & their function.

Phloem: Introduction, Components, structure & their function.

Nodal Anatomy: Definition, Types and structure.

Unit: 3

(a) History of embryology & Important embryologists.

(b) Male gametophyte -- Microgametogenesis, palynology, dispersal of pollen grain, abnormalities.

(c) Embryo-Embryogeny in dicot-Ludwigia palustris, Lactuca sativa, Sagina procumbans. Embryogeny in monocot-Sagittaria.

(d) Experimental embryology

(1) Anther & Pollen culture

(2) Nucellus culture

(3) Parthenocarpy and Parthenogenesis.

Unit: 4

- (a) Female gametophyte -- Types, development, organization of embryo sac and morphological nature.
- (b) Endosperms -- Types of endosperms, endosperms haustoria, Ruminant endosperms, Mosaic endosperms, morphological nature and function.
- (c) Polyembryony
- (d) Experimental embryology
 - (1) Embryo culture
 - (2) Seed culture
 - (3) Production of Adventive embryos.

Reference Books:

- **Comparative plant anatomy by Carlquist S. ; Hol Rinchart and Winston**
- **Apical meristems by Clowers F.A. L.; Blackwell Co. Oxford**
- **An introduction to plant Anatomy by Eames A.J. and I.H. Mac Deniels; MacGraw Hill Book Co**
- **Plant Anatomy by Esau K. John wiley and sons Inc.**
- **Anatomy of seed plants Esau K.; Jphn wiley and sonc Inc.**
- **Plant Anatomy by Fahn A. Pergmno Press, Oxford**
- **Secretary Tissues in Plants by Fahn A. Acedamic press London**
- **Plant Anatomy by Pande B.P.; S. Chand and Co.**
- **The embryology of Angiosperm by Bojwani S.S. and Bhatnagar S.P. ; Vikas publishing house Pvt ltd.**
- **Morphology of Angiosperm by Coutter J. M. And Chamberlin;**
- **Systematic embryology of the Angiosperm by Devis G.L. ;John Willey and sons**
- **Hand book of Palynology Morphology taxonomy by Erdtman G. ; Hafner Pub. Co.**
- **An Introduction to the embryology of Angiosperms by Maheshwari P.; MacGraw Hill Book Co.**

Note: All the practical experiments of this paper are based on the text theory.

SEMESTER I

BOT 104

Biostatistics, Computer Application & Botanical Techniques

Unit I Biostatistics

- Definitions and scope in biology
- Measures of central tendency- Mean, Median and Mode
- Measure of Dispersion- Standard Deviation, Standard Error and Coefficient of Variation
- Test of Statistical significance- Chi- square and T-test
- Probability- Basic concept- addition theorem, Distributions (Binomial, Poisson and Normal) – multiplication theorem
- Correlation and Regression.

Unit II Computer Application

- Concept of windows, icon, Menu, Desktop, Creating folder and shortcuts, finding files and folders, creating, copying, moving and deleting files, my computer, windows explorer, recycle bin.
- Microsoft Office Word-typing and editing, formatting text and paragraphs, Working with tables, Mail Merge, printing documents
- Microsoft Office Excel: Concept of worksheet, working and editing in workbooks, protecting and hiding data, built- in functions, creating charts (graphs), formatting and analyzing data, organizing data in a list (data management and formatting)
- Microsoft Office PowerPoint: Introduction, creating and editing slides, animation and slide transition effects, creating and running slide show.
- Introduction to internet- concept, internet utilities e-mail, chat, searching etc.

Unit III

- Herbarium Technique: Routine herbarium techniques uses and importance of Herbaria, Major herbaria of the world and India, preparation of Museum specimen.
- Artificial Key: Preparation of artificial key for plant identification. Uses of taxonomic literature for identification of the plant.
- Anatomical microscopic methods: Hand sectioning, maceration, Microtome section; fixation, dehydration, infiltration, embedding, sectioning and staining.

