

Genetics: Gardener.
 Principles of Genetics: Stickberger.
 Essentials of Genetics and Biotechnology: A.C. Gogoi
 Molecular Cytogenetics: Sinnott, Dunne & Donzhosky.
 A Text Book of Plant Ecology: R. S. Amharst.
 Population Ecology: M. Begon & M. Mortimer.
 Fundamentals of Ecology: M.C. Dogh.
 The Reproductive capacity of plants: E.J. Salisbury.
 Introduction to Environmental Management: Nag Choudhury.
 Environmental Biology: Trivedi & Raj.
 Microbiology: N.J. Pelezar et. al.
 General Microbiology: R.Y. Stamer et. al.
 Soil Microbiology: N. Walker.
 Molecular Viscosity: G.A. Knight.
 Petroleum Microbiology: R.M. Atlas.
 Agricultural Microbiology: Rangaswamy and Bhagyaraj.
 Biotechnology: Trichan.
 Microbial Genetics: Treifelder.
 Modern concept of Ecology: Verma & Agarwala
 Handbook of Agriculture: ICAR
 Economic Botany: Pandey
 A Handbook of Medicinal Plants: Prajapati; Sharma, Kumar, Purohit
 Medicinal Plants of N.E. India: NEDFI
 Cultivation of Medicinal Plants: Purohit & Vyas.
 Essentials of Genetics and Biotechnology: A. C. Gogoi, Anuradha Publication, Jorhat
 Fundamentals of Cell and Molecular Biology: Arvind K. Misra, Panima Publishing Corpn. New Delhi/Bangalore

DEPARTMENT OF LIFE SCIENCES; DIBRUGARH UNIVERSITY

UG SYLLABUS UNDER SEMESTER SYSTEM BOTANY GENERAL PROGRAMME

OUTLINE OF THE SYLLABUS

Semester-I	400 Marks
Compulsory course I: English-I	100-(80+20)
Non-major Course I: BOTGT-101: Algae, Fungi, Bacteria, Lichen, Virus, Plant Pathology : BOTGP-102:(Practical based on BOTGT-101)	48 End+12 IA 32 End+8 IA
Non-major Course II: Chemistry -I (Th)	100-(80+20)
Non-major Course III: Zoology -I (Th)	48 End+12 IA

: Zoology -II (Practical based on Zoology Course-I)	32 End+8 IA
Total 400	
Semester II 400 Marks	
Compulsory course: English-II	100=(80+20)
Non-major Course I: BOTGT -201:Bryophytes, Pteridophytes, Gymnosperms : BOTGP- 202(Practical based on BOTGT -201)	48 End+12 IA 32 End+8 IA
Non-major Course II: Chemistry -II (Th)	100=(80+20)
Non-major Course III: Zoology -III (Th) :Zoology -IV (Practical based on Zoology Course-III)	48 End+12 IA 32End+8 IA
Total 400	
Semester III 400 Marks	
Computer Application Course I (Th)	40 End+10 IA
Computer Application Course II (Practical based on CA Course I)	40 End+10 IA
Non major Course I : BOTGT-301:Morphology, Taxonomy, Development and Reproduction of Angiosperms : BOTGP-302(Practical based on BOTGT-301)	48 End+12 IA 32 End+8 IA
Non major Course II: Chemistry -III (Th) : Chemistry -IV (Practical based on Chem. Course - III)	48 End+12 IA 32 End+8 IA
Non major Course III: Zoology -V (Th) : Zoology -VI (Practical based on Botany Course-V)	48 End+12 IA 32 End+8 IA
Total 400	
Semester IV 400 Marks	
Computer Application Course -III (Th)	40 End+10 IA
Computer Application Course -IV (Practical based on CA Course III)	40 End+10 IA
Non-major Course I: BOTGT-401(Physiology & Economic Botany) : BOTGP-402(Practical based on BOTGT-401)	48 End+12 IA 32 End+8 IA
Non-major Course II: Chemistry -V (Th) : Chemistry -VI (Practical based on Chem. Course - V)	48End+12IA 32End+8IA
Non-major Course III: Zoology -VII (Th) : Zoology -VIII (Practical based on Zoology Course-VII)	48End+12 IA 32End+8 IA
Total 400	
Semester V 400Marks	
Non-major Course I: BOTGT-501(Cytogenetics, Evolution & Biostatistics) : BOTGP-502 (Practical based on BOTGT-501)	48 End+12 IA 32 End+8 IA

Non major Course II: Chemistry –VII (Th)	48 End+12 IA
: Chemistry –VIII (Practical based on Chem. - Course VII)	32 End+8 IA
Non major Course III: Zoology –IX (Th)	48 End+12 IA
: Zoology –X (Practical based on the Course-IX)	32 End+8 IA
Skill Based course –I: (Tissue culture/micropropagation, flouriculture/horticulture, sericulture, Medicinal and Aromatic Plants (MAP), Vermiculture, Mushroom culture,)	100(80+20)
	Total 400

Semester VI 400 Marks

Non major Course I: BOTGT -601(Biochemistry, Ecology & Plant Geography)	48 End+12 IA
: BOTGP-602 (Practical based on BOTGT-601))	32 End+8 IA
Non major Course II: Chemistry –IX (Th)	48 End+12 IA
: Chemistry –X (Practical based on Chem. Course - IX)	32 End+8 IA
Non major Course III: Zoology –XI (Th)	48 End+12 IA
: Zoology –XII (Practical based on Botany Course -XI)	32 End+8 IA
Skill based course –II: Project + Field Study + Practical.	100(80+20)
	Total 400

Grand Total (Semester I+II+III+IV+V+VI) =2400 marks

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UG SYLLABUS UNDER SEMESTER SYSTEM
BOTANY GENERAL PROGRAMME
DETAIL SYLLABUS**

Total Marks: 600

There shall be 12 (twelve) papers; 6 (six) each of theory and practical papers in Botany. The distribution of courses and marks will be as follows:

SUMMARY OF THE COURSE

TOTAL PAPERS: THEORY: 12 & PRACTICAL: 06 TOTAL MARKS: 600

KEY: BOTGT = botany general theory BOTGP = botany general practical

TOTAL LECTURES HOURS: THEORY: 40 (Per paper) PRACTICAL:15 (Per paper)

MARKS DISTRIBUTION:

THEORY: (48 End + 12 IA) [End=End Semester, IA=Internal Assessment]
PRACTICAL: (32 End + 12 IA) [End=End Semester, IA=Internal Assessment]

SEMESTERWISE COURSE CONTENT:

Semester I

100 Marks

BOTGT-101: Algae, Fungi, Bacteria, Lichen, Virus, Plant Pathology
BOTGP-102 Based on BOTGT-101

48 End+12 IA
32 End+8 IA

Semester II

100 Marks

BOTGT-201 Bryophytes, Pteridophytes, Gymnosperms
BOTGP-202 Based on the BOTGT-201

48 End+12 IA
32 End+8 IA

Semester III

100 Marks

BOTGT-301 Morphology, Development and Reproduction of Angiosperms
BOTGP-302 Based on BOTGT-301

48 End+12 IA
32 End+8 IA

Semester IV

100 Marks

BOTGT-401 Physiology & Economic Botany
BOTGP-402 Based on BOTGT-401

48 End+12 IA
32 End+8 IA

Semester V

100Marks

BOTGT-501 Cytogenetics, Evolution & Biostatistics
BOTGP-502 Based on BOTGT-501

48 End+12 IA
32 End+8 IA

Semester VI

100 Marks

BOTGT-601 Biochemistry, Ecology & Plant Geography
BOTGP-602 Based on BOTGT-601

48 End+12 IA
32 End+8 IA

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BOTANY GENERAL PROGRAMME

Objective : The main objective of the course is to provide fundamental knowledge to under graduate students about diversity structure and reproduction of plants along with the physiology of various life processes at genetic, cellular and molecular levels. Skills based courses are also include to increase the employability of the students.