Unit IV

Tools & Techniques

- **Cytological smearing technique:** Micrometry, uses of Camera Lucida; Microscopy.
- **Ecological method:** Uses of Ecological instruments, methods of floristic survey, Quadrates and transect methods soil analysis, study of different properties of water and soils.
- **Physiological method:** Chromatography, electrophoresis, Colorimetric analysis, Enzyme activity, Extraction and purification of organelles and compounds; Differential centrifugation, Electrophoresis, Spectrophotometer.

Reference Books:

Manual of Botany practical vol. I by S. K. Gupta

Microscopy for the students of Biology by B.A. Phadnis

Note: All the Practical experiments of this paper are based on the text theory

SEMESTER II

BOT 201

Diversity and classification of virus and fungi

Unit I: Viruses

- General characters and classification of viruses
- Nomenclature and symptoms of viruses
- Study of Tobacco mosaic virus
- Study of tobacco bacteriophage
- Study of viroids

Unit II

- Modern systematic, origin and phylogenetic relationship in fungi
- Principles and modern trends of the classification of fungi
- General characters of fungi
- The relationship of the fungi to other organism

Unit III

- Heterothallism in fungi
- Reproduction in fungi
- Biotechnological approaches in Mushroom production
- Fungi & Human welfare: Harmful aspects, Beneficial aspects
- Role of fungi in ecosystem

Unit IV- Study of morphology, reproductive features and classification with reasons of the following types

- | | |
|------------------------|------------------------|
| Phycomycetes: | (1) <i>Synchytrium</i> |
| | (2) <i>Albugo</i> |
| | (3) <i>Peronospora</i> |
| Ascomycetes: | (1) <i>Taphrina</i> |
| | (2) <i>Morchella</i> |
| | (3) <i>Xylaria</i> |
| Basidiomycetes: | (1) <i>Geaste</i> |
| | (2) <i>Ustilago</i> |
| | (3) <i>Clavaria</i> |

Reference Books:

- **An Introduction to Mycology by R. S. Malhotra and K. P. Aneja; Wiley Eastern Ltd.**
- **An Introduction to fungi by Pramod K Dubish; Kedar Nath, Ram Nath Publishing**
- **A test book of Fungi by G. L. Chopra; S. Nagin and Co.**
- **Fungi by B. R. Vashishta; S. Chand and co**
- **The fungi, bacteria and viruses by Lokendra Singh; Rastogi Publications**
- **Text book of fungi by J.C. Gupta; Oxford and IBH publishing**
- **Fungi, bacteria and viruses by H. C. Dube; Vikas publishing house**

Note: All the Practical experiments of this paper are based on the text theory.

SEMESTER II

BOT 202

Pteridophyta and Gymnosperms including Fossils

Unit I

- General characters
- Classification and lifecycle of pteridophytes
- Study of general habitat, external and internal morphology of pteridophytes
- Reproduction in pteridophytes
- Spore producing organs in pteridophytes
- Structure of sex organs

Unit II

- Apogomy, apospory and parthanogenesis
- Telome theory
- Phylogeny and affinities of pteridophytes
- Alternation of generation in pteridophytes
- Evolution of stele

Unit III

- General characters
- Distribution, phylogeny, classification and economic importance of Gymnosperms
- Study of external and internal morphology of vegetative and reproductive structures of following taxa:

Thuja, Pedocarpus, Cupressus, Juniperus, Zamia

Unit IV

- Geological time table
- Types of fossils and their significance
- Detail study of the following fossils

Psilophytosida: (1) *Asteroxylon*
(2) *Horneophyton*

Lycopsida: (1) *Protolpidodendron*
(2) *Miadesmia*
(3) *Stigmaria*

Filicopsida: (1) *Zygopteris*
(2) *Cladoxylon*

Study of morphology, reproductive features and classification, with reasons of the following types

Gleichenia, Lygodium, Alsophila, Pteris, Adiantum, Salvinia, Marselia.