Examination: 20% marks each of theory and practical papers shall be evaluated as Internal Assessment (IA). The distribution of courses and marks will be as follows:

SYLLABUS

SEMESTER – I

BOTANY I (GENERAL)
BOTGT-101

Lower Cryptogams (Algae, Fungi, Bacteria & Virus, Plant Pathology, Lichen)

48 End+12 IA = 60 Marks

Algae:

Marks: (12+3)=15

Unit -1: A general account of different algal groups, their relationship basing on the structure, lifehistories of the types and the economic importance of algae.

- a. Chlorophyceae: *Chlamydomonas*, *Volvox*, *Coleochaete*, *Oedogonium* and *Chara*.
- b. Bacillariophyceae: A general account.
- c. Phaeophyceae: *Ectocarpus*, *Fucus*.
- d. Rhodophyceae: *Polysiphonia* and *Batrachospermum*.
- e. Myxophyceae: *Nostoc* and *Anabaena*.

Fungi, Bacteria, Virus, Plant Pathology and Lichen: Marks: (12+3)+(8+2)+(8+2)+(8+2)=45

Unit -1: A general knowledge of the different fungal groups, their relationship based on the structure and life histories of the types-

- a. Phycomycetes: *Phytophthora*, *Synchytrium*.
- b. Ascomycotina: *Peziza*, *Penicillium*, *Xylaria*
- c. Basidiomycotina: *Puccinia*, *Psalliotia*, *Polyporus*, *Cyathus*. Fungi Imperfecti.
- d. General account of bacteria and virus
- e. Rust of Wheat, Grey Blight of Tea, Late Blight of Potato.
- f. Thallus structure and economic importance of lichen.

BOTANY II (GENERAL)
BOTGP 102

Marks: 40 (32 End+8 IA)

Study of vegetative morphology and reproductive structures of selected representative groups.

**SCHEME OF PRACTICAL EXAMINATIONS
(End Semester)**

Time: 4hrs.

Marks: 32

Algae/Fungi	16
Bacteria, Plant pathology	8
Laboratory Note Book	4
Viva-Voce	4
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	Total 32

Text Book:

1. Botany for Degree students: A.C. Dutta
2. College Botany Vol. II: Mukherjee, Das & Ganguly, Central Book
3. Studies in Botany
4. Text Book of thallophytes: Sharma
5. Plant Pathology: Mehrotra
6. Algae: B.R. Vaishista
7. Fungi: B.R. Vaishista

SEMESTER II

**BOTANY III (GENERAL)
BOTGT-201**

Bryophytes, Pteridophytes, & Gymnosperms: 48 End+12 IA=

Objective of the course: The main objective of this course is to introduce the undergraduate students with the basic knowledge of structure, forms and reproduction, evolution of tissue system and seed habit in higher cryptogams & Gymnosperms.

Bryophytes: Marks:(12+3)

Unit -1: A general account of the structure and life histories of the following
Riccia, Marchantia, Anthoceros and Polytrichum.

Pteridophytes: Marks: (20+5)

Unit -1: A general account of the structure and life histories of the following
Lycopodium, Selaginella, Equisetum, Ophioglossum, Polypodium and Marsilea.

Gymnosperms: Marks: (16+4)

Unit -1: Classification of Gymnosperms.

Unit -2: Morphological and reproductive studies and life histories of *Cycas, Pinus* and *Gnetum*.

**BOTANY IV (GENERAL)
BOTGP-202**

Marks: 40(32 End+8 IA)

Study of vegetative morphology and reproductive structures of selected representative groups.

**SCHEME OF PRACTICAL EXAMINATIONS:
(End Semester)**

Time: 4hrs.

Marks:32

Bryophyte	8
Pteriodephyte	8
Gymnosperms	8
Laboratory Note Book	4
Viva-Voce	4
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Total	32

Text Book:

1. Botany for Degree students: A.C. Dutta
2. College Botany Vol. II: Mukherjee, Das & Ganguly, Central Book.
3. Studies in Botany:
4. An introduction to Gymnosperms: Dutta, Kalyani
5. Text Book of Pteridophytes: Sharma, Macmillan.
6. Bryophytes: N.S. Parihar
7. Pteridophytes: B.R. Vasistha

SEMESTER III

**BOTANY V (GENERAL)
BOTGT-301**

Morphology, Taxonomy, Development and Reproduction of Angiosperms

48 End+12 IA=60

Objective of the course: The main objective of this course is to introduce the undergraduate students with the terminologies used in description of angiospermic plants, basic knowledge of plant classification, tissues & tissue systems, development of primary & secondary plant bodies and development of male & female reproductive components & their functions.

Morphology & Taxonomy:

Marks: (24+6)=30

Unit -1: Knowledge of the principles of classifications of angiosperms; salient features of system of classification proposed by Linnaeus, Bentham and Hooker and Engler and Prantl's.

Unit-2: Nomenclature- morphological details, diagram and floral formula of angiospermic species of the following families citing common and economically plants.

Unit-3: *Magnoliaceae, Brassicaceae, Malvaceae, Fabaceae, Rosaceae, Apiaceae, Lamiaceae, Euphorbiaceae, Orchidiaceae, Musaceae, Liliaceae, Arecaceae and Poaceae.*

Development and Reproduction:

Marks: (24+6)=30

Unit-1: Meristems and organization of root and shoot apices; Tissues and tissue systems, the primary body, stealer structures

- Unit-2: The secondary growth: cambium and its derivatives, anomalous types, periderm.
 Unit-3: Microsporangium and development of male gametophyte; Megasporangium development of female gametophyte.
 Unit-4: Embryo and Endosperm development.

SEMESTER III

BOTANY VI (GENERAL)

BOTGP-302

Marks: 40(32 End+8 IA)

Study of vegetative morphology, reproductive structures of selected species, tissue differentiation, double staining technique, permanent slides of embryology.

SCHEME OF PRACTICAL EXAMINATIONS: (End Semester)

Time: 4hrs.	Marks: 32
Morphology and taxonomy	12
Development and reproduction	12
Lab. Note Book	4
Viva-Voce	4
Total 32	

Text Book:

1. Botany for Degree students: A.C. Dutta
2. College Botany Vol. II: Mukherjee, Das & Ganguly, Central Book.
3. Studies in Botany:
4. Morphology of Angiosperms: M.L. Chopra
5. Plant Anatomy: Pandey.
6. Systematic Botany: O.P. Sharma

SEMESTER IV

BOTANY VII (GENERAL)

BOTGT-401

Physiology & Economic Botany:

Objective of the course: The main objective of this course is to introduce the undergraduate students with the basic knowledge of physiological activities of plants through the mechanism of absorption of inorganic components & production and functions of organic components & external factors upon them.

48 End+12 IA =

Physiology:

Marks: (32+8)=40

- ✓ Unit-1: An elementary knowledge; importance of water to plant life, diffusion, inhibition, osmosis and plasmolysis; absorption of water and solutes.
- ✓ Unit-2: Micro nutrition: Essential macro and micro elements and their role, transportation and exudation, ascent of sap and translocation.
- Unit-3: Enzymes, co-enzymes and their role in biochemical processes.
- ✓ Unit-4: Photosynthesis: mechanism and factors affecting photosynthesis, Calvin Cycle, carbon fixation in Calvin Cycle.
- ✓ Unit-5: Respiration: mechanism (Glycolysis & Krebs Cycle) and significance of respiration; fermentation; growth and development; definitions, phases of growth and development; dormancy and germination of seeds.
- ✓ Unit-6: Hormones: Auxin, Gibberellin, Cytokinins, Florigen; concept of photoperiodism and vernalisation; tropic and nastic movement.