Reference Books:

- **Biology and morphology of Pteridophyta by N. S. Parihar; Central book depot**
- **Botany for degree students: Pteridophyta by P. C. Vasishta; S. Chand and Co (Pvt.) Ltd.**
- **The morphology of pteridophytes by K. R. Sporne; Hutchinson and Co (Publisher) Ltd.**
- **Botany for degree students: Pteridophyta by B. R. Vasishta; S. Chand and company Ltd.**
- **Gymnosperms Structure and Evolution by Charls Joseph Chamberlain; Dover publications**
- **Gymnosperms by G.L. Chopra; S. Nagin and Co.**
- **The Gymnosperms by M. N. Gupta; Shivalal Agrawala and Co.**
- **Botany for degree students: Gymnosperms by P. C. Vasishta; S. Chand Publication**
- **Gymnosperms and Palaeobotany by S. K Singh; Campus books**
- **Pteridophytes, Gymnosperms and Palaeobotany by Kumarsan and Annie; Saras Publication**

Note: All the Practical experiments of this paper are based on the text theory.

SEMESTER II

BOT 203

Horticulture and Plant Pathology

Unit: 1

Concept & Scope
Famous gardens in india
Plant growing structures- green house
Plant propagation
Fertilizer- biofertilizer, green manure, vermicompost
Kitchen gardening
Storage of Fruits

Unit: 2

Commercial horticulture- nurseries, indoor, plants and flowers
Floriculture-commercial floriculture- production of cut flowers and home
Floriculture, disease & pest control in gardening- fungicides & pesticides
Landscaping

Unit: 3

History of Plant Pathology
Introduction, general symptoms, & classification of plant diseases
Control of plant diseases
Agent of infection & non-infection plant diseases
Modification of Environments

Unit: 4 Study of the following plant diseases with reference to symptoms, casual organism and control.

- (1) Citrus canker
- (2) Bacterial blight of Cotton
- (3) Bacterial blight of Paddy
- (4) Bacterial leaf streak diseases of Rice
- (5) Bacterial brown rot of Potatoes
- (6) Leaf spot of Mango
- (7) Black rot of Crucifer
- (8) Stalk rot of Maize
- (9) Leaf roll disease of Potato
- (10) Leaf curl of Papaya
- (11) Yellow vein mosaic of Bhindi
- (12) Potato mosaic
- (13) Leaf curl of Tomato
- (14) Bunchy top of Banana
- (15) Yellow mosaic of Legumes

Reference Books:

- **A text book of Modern plant pathology by Bilgrami K. S. ; Vikas Publishing house**
- **Plant Pathology by Horsfall J. G. and Diomond A. E. ; Academic press, London**
- **Plant Diseases by Singh R. S.; Oxford and IBH Publishing Co.**
- **Gardening in India by K. Bose and Mukherjee. Oxford and Publishing Co. Mumbai.**
- **Introductory Horticulture by H Edward Reiley and Caroll Shry. Jr. Van Nostrand Reinhold Company Canada.**
- **Vegetable growing in India by S. L.Katyal Oxford and Publishing Co. Mumbai.**
- **Fruit growing in India by W. B. Hyes Kitabistan, Allahbad**
- **Fundamentals of Horticulture by Edmond-Senn-Andrews Helfacre TMH Publication, New Delhi.**
- **Fruit Physiology and Production by Amar Singh. Kalyani Publication, New Delhi.**
- **A Manual on Fruit and Vegetable Preservation by B.S. Chundawat and R.C. Sharma.**
- **Ornamental Gardening by G. S. Randhava I.C.A.R. Publication.**

Note: All the Practical experiments of this paper are based on the text theory

SEMESTER II

BOT 204

Taxonomy of Angiosperms

Unit I:

- History of plant taxonomy in India
- Definition and importance of plant taxonomy
- Aims and objectives of plant taxonomy
- Botanical nomenclature: need for scientific names, history of botanical nomenclature, principles of ICBN, Name of taxa

Unit II:

- Pre Darwinian and post Darwinian theories of biological classification
- Detail study of Bentham and Hooker system of classification
- Comparative study of the system of classification by Engler-Prantl and Bassy
- Study of system of classification by Hutchinson and Takhtajan