Economic Botany:

Marks: (16+4)=20

- Unit -1: A general knowledge of the following economically important plants with reference to their local names, scientific names and parts used.
- a. Cereals—Rice, Wheat and Maize.
 - b. Pulses — Pea and Soyabean.
 - c. Oil seeds — Mustard, Ground Nut, Coconut and Sunflower.
 - d. Fibre Yielding Plants — Jute, Cotton, Ramie.
 - e. Medicinal Plants — Rauwolfia, Swertia, Ocimum and Neem. *Rauwolfia*
 - f. Timber yielding Plants — Sal, Sissoo, Teak, Holokh.
 - g. Non-alcoholic Beverages — Tea and Coffee.

**BOTANY VIII (GENERAL)
BOTGP-402**

32 End+8 IA =40

Physiology:

Performance of simple physiological experiments from the prescribed course.

1. Phenomenon of inhibition.
2. Phenomenon of Plasmolysis.
3. Phenomenon of Transpiration — 3 expts. (minimum).
4. Phenomenon of Photosynthesis — 3 expts. (minimum).

Economic Botany:

Candidates to submit some specimens with proper identification and herbarium sheets of some economically important plants.

**SCHEME OF PRACTICAL EXAMINATIONS:
(End Semester)**

Time: 4hrs.

Marks:32

Plant Physiology	14
Economic Botany (including collection)	10

Laboratory Note Book
Viva Voce

4
4

Total 32

Text Book:

1. Botany for Degree students: A.C. Dutta
2. College Botany Vol. II: Mukherjee, Das & Ganguly, Central Book.
3. Economic Botany: Pandey
4. A Text Book of Plant Physiology: Malik & Srivastava.
5. Handbook of Agriculture: ICAR

SEMESTER V

**BOTANY IX (GENERAL)
BOTGT 501**

48 End+12 IA=

Cytogenetics, Evolution & Biostatistics:

Objective of the course: The main objective of this course is to introduce the undergraduate students with the basic knowledge of structures & function of cell and cell organelles, genetic materials, principles of genetics, modern concepts of evolution and the statistical tools useful in biology.

Marks: (32+8)

Cytogenetics

- Unit-1: Detail structure and functions of Nucleus, Chromosomes, Cell Wall, Cell membrane (physical and chemical organisation and types), Mitochondria, Plastids & Ribosomes replication of DNA and RNA.
- Unit-2: Concept of Polyploidy and its application, Mendel's Laws, Linkage, Crossing Over, Chromosome Mapping, concept of Gene, Allele and Mutation.
- Unit-4: Knowledge of Non-Chromosomal Inheritance, concept of Genetic Engineering and its improvement.
- Unit-5: Concept of Protoplast, Cell & Organ Culture, Tissue Culture Techniques & its Application and Somatic Hybridisation

Evolution:

- Unit -1: Origin of life, Evidences of Organic Evolution; mechanism of evolution; theories of organic evolution. (8+2)
- Unit -2: Modern concept of evolution (Molecular basis of evolution). (8+2)

Biostatistics

- Unit -1: Importance of biostatistics, mean, median, and mode; mean deviation and standard deviation, standard error, test of significance. (8+2)

**BOTANY X (GENERAL)
BOTGP 502**

Cytogenetics:

Biostatistics: of chromosomal stains and study of chromosomes by smearing the root tips using proper technique of Carbohydrates, Fats and Proteins.

Plant Ecology and Phytogeography: on Central Tendency, Standard Error and Standard Deviation

Evolution: Study of fossils, slides/stocks of different habitats. Study of producer, consumer and decomposer (if possible) and preparation of food chain and food web to show the probable path of energy transformation. **SCHEME OF PRACTICAL EXAMINATIONS:** plants, collection of representative plant samples of different habitats. (End Semester)

SCHEME OF PRACTICAL EXAMINATIONS	
(End Semester)	
Time: 4hrs.	16
Cytogenetics	8
Biostatistics	8
Total: 4hrs. Note Book	Marks: 32
Vin-a-Voce	4
Biochemistry	Total 12
Plant Ecology and Phytogeography (including collection)	14
Laboratory Note Book	4
Total:	4

- Text Book:**
1. Fundamentals of Biostatistics: Prasad, Emby Publications Total 32
 2. Cytology, Genetics, Evolution and Ecology: Verma & Agarwalla
 3. Genetics: P.K. Gupta

Text Book: Cytogenetics & Plant Breeding: Sukla & Chandey.

5. Elements of Cytology: N.S. Chonn
1. A Text Book of Plant Ecology: R.S. Ambasht
2. Concept of Ecology: E.J. Kormandy
3. Modern Concept of Ecology: M.C. Dash
4. Modern Concept of Ecology: Verma & Agarwala
5. Fundamentals of Ecology: E.P. Odum
6. Biochemistry: A.L. Lenninger, Macmillan.
7. Biochemistry: Suyer, Academic Press.
8. Biochemistry: Trehan, Willey Eastern
9. Cell Physiology: A.C. Ghose.
10. College Botany in Tropics: Kochar, Macmillan.
11. College Botany Practical Vol. I and II: Santra, Chatterjee & Das, Central Book.
12. College Botany Vol. I and II: Mukherjee, Das & Ganguly, Central Book.

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BOTANY MAJOR PROGRAMME

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SEMESTER VI

BOTANY XI (GENERAL) BOTGT-601

Biochemistry, Plant Ecology and Plant Geography:

48 End+12 IA =60

Objective of the course: The main objective of this course is to introduce the undergraduate students with the basic knowledge of acid base concept and its importance, importance of macromolecules, ecological importance of plants, their distribution and ecosystem structure & function of ecosystem.

Biochemistry:

Marks: (16+4)=20

Unit-1: Basic principles of biochemistry, acid, base, pH and buffer (inorganic and organic) enzymes, (physiochemical properties), Vitamins & Coenzymes and their importance.

Unit -2: General account of Carbohydrates, Fats, Proteins, Nucleic Acids and their importance

Plant Ecology:

Marks: (24+6)=30

Unit-1: Ecological factors and their role in plant biodiversity.

Unit-2: Structure and function of ecosystem, energy flow through ecosystem, an overview on different types of ecosystem.

Unit-3: Plant communities: definition, classification, characteristics, function, succession and adaptation: concept and types.

Unit-5: Pollution: Air, Water, Soil, global climate change : Green House Effect, Ozone Depletion, Acid Rain), Deforestation and Consequences of Deforestation.

Unit-4: Natural Resources: Renewable and Non- Renewable Resources, Conservation and Management of Natural Resources, Natural Capital, IUCN Red List Categories, Knowledge on WWF, IUCN, CITES, NBWL, NBA

Unit-5: Biodiversity: Definition, Concept on Hot Spot of Biodiversity,

Plant Geography:

(8+2)=10

Unit -1: General account on the Phytogeographical Regions of India with special reference to the Eastern Himalayas

Unit -2: Endemism and Endemic flora – a general account.

BOTANY V (GENERAL) BOTGP-602

TOTAL MARKS: 2400

There shall be 27 (twenty seven) courses 13(thirteen) each of theory and practical courses for TDC Botany Major programme. The distribution of courses and marks will be as follows:

Semester-I	Total Marks: 400
Compulsory course-I: English I	100
Non-major Course I: Zoology I (Th)	48 End+12 IA= 60
Non-major Course I: Zoology II (Pr)	32 End+8 IA= 40
Non-major Course II =Chemistry I (Th)	100
BOTMT-101: Algae, Fungi and Lichen	48 End+12 IA= 60
BOTMP-102: Based on BOTMT-101	32 End+8 IA = 40
Total 400	
 Semester II	 Total Marks: 400
Compulsory course-II: Computer Skill-II	100
Non-major Course I: Zoology III (Th)	48 End+12 IA=60
Non-major Course I: Zoology IV (Pr)	32 End+8 IA=40
Non-major Course II =Chemistry -I (Th)	100
BOTMT-201: Plant Pathology and Bryophytes	48 End+12 IA=60
BOTMP-202: Based on BOTMT-201	32 End+8 IA = 40
Total 400	
Compulsory course III: Environmental Studies	100*
 Semester III	 Total Marks: 400
Non-major Course I: Zoology V (Th)	48 End+12 IA =60
Non-major Course I: Zoology VI (Pr)	32 End+8 IA =40
Non-major Course II: Chemistry III (Th)	48 End+12 IA =60
Non-major Course II: Chemistry IV (Pr)	32 End+8 IA =40
BOTMT-301: Pteridophytes, Gymnosperms, and Palaeobotany	48End: 12 IA =60
BOTMP-302: Based on course 301	32End+8 IA =40
BOTMT-303: Microbiology and Biotechnology	48End: 12 IA =60
BOTMP-304: Based on BOTMT-303	32End+8 IA =40
Total 400	

Semester IV

Non-major Course I: Zoology VII (Th)
Non-major Course I: Zoology VIII (Pr)
Non-major Course II: Chemistry VII (Th)
Non-major Course II: Chemistry VIII (Pr)
BOTMT-401: Morphology and Taxonomy of Angiosperms
BOTMP-402: Based on BOTMT-401
BOTMT-403: Cell Biology and Modern Laboratory Technique
BOTMP-404: Based on BOTMT-403

Total Marks: 400

48 End+12 IA =60
32 End+8 IA =40
48 End+12 IA =60
32 End+8 IA =40
48 End+12 IA =60
32 End+8 IA =40
48 End+12 IA =60
32 End+8 IA =40

Total 400

Semester V

BOTMT-501: Development and Reproduction in Angiosperms
BOTMP-502: Based on course BOTMT-501
BOTMT-503: Genetics, Plant Breeding & Biostatistics
BOTMP-504: Based on BOTMT-503
BOTMT-505: Functional and Chemical Biology
BOTMP-506: Based on BOTMT-505
BOTMT-507: Plant Ecology, Phytogeography and Evolution
BOTMP-508: Based on BOTMT-507

Total Marks: 400

48 End+12 IA=60
32 End+ 8 IA=40
48 End+12 IA=60
32 End+8 IA =40
48 End+12 IA=60
32 End+8 IA =40
48 End+12 IA=60
32 End+8 IA =40

Total 400

Semester VI

BOTMT-601: Plant Physiology
BOTMP-602: Based on BOTMT-601
BOTMT-603: Molecular Biology and Immunology
BOTMT-604: Biophysics and Bioinformatics
BOTMP-605: Based on course BOTMT-603 & 604 +Project
BOTMT-606: Agro-technology and Sustainable Utilization of Plants
BOTMP-607: Based on course BOTMT-606

Total Marks: 400

48 End+12 IA =60
32 End+ 8 IA =40
48 End+12 IA =60
48 End+12 IA =60
52 End+13 IA +15=80
48 End+12 IA =60
32 End+8 IA =40

Total 400

Grand Total=Semester (I+II+III+IV+V+VI) =2400 mark

BOTANY MAJOR PROGRAMME

SUMMARY OF THE COURSE

TOTAL PAPERS: THEORY: 27 & PRACTICAL 13

TOTAL MARKS: 2400

KEY:

BOTMT = BOTANY MAJOR THEORY

BOTMP = BOTANY MAJOR PRACTICAL

TOTAL LECTURE HOURS:

THEORY: 40 (Per Paper)

PRACTICAL: 15 (Per Paper)

MARKS DISTRIBUTION:

THEORY: (48 End + 12IA) [End=End Semester, IA=Internal Assessment]

PRACTICAL: (32 End + 12IA) [End=End Semester, IA=Internal Assessment]

Except BOTMP-605 (Based on course BOTMT 603 & BOTMT 604) where distribution of marks is—(52 End + 13IA) + 15 Marks in Project Work, Grand Total is 80 Marks.

SEMESTER- I

BOTANY MAJOR BOTMT 101

48 End+12 IA =60

Algae, Fungi and Lichen:

Objective of the course: The main objective of this course is to provide basic knowledge of thallus morphology, reproduction and evolution of lower cryptograms and plant pathology.

Marks: (20+5)=25

Algae:

Unit -1 ✓ General characters, ✓ classification and ✓ economic importance of algae: its phylogeny and distribution in India. ✓

Unit -2: Vegetative structure: cell and thallus structure; algal chromatophores and pigments; range of thallus structure. ✓
Reproduction: Vegetative, asexual, sexual and pattern of life cycles. ✓

Unit -3: A comprehensive knowledge of the following classes with special reference to the structure and life histories of the genera mentioned below:

- ✓a) Myxophyceae: *Nostoc* and *Anabaena*.
- ✓b) Chlorophyceae: *Chlorella*, *Volvox*, *Oedogonium*, *Coleochaete*, *Chara*
- ✓c) Xanthophyceae: *Vaucheria*
- ✓d) Bacillariophyceae: A general account.
- ✓e) Phaeophyceae: *Ectocarpus* and *Fucus*.
- ✓f) Rhodophyceae: *Polysiphonia* and *Batrachospermum*.

Marks: (20+5)=25

Fungi:

Unit -1. Salient features of fungi, fungal cell structure and fungal nutrition; Classification of fungi (Alexopoulos, 1969 & 1983) and their distribution in India.

Unit -2. Comparative account of structure, method of reproduction and mode of spore dispersal of fungi; Economic importance of fungi.

Unit -3. Comprehensive knowledge of the following groups with special reference to the structure and life histories of the genera mentioned below from an evolutionary point of view.

- (a) Mastigomycotina: *Myxomycetes*: a general account, *Albugo*, *Pythium*.
- (b) Zygomycotina: *Rhizopus*.
- (c) Ascomycotina: *Peziza*
- (d) Basidiomycotina: *Puccinia*, *Polyporus*, *Cyatrus*, *Agaricus*
- (e) Deuteromycotina: *Aspergillus*, *Alternaria*, *Penicillium*

Marks: (8+2)=10

Lichen:

Unit -1: A general account with particular reference to types and their detail cell structure.
Unit -2: Mode of reproduction, symbiotic association, nutrition and economic importance.

**BOTANY MAJOR
BOTMP-102**

Marks: 40(32 End+8IA), 10 class hours

Algae, Fungi & Lichen:

Preparation, drawing, description and identification of the types prescribed for study in theory syllabus and microscopic measurements and camera lucida drawing of fungal types.

**SCHEME OF THE PRACTICAL EXAMINATION:
(End Semester)**

Time: 4 hrs.

Marks: 32

1. Slide preparation (algae)	8
2. Drawing labelling & description (with Camera lucida drawing and spore measurement of fungi / pathology.	8
3. Lichen	3
4. Identification	3
5. Practical record book	5
6. Viva voce	5
Total	32

* Book list is given at the end of the programme.

Semester II

**BOTANY MAJOR
BOTMT-201**

Plant Pathology and Bryophytes:

48End+12IA= 60

Objective of the course: The main objective of this course is to provide fundamental knowledge on the structure, morphology, reproduction, alternation of generation and tissue organisation and spore dispersal mechanisms in Bryophytes.