Unit III:

- Phylogeny and floral variation of the following:
 - (1) Parietals
 - (2) Rosales
 - (3) Geraminales
 - (4) Myrtales

Unit IV

- Study of the following families giving importance to morphological peculiarities if any, and economic importance, interrelationship and evolutionary lines.
 1. Dilleniaceae
 2. Guttiferae
 3. Malpighiaceae
 4. Oxalidaceae
 5. Balnitaceae
 6. Celastraceae
 7. Turneraceae
 8. Cactaceae
 9. Plumbaginaceae
 10. Santalaceae
 11. Orchidaceae
 12. Commelinaceae

Reference Books:

- **Manual of Cultivated plants by Bailey, L. H; The Macmillan Comp.**
- **Plant Classification by Benson, L. B; D. C. Health Comp.**
- **Plant Taxonomy by Benson L. B. ; Ronald Press**
- **Plant taxonomy by Core E. L.; Prentice-hall Engle-wood Cliff .**
- **Evolution and classification of Flowering plants by Cronquist A.; Nelson New York**
- **Principles of Angiosperm Taxonomy by Devis P. H. And V. M. Heywood; Oliver and Boyd, Edinburgh**
- **Families of flowering plants by Gunderson A.; ELBS series**
- **The families of flowering plants Vol-I- Dicotyledon and Vol-II- Monocotyledon by Hutchinson J.; Oxford University Press**
- **College Botany Vol-III by Mukerjee S.K. ; New central Book Agency**

Note: All the Practical experiments of this paper are based on the text theory

SEMESTER III

BOT 301

Plant Physiology

Unit I: Plant cells & water

Translocation of water- Bulk flow, diffusion, osmosis, the concept of water potential.

Membrane transport and translocation of water and organic solute: The ascent of xylem water, roots, soil and the uptake of water, absorption of water by roots, comparison of xylem and phloem transport, passive and active transport.

Unit II: Photosynthesis

Importance, photosynthetic pigments, electron transport, photo system I and II; structure and function, Calvin cycle, photorespiration and its significance, C₄ cycle,

Crassulan acid metabolism (CAM pathway), Photosynthetic phosphorylation,

Characteristics of C₃, C₄ and CAM plants, Factors affecting photosynthesis (Internal and external).

Unit III: Respiration

Glycolytic pathway of glucose degradation, oxidative pentose phosphate pathway,

Kreb's cycle, respiratory chain, generation of ATP, oxidative phosphorylation, Entner-Doudoroff pathway, factors affecting respiration (internal and external).

Unit IV: Photoregulation and growth responses

Growth regulators: their mode of action, characteristics, chemical nature, biosynthesis of growth regulators, role of Auxin, Gibberellins, Cytokinin, florigen, Vernalin.

The physiology of plants under stress

Water stress, Temperature stress, Salt stress

Reference Books:

- **An Introduction to Plant physiology by A.K. Ganguly and N. C. Kumar; Emkay Publications**
- **Plant physiology by Robert M Devlin; Affiliated East-west Press Pvt Ltd.**
- **Text book of Plant Physiology by P. L. Kochhar and A.C. Joshi; Atma Ram and Sons**
- **Pant Physiology by R.C. Grewal; Campus books international**
- **An Introduction to Plant Physiology by W. O. James; Oxford university press.**
- **Plant Physiology by S. N. Pandey and B. K. Sinha; Vikas publishing house Pvt Ltd.**

- **Fundamentals of Plant Physiology by V. K. Jain; S. Chand and company ltd.**
- **Advance in Plant Physiology Vol I, II and III by A. Hemantaranjan; Scientific Publishers**
- **Plant Physiology by Salisbury and Ross; Prentice/Hall of India Pvt. Ltd.**
- **Physiology of plant growth and development by M. B. Wilkins; Tata McGrew-Hill publishing co. Ltd.**
- **Plant physiology - Salisbury, F. B. and Ross, C.W. 1992**
- **Advances in plant physiology, vol. 10, by D.K. Arora and Seema Gupta, 1996. Anmol publications pvt. ltd.**