Plant Pathology:

Marks: (24+6)=30

Unit -1: Principles of plant pathology with special reference to systematic and localised diseases and symptoms.

Unit -2: Host parasite interaction, (toxins, enzymes, resistant).

Unit -3: Plant disease management through physical, chemical, biological, regulatory and cultural methods, and post harvest management.

Unit -4: Study of the following diseases and their methods of control: late blight of potato, ergot of rye, loose smut of wheat, rust of wheat, red rot of sugarcane, grey blight of tea, citrus canker and mosaic disease of tobacco.

Bryophytes:

Marks: (24+6)=30

Unit-1: General account, classification and distribution in India

Unit-2: Evolution of saprophytes and spore dispersal mechanism Comparative account of the gametophyte

Unit-3: A comparative knowledge of the structure and life history of the following types from the evolutionary point of view and their ecology and economic importance.

Riccia, Marchantia, Anthoceros, Sphagnum, Polytrichum

**BOTANY MAJOR IV
BOTMP-202**

Marks: 40(32End+8IA)

Plant Pathology & Bryophyte:

Preparation of slides by cutting sections, drawing, labelling, description and identification of the types prescribed in the theory syllabus, microscopic measurement and camera lucida drawing of vegetative and reproductive types.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: 32

1. Plant Pathology	8
2. Slide preparation (Bryophyte)	7
3. Identification	4
4. Slide submission	3
5. Practical record book	5
6. Viva voce	5
Total	<hr/> 32

SEMESTER III

BOTM - 301

Pteridophytes, Gymnosperms and Palaeobotany:

48 End+12 IA = 60

Objective of the course: The main objective of this course is to provide comparative account of structural morphology, distribution anatomy, reproduction and evolution of seed habit in higher cryptogams; special emphasis is to be given on the stelar structure and evolutionary links.

Pteridophytes

Marks: (20+5)=25

Unit -1: General classification, organisation and affinities, distribution in India and economic importance.

Unit -2: Stele organisation in Pteridophytes; Evolution of sporophytes and sporophylls in Pteridophytes; Homospory and Heterospory and its importance in evolution of seed habit

Unit -3: Comparative study of morphology and life history of *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum*, *Marsilea*.

Gymnosperms:

Marks: (16+4)=20

Unit -1: Classification, distribution and economic importance.

Unit -2: Comparative and evolutionary study of morphology, anatomy and reproduction of *Cycas*, *Pinus*, *Ginkgo*, *Gnetum*.

Palaeobotany:

Marks: (12+3)=15

Unit -1: An elementary knowledge of paleobotany – process and the theory of fossilization, geological periods and importance of Palaeobotany.

Unit -2: General account of anatomy and reproduction of the following types:

- (a) Pteridophytes – *Rhynia*, *Hornea*, *Psilophyton*, *Sphenophyllum*
 (b) Gymnosperms – Cycadefilicales (*Lyginopteris*), Bennettitales (*Willimasonia*) and Cordaitales (*Cordaites*).

**BOTANY MAJOR
 BOTMP- 302**

Pteridophyte:

Marks: 40(32 End+8 IA)

Preparation of slides by cutting section, drawing, labelling, description and identification of the types, prescribed in the theory syllabus.

Gymnosperm:

Preparation of slides by cutting section drawing, labelling, description and identification of the types, prescribed in the theory syllabus.

Palaeobotany:

**SCHEME OF THE PRACTICAL EXAMINATION:
 (End Semester)**

Time: 4 hrs.

Marks: 32

1. Slide preparation (Pteridophytes)	8
2. Slide preparation (gymnosperms)	8
3. Identification (Palaeobotany)	6
4. Practical record book	5
5. Viva voce	5
Total	32

**BOTANY MAJOR VII
 BOTMT-303**

Microbiology and Biotechnology:

Marks:48 End+12 IA = 60

Objective of the course: The main aim of this course is to introduce the students with the basic knowledge of microbiology and biotechnology in the light of recent developments.

Microbiology:

Marks: (32+8)=40

- Unit -1: Contribution of scientists for development of microbiology.
 Unit -2: Classification of micro-organisms and characteristic features of different groups of micro-organisms, brief knowledge of bacteria, cyanobacteria, virus, bacteriophage, mycoplasma (Structure, reproduction and importance).
 Unit -3: Elementary principles of isolation, and cultivation of micro-organisms and pure culture concept; General ecology of soil microflora, mycorrhiza and bacteriorrhiza.
 Unit -4: Microbiology of food, milk and water.

Unit -5: Importance of micro-organisms for human welfare, elementary knowledge of disease caused by microbes to man, and plants (only two diseases from each group, mentioning causal organism, symptoms and control measures).

Marks: (16+4)=20

Biotechnology:

- Unit - 1: Introduction, scope of biotechnology, recent advances in biotechnology, application of biotechnology in agriculture and industry, concepts pertaining to biofertilizers.
 Unit - 2: Genetic Engineering and its merits and demerits
 Unit - 3: Tissue culture: basic principle, medium, protoplast fusion and somatic hybridization.
 Unit - 4: Basic knowledge of industrial microbiology with reference to production of Alcohol, Vinegar and Antibiotic.

**BOTANY MAJOR
BOTMP-304**

Marks: 40(32 End+8 IA)

Use of the following apparatus - Hot air oven, autoclave, incubator, sterilization technique methods, preparation of different types of media and cultures, dilution plate technique, staining bacteria, slide preparations, demonstration of tissue culture techniques.

**SCHEME OF THE PRACTICAL EXAMINATION:
(End Semester)**

Time: 4 hrs.

Marks:32

1. Different techniques (Microbiological /Biotechnological)	12
2. Demonstration	10
3. Practical record book	5
4. Viva-Voce	5
Total	32

SEMESTER IV

**BOTANY MAJOR IX
BOTMT= 401**

Marks:48 End+12 IA

Morphology and Taxonomy of Angiosperms:

Objective of the course: The main aim of this course is to provide fundamentals of morphology and classification with special reference to the polygenerid relationship of various groups.

Morphology of Angiosperms:

Marks: (12)

Unit -1: Detail study of Morphological characters:

- (i) Carpel polymorphism
- (ii) Origin of angiosperms

BOTANY MAJOR
BOTMT-403

Marks: 48 End+12 IA=60

Cell Biology and Modern Laboratory Technique:

Objective of the course: The main objective of this course is to provide fundamental knowledge of structural and functional aspects of cell and cell organelles and the tools and techniques used in modern biological study.

Marks: (32+8)=40

Cell Biology:

Unit-1: Cell theory and its exceptions, prokaryotic and eukaryotic cells.

Unit-2: Cell organisation: Cell wall, its formation and growth, plasma membrane, chemical organisation and function; protoplast, Cell-sap, Plasmodesmata, ergastic substance, cell organelles, structure, origin and function of mitochondria, nucleus, chromosome - special types of chromosomes, plastids with reference to chloroplast, golgi bodies, endoplasmic reticulum, ribosome and lysosome.

Unit-3: Cell formation - amitosis, mitosis, and meiosis, and cell cycle.

Unit-4: Nucleoproteins and nature of genetic material

Unit-5: Cell Adhesion, Membrane Transport, Signal Transduction (G proteins).

Marks: (16+4)=20

Modern Laboratory Technique:

Unit -1: Working principles, operations and application of the following in biological sciences:

- Microscopy: Compound, Phase Contrast, Dark Field and Electron microscopes.
- Separation Techniques of Biomolecules: Paper Chromatography, TLC, HPLC, Gel Filtration, Centrifuge.
- Colorimeter and Spectrophotometer.
- pH meter, BOD incubator, Autoclave, Laminar Air Flow, Hot Air Oven.
- Basic knowledge of Computer and its application in biological science.