Note: All the Practical experiments of this paper are based on the text theory

SEMESTER III

BOT 302

Economic Botany and Applied Botany

Unit I: Study of Botanical name, family and morphology of the useful parts and utility of the following:

- (1) Vegetables and fruits
- (2) Spices and condiments
- (3) Beverages and sugar yielding plants

Unit II

Paper-raw material, manufacture of paper, kinds of paper and paper products, paper industries in India.
 Natural Dyes and Narcotic Plants
 Edible mushrooms, Biofertilizer, Biodegradation
 Value of Botany in service of mankind

Unit III

Plant Exudates-Gums and Resins
Plant fibres- Difference between various plant fibres, structure and occurrence of fibres, economic classification of fibres, characters and their use
Aromatic Plants and Essential oils- Fats and solvent extraction of essential oil, nature, function, uses, medicinal and industrial oils, fat and solvent extraction, camphor oil, peppermint oil, sandal wood, Jasmin, Rose, Khus, Lemon grass, Citrus oil

Unit IV

Collection and processing of plant drugs, storage and preparation of drugs
 Herbal drugs-their sources, characters and uses
 Pharmacognosy of *Neem*, *Rauwolfia*, *Adhatoda*, *Withania*, *Aloe*, *Ginger* and *Garlic*

Reference Books:

- **Manual of Indian Forester** by Bor N. L. ; Oxford University Press
- **Indigenous drugs of India** by Chopra R. N. ; Manager of Publications
- **Glossary of Indian Medicinal plants** by Chopra R. N. ; CSIR
- **Useful plants of India Pakistan** by Dastur J. F.; D. B. Taraporwala sons and co. Ltd
- **Vegetable Fats and Oils** by Eckey E.; Reinhold Publishing corporation
- **Indian medicinal Plants 3 Vol** by Kirtikar , K. R. And Basu B.D.
- **Directory of Economic Plants in india** by Maheshwari P. And Singh U. ; ICAR New Delhi
- **Economic Botany** by Bendre and Kumar ; Ratogi Publications

Note: All the Practical experiments of this paper are based on the text theory

SEMESTER III

BOT 303 Genetics, Biotechnology & Bioinformatics

Unit I:

Basic concept, principles, scope and importance of plant tissue culture;
Cell, organ and tissue culture in plants, callus culture, in vitro morphogenesis
and embryo culture, somatic cell fusion, Hybridoma technology, Anther culture

Micropropagation- Advantage and limitation

Somatic embryogenesis, Somoclonal Variation, artificial seed, Induction of
adventitious buds, bulbs and protocorms

Unit II

Genomic and organelle DNA isolation, methods of gene identification,
polymerase
chain reaction (PCR), Restriction, digestion and ligation ; restriction mapping,
genomic and cDNA libraries; Vectors- Properties, cloning and expression,
vectors.

Recombinant DNA technology: Principles and methods of recombinant DNA
technology, expression of cloned gene in *E. Coli*, Restriction endonuclease

Unit III: Bioinformatics

Introduction to Bioinformatics
Sequences and nomenclature
Principles and application of Bioinformatics
Genome database
Tools of bioinformatics
Similarity searches software and their applications

Unit IV Intellectual Property Rights

- Introduction, protection of IPR
- International harmonization of patent laws :
 1. World Intellectual Property Organization (WIPO)
 2. Trade Related Intellectual Property Rights (TRIP'S)
 3. World Tread Organization (WTO)
 4. India and Trade related Intellectual Property Rights
- Plant Breeder's Rights, Farmer's rights, the protection of plant varieties and
farmer's rights Act: 2001, Benefits and disadvantages.
- Management, Benefits and Problems from IPR

Reference Books:

- **Plant functions and biotechnology by V. Kumardan and Annie Ragland; Saras Publication**
- **Plant biotechnology by M. Sudhir ; Dominant publisher and distributor**
- **Trends in plant tissue culture and Biotechnology by L. K. Pareek; Updesh Purohit for Agrobios**
- **Tools and techniques of Biotechnology by Mousumi debnath; Pointer publisher**
- **Plant Biotechnology by S. S. Purohit; Updesh Purohit for Agrobios**
- **Plant Biotechnology- the genetic manipulation of Plants by Adrion slater, Nigel W. Scott and Mark R. Fowler; Oxford University Press.**
- **Principles and methods of plant molecular biology, biochemistry and genetics by Pratibha devi; Agrobios**
- **Molecular biology and genetic engineering by L. M. Naraya, A. Mani, A. M. Selva Raj, N. Arumugam and Padmalatha Singh; Saras Publication**
- **The science of genetics by William Hexter, Henry T. Yost; Prentice Hall of India.**
- **Genetics by A.M. Winchester; Oxford and IBH publishing Co.**
- **Genetics by Karvita B Ahluwalia; Wile Eastern Limited.**
- **Genetics by P.S. Verma and V.K. Agrawal; S. Chand and Co.**
- **Principles of Genetics by Sinnott, Dunn, Dobzhansky; TMH Edition**
- **An Introduction to Morden Genetics by C.H. Waddington; Mangal deep publications**
- **Fundamentals of Genetics by Mohan P. Arora; Himalay Publication House**
- **Bio-informatics by M. N. Ranga; Agrobios**

Note: All the Practical experiments of this paper are based on the text theory

SEMESTER III

BOT 304 Cell Biology

Unit I

- An overview of Cell organization
- Structure of Prokaryotic and Eukaryotic cell.
- Experimental approaches for studying cell.
 - Various types of Light microscopy
 - Electron microscopy.
 - Fixation and Staining.

Unit: II

Cell structure and function:

Cell membrane: Historical origin, membrane structure, chemical composition, intercellular communication, function, membrane biosynthesis

Nucleus : Role of Nucleus, structure of Nucleus, Nuclear envelop, Nucleolus

Mitochondira: Historical origin, Morphology, ultra structure, chemical composition, function

Chloroplast: Historical origin, Morphology, ultra structure, chemical composition, function

Endoplasmic reticulum: Historical origin, Morphology, ultra structure, chemical composition, function

Golgi Complex: Historical origin, Morphology, ultra structure, chemical composition, function

Lysosomes: Historical origin, Morphology, ultra structure, chemical composition, function

Ribosomes: Historical origin, Morphology, ultra structure, chemical composition, function

Unit: III

Cell cycle:

Introduction

Interphase- The G1, S and G2 phases

Visualization of Chromosomes during G1, S and G2

Cell division:

Mitosis

Meosis

Unit: IV

Nucleic Acid: The chemical composition of Nucleic Acids, Tautomeric forms of Pyrimidines and Purines, The physical structure of DNA, Types of DNA, Biological significance of DNA; Structure of RNA, Structure & function of Messenger and Transfer RNA; Biological significance of RNA.

Chromosomes: Number, Size and Morphology; Polytene and Lampbrush chromosomes

Replication of DNA: Enzyme and proteins involved in replication, DNA repair mechanisms.

Reference Books:

- **Cell Biology by C. B. Powar; Himalaya publication house**
- **Cell Biology by Vishwanath ; S. Chand and company**
- **Cell Biology by S. P. Singh and B. S. Tomar; Rastogi Publications**
- **Cell Biology- Fundamentals and applications by M. L. Jangir; Student edition**
- **Cell Biology- organelle structure and function by Devid ; Jones and Bartlett publishers**
- **Cell Biology by Anju Bhasin; Discovery Publishing house**
- **Fundamental concept of Cell Biology by K. G. Purohit; Pragati Prakashan**
- **Cell Biology by R. M. Shulka; Dominant Publishers and distributors**
- **Cell Biology by Neal O. Thorpe; John Willey and sons publication**