- (iii) Evolution of inflorescence
- (iv) Role of morphology in the classification of the flowering plants.

(32+8 = 40)

Taxonomy of Angiosperms

Marks: (16+4)=20

- Unit -1: History of plant classification, its aims and objectives, outlines of the main classifications (systems of classification) – Artificial, Natural, Phylogenetic and Modern with special reference to Linnacus, Bentham and Hooker, Engler and Prantl, Hutchinson and Takhtajan's classification.
- Unit -2: Generic names, specific epithets, citation and authority, binomial nomenclature, taxonomic keys; typification and priority; importance of herbarium specimens and their preparations; role of herbaria and botanical gardens; documentation (floras, monographs, manuals, journals, abstracts, indices and dictionaries).
- Unit -3: Details on Cytotaxonomy, Chemotaxonomy, Numerical Taxonomy and Biosystematics.
- Unit-4: A detailed knowledge of the following families and their phylogenetic affinities and economically important plants:

Dicotyledons: *Magnoliaceae, Malvaceae, Rubiaceae, Fabaceae, Rosaceae, Solanaceae, Cucurbitaceae, Apiaceae, Asteraceae, Lamiaceae, Theaceae, Apocynaceae and Euphorbiaceae*

Monocotyledons : *Orchidaceae, Musaceae, Zingiberaceae, Arecaceae and Poaceae, Commelinaceae, Cyperaceae.*

**BOTANY MAJOR
BOTMP-402**

Marks: 40(32 End+8 IA)

Candidates will be asked to dissect, draw and describe the plants in simple technical language and identify up to genera with the help of identifying keys.

Submission of preserved and dry botanical specimens, herbarium sheets, permanent and semi-permanent slides of roots, leaves and pollen grains.

Field Study: Students to be visited local place(s) of botanical interest and to submit a field report on the visit.

**SCHEME OF THE PRACTICAL EXAMINATION:
(End Semester)**

Time: 4 hrs.

Marks: 32

1. Dissection, drawing, labelling, description	12
2. Herbarium	3
3. Practical record book	5
4. Field Study Report	7
4. Viva-Voce	5
Total	32

BOTANY MAJOR
BOTMP- 404

Marks: 40(32 End+8 IA)

Cell biology:

Paraffin methods of making slides; preparation of paraffin blocks with specimen
teaming, fixing; cuttings of ribbon with specimen

Modern Laboratory Technique:

Separation of plant pigments and amino acids by paper chromatography/TLC. Demonstration
of modern biological tools as per theory syllabus mentioning their principle, function and uses in the
biological sciences.

SCHEME OF THE PRACTICAL EXAMINATION:
(End Semester)

Time: 4 hrs.

Marks: 32

1. Cell biology	12
2. Separation techniques	10
3. Practical record book	5
4. Viva voce	5
Total	32

SEMESTER V

**BOTANY MAJOR
BOTMT - 501**

Development and Reproduction in Angiosperm:

Marks: 4End+11A =60

Objective of the course: The main objective of this course is to provide fundamental knowledge of structural and functional aspects of cell and cell organelles and the tools and techniques used in modern biological study.

Development in Angiosperm:

Marks: (24+6)

- Unit-1: Organisation of tissues: Types of tissues, Meristematic and permanent, their structures, distribution and functions; theories of differentiation of roots and shoots.
Unit -2: Stele Body - origin and development, Root - stem transition, leaf traces and leaf branch gaps, abscission layer.
Unit -3: Secondary structures of roots and stems, initiation of cambium and its activities, 4 classes.
Unit-4: Anomalous secondary growth in thickness (*Amaranthus*, *Asparagus*, *Boerhaavia*, *Mirabilis*).
Unit-5: Anatomico-physiological consideration of dermal, mechanical, conducting and photosynthetic system of tissues; anatomy of C3 and C4 plants.

Reproduction in Angiosperm::

Marks: (24+6)

- Unit -1: A general account of the following topics: Development of male and female gametophyte of angiosperms; monosporic, bisporic & tetrasporic embryosac.
Unit -2: Fertilization, development of embryo; Apomixis, polyembryony, Palynology.
Unit -3: Development of Endosperm - nuclear, cellular, helobial; haustorial structures.

**BOTANY MAJOR
BOTMP - 502**

Marks: 40(32 End+8 IA)

Development in Angiosperm:

Study of primary, secondary and anomalous structures of stem and roots; Internal structure of different types of leaves; maceration of tissues; identification of the elements; Knowledge of simple and double staining methods; preparation of temporary and permanent mounts.

Reproduction in Angiosperm:

Study of permanent slides of embryological importance and preparation of temporary slides of placenta and pollen grains (germinating).

SCHEME OF THE PRACTICAL EXAMINATION:
(End Semester)

Time: 4 hrs.

Marks: 32

1. Double staining slide (anatomy) drawing, labelling, description	12
2. Workout and study of permanent slide (embryological)	10
3. Practical record book	5
4. Viva-Voce	5
Total	32

BOTANY MAJOR
BOTMT-503

Marks:48 End+12 IA=60

Genetics & Plant Breeding, Biostatistics:

Objective of the course: The main objective of this course is to introduce the students with the basic knowledge on plant genetics and application of genetic for improvement of crop, application of statistics in biology.

Genetics:

Marks: (20+5)=25

- Unit - 1: Mendel's Laws, their critical appreciation, gene interactions and modified monohybrid and dihybrid ratios; concept of alleles, multiple alleles and multiple genes, Linkage, Crossing Over and basic knowledge of Gene Mapping.
- Unit - 2: Determination of Sex, Sex Linked and Sex Limited Traits, Cytoplasmic Inheritance with reference to Plastid Inheritance and Kappa Particle Inheritance.
- Unit - 3: Chromosomal (numerical and structural) and Gene Mutation, concept of Biochemical Mutation.
- Unit - 4: Basic ideas of Gene and its fine structure, Genetic Engineering and Gene Cloning, Concept Trans Gene.
- Unit - 5: Human Genetics: Karyotype, impatant Syndromes and disorders

Plant Breeding:

Marks: (16+4)=20

- Unit - 1: Methods of reproduction: Sexual, Vegetative, apomixes; Principles and methods of Plant Breeding: Introduction, Selection, Hybridization, Heterosis Breeding and concept of Mutation Breeding.
- Unit - 2: In vitro Culture: Requirements, techniques and application in Crop Improvement.

Biostatistics:

Marks: (12+3)=15

- Unit -1: Application of statistics in Biological Science, collection and classification of data for frequency distribution.
- Unit -2: Measurement of Central Tendency; Mean, Media , Mode, Standard Error and Standard Deviation.
- Unit -3: Test of Significance, Probability Test.

**BOTANY MAJOR
BOTMP-504**

Marks: 40(32 End+8 IA)

Concept of fixation, staining and squashing/smearing of materials for chromosome preparation
Temporary aceto-carmin and aceto-orcein smear preparations of root tips (onion/lily) and
flowerbuds (onion/tradescantia); drawing, description of the mitotic and meiotic stages. Simple
calculation of Mendelian ratios including ratios due to gene interaction

Study of floral biology and techniques of plant breeding emasculation, bagging, tagging and
labelling.

Computation of central tendency and deviation: t-test, chi square test

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: 32

1. Genetics
2. Plant breeding
3. Biostatistics
4. Practical record book
5. Viva voce

9

6

7

5

5

Total

32

**SEMESTER V
BOTMT- 505**

48 End+12 IA=60

Functional and Chemical Biology:

Objective of the course: The main objective of this course is to introduce the students with the basic knowledge of modern approaches to functional and chemical biology of plants.

- ✓ Unit -1: Concept of Biomolecules, Polymorphic substances in plants- A brief study of Polysaccharides, ✓ Lipids, ✓ Proteins, ✓ Nucleic Acids, Chlorophylls with special reference to their functions.
- ✓ Unit -2: Metabolic concept- Anabolism and Catabolism.
- ✓ Unit -3: Secondary plant products- ✓ Terpenoids, ✓ Phenols, ✓ Flavonoids, ✓ Anthocyanins, ✓ Alkaloids, ✓ Non-protein Amino Acids.
- ✓ Unit -4: General account of - Plant Hormones and their role (✓ Auxins, ✓ gibberellins, ✓ Cytokinins, ✓ Florigen ✓ Abscisic Acid), ✓ phytochrome, and storage products.
- ✓ Unit -5: Mechanism of Source Sink Relationship.

**BOTANY MAJOR
BOTMP-506**

Marks: 40(32 End+8 IA)

- ✓ 5. Qualitative analysis of secondary metabolites in different plant samples.
- 2 6. Quantitative estimation of secondary metabolites in different plant samples
- ✓ 3 7. Qualitative and quantitative estimation of different photosynthetic pigments.
- 4 8. Determination of antioxidant capacity of various plant extracts of food and medicinal importance.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: (32+8)=40

1/2 Phytochemical analysis	
c) Major	14
d) Minor	8
2. Practical record book	5
3. Viva - Voce	5
	<hr/>
Total	32

**BOTANY MAJOR
BOTMT- 507**

48 End+12 IA=60

Plant Ecology, Phytogeography and Evolution:

Objective of the course: The main objective of this course is to introduce the students with the basic principles and concepts of plant ecology, structure & function of natural plant units, habitat degradation and role of plant on improvement of habitat, conservation ecology, phytogeography & evolution.

Plant Ecology:

Marks: (32+8)=40

Unit - 1 Introduction: definition and scope of plant ecology, development of plant ecology in India and abroad, division of plant ecology; Edaphic factor: Soil Profile, Soil Properties (Physical & Chemical); Physiographic Factors: Types of Biotic Interactions.

Unit - 2 Ecosystem Ecology: Ecosystem Concept, Structure & Function, Ecological Pyramids, Food Chain, Food Web, Trophic Level, Ecological Niche, Flow of Energy in an ecosystem, Productivity, Nutrient Cycling, Biogeochemical Cycle (Water, Oxygen, Carbon Nitrogen, Sulphur and Phosphorous Cycle)

Unit - 3 Demography and population dynamics: definition, characteristics of population, population growth forms, Synecology and Community Dynamics: structure and characteristics of plant community, community characteristics, Analytic and Synthetic communities; Plant Succession: Concept, Types of Succession, causes of Succession, the Climax concept, Plant Adaptation: Hydrophytes, Xerophytes, Helophytes and Epiphytes

Unit - 4 Ecosystem Dynamics: Definition, Types, Structure and Function of Ecosystem, concept of

Energy Flow through Ecosystem; Nutrient Cycling and Biogeochemical Cycles with special reference to water, oxygen, carbon, nitrogen, sulphur and phosphorus cycles.

Unit -5: Habitat degradation: Pollution of air, water, soil and its impact on our environment; control of pollution with special reference to phytoremediation, public awareness and people's participation; Global Environmental Problems (Global Warming, Ozone Depletion, Acid Rain, Global Water Crisis), Concept on EIA.

Unit - 6: Conservation Ecology and Biodiversity: Definition and classification of Natural Resources, In-Situ & Ex-Situ Conservation in details; Biodiversity: Concept, origin, value, Hot-Spot of Biodiversity (Terrestrial & Marine), IUCN Red List Categories, Concept of Flagship, Keystone and Endemic Species, Biodiversity & Sustainable Development. Knowledge on WWF, IUCN, CITES, NBWL, NBA.

Phytogeography:

(8+2)=10

Unit -1: Principles of static and dynamic phytogeography; general idea of the distribution of plants over the globe (from tropical to arctic zones) with special reference to the Phytogeographic Regions of India.

Evolution

(8+2)=10

Unit -1: Organic evolution, mechanism of organic evolution, theories of organic evolution (a general idea).

Unit -2: Modern concept of evolution and origin of life in the light of chemical evolution.

BOTANY MAJOR BOTMP- 508

Marks: 40(32 End+8)

Plant Ecology:

11. Study of the common instruments (P^H meter, spectrophotometer, colorimeter, Muffle furnace, hot air oven, growth chamber, soil thermometer, maximum and minimum thermometer, hygrometer, psychrometer or dry and wet bulb thermometer, lux meter etc.) used in ecological investigation.
12. Study of floristic composition within the college campus / outside near to the college campus.
13. Determination of minimum sampling size (Species-area-curve) for vegetation study.
14. Determination of minimum number of samples to be taken for vegetation study (Species-area-curve).
15. Determination of abundance and density of herbaceous species in a study area.
16. Determination of percentage frequency of herbaceous species in a study area.
17. Determination of root - shoot ratio of herbaceous plants grown in different conditions.
18. Determination of Relative Growth Rate (RGR) of herbaceous species grown in different conditions.
19. Study of ecosystem structure by analyzing the producer, consumer, and decomposer (if possible) and preparation of food chain and food web of a particular locality to show the probable path (s) of energy transformation through the system.
20. Study of standing crop biomass and productivity of an ecosystem.

Phytogeography:

3. Preparation of chart on the major biomes of the world / landscape with distribution of plants with reference to particular ecological condition (s).

Evolution:

4. Study of permanent slides / fossil rocks having evolutionary significance.

SCHEME OF THE PRACTICAL EXAMINATION:
(End Semester)

Time: 4 hrs.

Marks: 32

1. Ecology	
a) Major Expt.	3
b) Minor expt.	10
2. Phytogeography and evolution	7
3. Practical record book	5
4. Viva-Voce	5
	5
Total	32

**Topic of the Project work may be given in the Semester-V and report should have scientific investigation and outcome with statistical analysis of data (where necessary). The same have to be presented in the headings: Title, Introduction, Objective, Materials & Methods, Results, Conclusion and References. The project will be evaluated in Semester-VI with the paper BOTMP-605. Separate project preferably be given to each student.*

BOTANY MAJOR
BOTMT- 601

48 End+12 IA=60

Plant Physiology:

Objective of the course: The main objective of this course is to introduce the students with the basic knowledge on major physiological aspects of plants.

Unit -1: Plant water relationships: Diffusion, imbibition and Osmosis; water potential and chemical potential; absorption of water; mechanism of active and passive absorption; water holding and wilting co-efficient; co-efficient; transpiration, its mechanism and significant factors.

Unit -2: Ascent of sap: Definition; different theories related to ascent of sap; physiological effects of water deficit and stress physiology; Mineral nutrition in plants: Role of micro and macro elements; mineral deficiency symptoms in plant growth; Translocation of Organic Solutes; Transport of Photosynthates.

Unit -3: Nitrogen Metabolism: Nitrogen Fixation (Symbiotic and Non-Symbiotic), nif-gene and nitrification.

Unit -4: Photosynthesis: Historical background and significance; mechanism a) Light Reaction - Red Drop, Emerson Effect, Photosynthetic Pigments; two pigment systems; Cyclic and Non-cyclic Electron Transport; Photophosphorylation and production of Assimilatory Power. (b) Dark Reaction: Calvin Cycle (C3 pathway), Hatch-Slack Pathway (C4 pathway); differences between C3 and C4 cycle; Photorespiration, Crassulacian Acid Metabolism (CAM) and Chemosynthesis; factors affecting photosynthesis.