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SEMESTER IV

BOT 401

Ecology and Environment

Unit-I

(1) Concepts of ecosystems

Types–Fresh water, marine and terrestrial
Components of Ecosystems
Food chain and food web
Ecological pyramids and recycling
Energy flow and transaction
Development and evolution of ecosystems

Ecosystem organization

Structure and functions
Primary production
Energy dynamics
Litter fall and decomposition
Global biogeochemical cycle C, N, P and S
Mineral cycles in terrestrial and aquatic ecosystems

(2) Plant community

Concept
Difference between community and vegetation
Methods of study of communities-Floristic, physiognomic and phytosociological methods
Classification
Main concepts in classification of communities

Unit – II

Pollution

Causes
Effects and preventive measures of air, water, soil and radiation pollution
Greenhouse effects
Ozone depletion
Global warming

Unit – III Environmental biology

Environmental Law

- Air quality and emission standards
- Functions of the central board and the state boards
- Environmental laws in India

Importance and conservation of biological diversity
Population ecology and biological control

Unit – IV

Ecological Level

- Concept of species
- Biological clock
- Autecology level
- Ecosystem level
- Ecological Niche

Biological Diversity

- Significance of biodiversity
- Types of biodiversity
- IUCN Red data books
- Germplasm banks
- Environmental organizations
- Human activity threat to biodiversity
- Endangered flora of India
- In-situ and Ex-situ conservation

Reference Books:

- **Ecology and Environment by P.D. Sharma; Rastogi publication**
- **Ecology by Odum; Mohan Primalani**
- **Fundamentals of Ecology by Odum; W. B. Saunders Company**
- **Plant Ecology by Weaver and F.E. Clements; Ma-grew- hill book Company**
- **Plant Ecology and applied botany By V. Kumaresan; Sars publication**
- **Plant Ecology by P. L. Kochhar; S. Nagin and Co.**
- **Plant Ecology by V.B. Mehra and S.K. Khanna; S. Chand and Company Ltd.**
- **Text book of Plant Ecology by R.S. Ambasht; Student' friends and co.**
- **A Text book of Plant Ecology by V. Verma; Emkay Publications**
- **Modern concept of ecology by H. D. Kumar; Vikas Publishing House Pvt. Ltd.**

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SEMESTER IV

BOT 402

Phytogeography, Ethnobotany and Forest botany

Unit – I

Main forest type of India and their floristic composition
Different forest of Gujarat and their vegetation
Social forestry and Agroforestry

Unit – II

Major forest products of India and their utilization
Important timber yielding plants and timber types
Important firewood plants

Non timber forest product of India and their utilization

- Bamboo
- Fiber pulp
- Timroo leaf
- Gums
- Resins
- Tannis
- Latex
- Mahuda
- Fruits and Tubers

Principals of conservation

- Environmental status of plants based on International Union for conservation of nature

Unit – III

Ethnomedicobotany

Basic approaches to study traditional knowledge on herbal medicine
Scope and potential applications

Ethnobotany

Relevance in modern medicine
Ethnic societies of Gujarat and their traditional herbs
Medicines derived from herbal plants

Unit - IV

Principals of Phytogeography
Geological history and evolution of plant life
Forest, Grasslands and deserts of India
Mangrooves of India
Phytogeography of Gujarat

Reference Books:

- **Ecology and Environment by P. D. Sharma; Rastogi publication**
- **Plant Ecology and Phytogeography by V. Kumaresan; Saaras publication**
- **Ecology of plants by Eug Warming; Biotech Books**
- **Text book of Plant Ecology by R. S. Ambasht; Student' friends and co**
- **A text book of Plant Geography of India by Bharuch; Oxford university Press Ltd.**
- **Plant Geography of flowering plants by Good R; Longmans , Green and Co**

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SEMESTER IV
BOT 403
Biochemistry & Phytochemistry

Unit – I**Carbohydrate**

- Classification
- Polysaccharides
- Cell wall
- Architecture
- Components
- Synthesis
- Biosynthesis
- Storage, mobilization and transport of carbohydrates