- ✓ Unit -5: Respiration: Glycolysis and TCA Cycle, Pentose Phosphate pathway; oxidative phosphorylation.
- ✓ Unit -6: Growth and Development: Definitions; Phases of Growth; Kinetics of Growth; Physiology of Seed Dormancy and Germination; Photopefidism and Vernalisation; ✓ Phytohormones; Plant Movements -tropic and nastic.

BOTANY MAJOR
BOTMP- 602

Marks: 40(32 End+8 IA)

Properties of colloids; imbibition and absorption of water and solutes - Osmosis in plant tissues; determination of osmotic pressure and suction pressure; root plant tissues; determination of inorganic constituents of tissues and the experiments on transpiration, respiration, photosynthesis, growth and movement, ash analysis on transpiration, respiration, photosynthesis, growth and movement, ash analysis.

SCHEME OF THE PRACTICAL EXAMINATION:

(End Semester)

Time: 4 hrs.	Marks: 32	
2. Experiment		
a)Major		14
b)Minor		8
2. Practical record book		5
3. Viva voce		5
	Total	32

BOTMT- 603

48 End+12 IA=60

Molecular Biology and Immunology:

Objective of the course: The main objective of this course is to introduce the students with the fundamentals of molecular biology and immunology.

Molecular Biology:

Marks: (32+8)=40

Unit -1: Nucleic Acids, DNA as genetic material, structure and functions of DNA & RNA, Watson & Crick Model of DNA, other forms of DNA (A & Z), Genome organization in prokaryotes and eukaryotes.

Unit-2: Replication of DNA- prokaryotes and eukaryotes, Transcriptions in prokaryotes and eukaryotes.

Unit-3: Features of genetic code wobble hypothesis, protein biosynthesis in prokaryotes and eukaryotes.

Unit-4: Recombination in Prokaryotes; Transformation, Conjunction and Transduction; Concept of Transposons and Plasmids.

Unit -5: Regulation of Gene Expression in Prokaryotes- Operon concept (Lac)

Immunology:

Marks: (24+6)=30

Unit -1: Plant health management.

Unit -2: Immunity & resistant in mammals, principle of antigens and Antibodies reaction.

Unit-3: Interaction of plants with bacteria, virus and fungi breeding for disease resistance, environment & immunity, laws in the distribution of immunity from infectious diseases in plants.

**BOTANY MAJOR
BOTMT-604**

Marks: (24+6)=30

Biophysics and Bioinformatics:

Objective of the course: The main objective of this course is to introduce the students with the tools and techniques of physical and computer sciences used in biological study.

Biophysics

Marks: (24+6)=30

Unit -1: Scope and development of Biophysics. P^H and buffer solution in details.

Unit -2: Laws of Thermodynamics, Concept of Free Energy, Redox Potential and Bioenergetics(only high energy compound)

Unit-3: X-ray Crystallography (XRD), Chromatography, LASER and its biological applications, Fluorescence and its application, Basic concept of NMR and Ultra Sound

Unit -3: Isotopes, Types, their importance in biological studies, measure of radioactivity.

Bioinformatics:

Marks: (24+6)=30

Unit-1: Fundamentals of bioinformatics: introduction, history and scope of bioinformatics; sources of information, internet world wide web and web browsers.

Unit-2: Biological database: introduction, basic concepts of primary and secondary databases; Nuclie acid and protein sequence database (NCBI, gene bank and SWISS-PROT); Data mining and data mining tools (ENTREZ).

Unit-3. Database search and sequence alignment, Tools of sequence alignment - FASTA and BLAST; methods of sequence alignment.

Unit-4: Phylogenetic analysis: basic concept, steps in evaluation of phylogeny and constructing phylogenetic trees.

**BOTANY MAJOR
BOTMP- 605**

Marks: 80(52End+13IA), Project work 15

C. Molecular Biology and Immunology

1. Separation of ball and stick model of Nucleotides.
2. Detection Estimation of RNA/DNA
3. Study of antimicrobial activity (inhibition zone) of various plant extract of economic importance.

D. Biophysics and Bioinformatics:

1. Application of different microscopes in biological studies.
2. Separation techniques.
3. Different resources and database search.
4. Similarity search in sequence such as BLAST / FASTA.
5. Submission of charts and models etc.

PROJECT WORK *Topic of the Project work may be given in the Semester V and report should have scientific investigation and outcome with statistical analysis of data (where necessary). The same have to be presented in the headings: Title, Introduction, Objective, Materials & Methods, Results, Conclusion and References. The project will be evaluated in Semester-VI with the paper BOTMP-605. Separate project preferably be given to each student.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 6 hrs.	Marks: 52+15=67
1. Molecular Biology	12
2. Immunology	8
3. Biophysics	10
4. Bioinformatics	10
5. Practical record book	7
6. Viva-Voce	5
	<hr/>
	Total 52
	15
***Project	<hr/>
	67

BOTANY MAJOR
BOTMT- 606

48 End+12 IA=60

Agrotechnology and Sustainable Utilization of Plants:

Objective of the course: The main objective of this course is to provide students comprehensive knowledge of usefulness of plant resources for human welfare.

Unit -1. Origin of cultivated plants, Vavilov's centre of origin of crop plants; ethnobotany and its importance in Indian context, Knowledge on Indigenous Knowledge System (IKS)

Unit - 2: Agrotechnology of rice, wheat, mustard, sunflower, sesame, groundnut, soyabean, gram, mung, pea, tea, coffee, potato, cabbage, cauliflower, tomato and their economic utilization

Unit - 3: Agrotechnology of Chilli, turmeric, zinger, cardamom, black piper, jute, cotton, ramie, bamboo, teak, sal, sesoo, ajar, nahar and their economic utilization.

Unit - 4: Medicinal importance of serpagandha, ashwagandha, kalmegh, saimul, bos, giloi (Celastraceae), bhoot jalakia, amlakhi, arjun, silikha and their economic utilization .

Unit - 5: Aromatic and Petroscrops (Cultivation and economic utilization) of patchouli, citronella, saffron, rose, jatrophia, era.

Unit - 6: Domestication of Plants, Germplasm Collection & Conservation, Importance of Germplasm of Wild Species Gene Library, Gene Bank; Concept of , Biofertilizers, biopesticides and Organic farming. Useful aspect of Lower Group of Plants: Algae, Fungi, Lichen.

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Marks: 40(32End+8IA)

5. Determination of soil pH, Soil Moisture, Water Holding Capacity (WHC) of different soil samples collected from different habitats and soil physical properties.
6. Study of botanical characteristics, useful part (s), and products.
7. Determination of protein, fat, oil content of certain materials.
8. Collection of useful plants/plant parts.

SCHEME OF THE PRACTICAL EXAMINATION:
(End Semester)

Time: 1 hrs.	Marks:32
1. Soil analysis	10
2. Spot identification of useful plant / plant part(s) of different categories with distinguishing characters to be selected by the External Examiner.	12
4. Practical record book	5
5. Viva-Voce	5
Total	32

Books Recommended (including text books):

- Cryptogamic Botany Vol I & II: Smith, Tata McGraw Hill.
Introduction to lower plants: Round, Bultherworth.
Morphology of Gymnosperms: Coulter & Chamberlein.
Plant Anatomy. Basu, Willey.
Introduction to Embryology: P. Maheswari.
Introduction to Plant Taxonomy: Jeffrey, Churchill.
Int. to Plant Physiology: Meyer & Anderson, East West.
A Class Book of Botany: A.C. Dutta.
Modern Concept of Ecology: Kumer, Vikash.
Cell Biology: S.C. Rastogi, Rastogi Publication.
General Microbiology Vol. I & II: Power & Daginaqala, Himalayan Publishing House.
Economic Botany: Hill, McGraw Hill.