Lipids

- Classifications and Structure and Properties of differential lipids
- Lipid bilayers
- Interactions cutin
- Suberin and waxes
- Fatty acid oxidation and biosynthesis
- Biosynthesis of membrane lipids

Unit - II**Proteins**

- Primary structure
- Polypeptide diversity
- Three dimensional structure
- Secondary, tertiary and quaternary structure
- Biological functions
- Storage and utilization in seeds
- Synthesis and degradation in plant cells

Unit - III**Enzyme**

- Fundamentals of enzymology
- General aspects
- Mechanism
- Regulatory and active sites
- Isozymes
- Kinetics of enzymatic catalysis
- Michalis- menten equation and its significance

Alkaloids

- Definition
- Properties
- Classification
- Alkaloidal drugs Datura, Atropa, Opium, Tea, Rauvolfia, Holarrhena, Catharanthus
- Alkaloidal constituents, uses, allied drugs

Unit - IV**Antibiotics**

- Sources
- Production
- Properties of penicillin
- Streptomycin
- Chloramphenicol
- Tetracyclin
- Tyrothorecin
- Griseofulvin

Vitamins

- Concept
- Classification
- Sources
- Chemical nature
- Properties
- Soluble vitamins: A,D,K and E and water soluble vitamins- B complex and Vitamins C

Reference Books:

- **Pharmacognosy and phytochemistry by Vinod D.; Correr Publication**
- **Text book of Pharmacognosy and Phytochemistry by Biren Shah; Elsevier Health Science**
- **Text book of Pharmacognosy and Phytochemistry by Edwin Jerald; CBS publishers and dristributors**
- **Phytochemistry by Denial**

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SEMESTER IV

BOT 404

Elective Special Paper: Angiosperms Systematics

Unit –I

- (1) Botanical gardens and their uses
- (2) Botanical survey of India
- (3) Literature of taxonomy: Floras, Manual, Index, Monographs, Abstract glories, Catalogue, journals, Text books, Encyclopedia and Dictionary

Unit – II

Taxonomy in relation to Anatomy, Embryology, Cytology, Palynology, and Phytochemistry

Unit – III

1. Numerical Taxonomy
2. Chemotaxonomy
3. Serotaxonomy
4. Application of DNA hybridization techniques in taxonomy

Unit- IV

1. Fossil angiosperms
2. Origin and evolution of Angiosperms
3. Endemism
4. Special types of Angiosperms (a) Parasites (b) Saprophytes

Unit – V

- **Study of the following families with reference to their geographical distribution, Systematic Position, floral variations, uses and examples (Scientific names).**

Bixaceae, Flacourtiaceae, Polygalaceae, Caryophyllaceae, Tamaricaceae, Zygophyllaceae, Simaroubaceae, Burseraceae, Ochanaceae, Avertroaceae, Onagraceae, Alangiaceae, Ebenaceae, Myrsinaceae, Polemoniaceae, Pedaliaceae, Martyniaceae, Phytolaccaceae, Aristolochiaceae, Piperaceae, Louraceae, Iridaceae, Alismaceae, Eriocaulaceae

Reference Books:

- **Manual of Cultivated plants by Bailey, L. H; The Macmillan Comp.**
- **Plant Classification by Benson, L. B.; D. C. Health Comp.**
- **Plant Taxonomy by Benson L. B. ; Ronald Press**
- **Plant taxonomy by Core E. L.; Prentice-hall Engle-wood Cliff .**
- **Evolution and classification of Flowering plants by Cronquist A.; Nelson New York**
- **Principles of Angiosperm Taxonomy by Devis P. H. And V. M. Heywood; Oliver and Boyd, Edinburgh**
- **Families of flowering plants by Gunderson A.; ELBS series**
- **The families of flowering plants Vol-I- Dicotyledon and Vol-II- Monocotyledon by Hutchinson J.; Oxford University Press**
- **College Botany Vol-III by Mukerjee S.K. ; New central Book Agency**
- **An Introduction to plant Taxonomy by Jeffrey C.; Oxford university press**

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