

**B.Sc. (GENERAL) PROGRAMME
BOTANY (BOTG)
SCHEME OF COURSES**

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

Semester I	100 Marks
BOTG 101: Botany –I (Th) Algae, Fungi, Bacteria, Lichen, Virus, Plant Pathology	48End+12IA
BOTG 102: Botany –II (Pr.) Based on Botany Course-I	32End+8IA
Semester II	100 Marks
BOTG 201: Botany –III (Th) Bryophytes, Pteridophytes, Gymnosperms	48End+12IA
BOTG 202: Botany –IV (Pr) Based on the Botany Course- III	32End+8IA
Semester III	100 Marks
BOTG 301: Botany –V (Th) Morphology, Development and Reproduction of Angiosperms	48End+12IA
BOTG 302: Botany –VI (Pr) Based on Course-V	32End+8IA
Semester IV	100 Marks
BOTG 401: Botany –VII (Th) Physiology & Economic Botany	48End+12IA
BOTG402: Botany –VIII (Pr) Based on Botany Course VII	32End+8IA
Semester V	100Marks
BOTG 501: Botany –IX (Th) Cytogenetics, Evolution & Biostatitstics	48End+12IA
BOTG 502: Botany –X (Pr) Based on Botany Course -IX	32End+8IA
Semester VI	100 Marks
BOTG 601: Botany –XI (Th) Biochemistry, Ecology & Plant Geography	48End+12IA
BOTG 602: Botany –XII (Pr) Based on Botany Course -XI	32End+8IA

BOTG 101
Botany I

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

48End+12IA = 60 Marks

Objective of the course: The main objective of this course is to introduce the undergraduate students with the basic knowledge of the structure, forms and reproduction of thallophytes.

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. 3 class hours
- a. Chlorophyceae: *Chlamydomonas*, *Volvox*, *Coleochaete*, *Oedogonium* and *Chara*. 5 class hours
 - b. Bacillariophyceae: A general account. 2 class hours
 - c. Phaeophyceae: *Ectocarpus*, *Fucus*. 2 class hours
 - d. Rhodophyceae: *Polysiphonia* and *Batrachospermum*. 2 class hours
 - e. Myxophyceae: *Nostoc* and *Anabaena*; 2 class hours

Fungi&Bacteria, Virus, Plant Pathology, 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- 3 class hours
- a. Phycomycetes: *Phytophthora*, *Synchytrium*. 3 class hours
 - b. Ascomycotina: *Peziza*, *Penicillium*, *Xylaria* 3 class hours
 - c. Basidiomycotina: *Puccinia*, *Psaliota*, *Polyporus*, *Cyathus*. Fungi imperfecti. 5 class hours
 - d. General account of bacteria and virus 2 class hours
 - e. Rust of Wheat, Grey Blight of tea, Late blight of potato. 3 class hours
 - f. Thallus structure and economic importance of lichen. 2 class hours

BOTG 102
Botany II
(Practical)

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

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

SCHEME OF PRACTICAL EXAMINATIONS

Time: 4hrs.

Marks: (32+8)= 40

Algae/Fungi	20
Bacteria, Plant pathology	10
Lab. Note Book	5
Viva Voce	5
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	Total 40

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. Vaishistha
7. Fungi: B.R. Vaishistha

BOTG 201
Botany III

Bryophytes, Pteridophytes, & Gymnosperms

48End+12IA= 60

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 systems, seed habit in higher cryptograms & Gymnosperms.

Bryophytes

Marks:(12+3)=15, 10 class hours

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

Pteridophytes

Marks: (20+5)=25, 18 class hours

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

Gymnosperm

Marks: (16+4)=20, 10 class hours

Unit –1: Classification of Gymnosperms.

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

BOTG 202
Botany IV

(Practical)

Marks: 40(32End+8IA), 12 class hours

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

SCHEME OF PRACTICAL EXAMINATIONS:

Time: 4hrs.

Marks: (32+8)=40

Bryophyte	10
Pteridophyte	10
Gymnosperms	10
Lab. Note Book	5
Viva Voce	5
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Total	40

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

BOTG 301
Botany V

Morphology, Taxonomy, Development and Reproduction of Angiosperms

48End+12IA=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. 4 class hours

Unit –2. Nomenclature- morphological details, diagram and floral formula of angiospermic species of the following families citing common and economically plants. 3 class hours

Unit –3. *Magnoliaceae, Brassicaceae, Malvaceae, Fabaceae, Rosaceae, Apiaceae, , Lamiaceae, Euphorbiaceae; Orchidaceae, Musaceae, Lilliacae, Arecacuae, and Poaceae.* 13 class hours

Development and Reproduction

Marks: (24+6)=30

Unit –4. Meristems and organization of root and shoot apices. 3 class hours

Unit –5. Tissues and tissue systems, the primary body, stealer structures 4 class hours

Unit –6. The secondary growth: cambium and its derivatives, anomalous types, periderm. 3 class hours

Unit -7: Microsporangium and development of male gametophyte. 3 class hours

Unit – 8:. Megasporangium and development of female gametophyte. 3 class hours

Unit – 9: Embryo and endosperm development. 4 class hours

BOTG 302
Botany VI

Practical based on the Botany Course V

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

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

SCHEME OF PRACTICAL EXAMINATIONS:

Time: 4hrs.

Marks(32+8)= 40

Morphology and taxonomy	15
Development and reproduction	15
Lab. Note Book	5
Viva Voce	5
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Total	40

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

BOTG 401
Botany VII
Physiology & Economic Botany

48End+12IA = 60

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 mechanisms of absorption of inorganic components & production and functions of organic components & role of external factors upon them.

Physiology

Marks: (32+8)=40

- Unit –1: An elementary knowledge; importance of water to plant life, diffusion, imhhibition, osmosis and plasmolysis; absorption of water and solutes. 6 class hours
- Unit –2: Micro nutrition: Essential macro and micro elements and their role, transportation and exudation, ascent of sap and translocation. 5 class hours
- Unit –3: Enzymes, co-enzymes and their role in biochemical processes. 4 class hours
- Unit –4: Photosynthesis: mechanism and factors affecting photosynthesis, calvin cycle, carbon fixation in ozone cycle. 5 class hours
- Unit –5: Respiration: mechanism (Glycolysis and Kreb cycle) and significance of respiration; □ermentation; growth and development: definations, phases of growth and development; dormancy and germination of seeds. 6 class hours
- Unit –6: Hormones: Gibberlin, auxin, cylokinins, florigen; concept of photoperiodism and vernalisation; tropic and nastic movement. 4 class hours

Economic Botany

Marks: (16+4)=20, 1 class hours for each=8 class hour

- Unit –1: A general knowledge of the following economically important plants with reference to their local names, scientific names and parts used.
- a. Rice, wheat and maize.
 - b. Pulses – Pea and Soyabean.
 - c. Oil seeds – Mustard, ground nut coconut and sunflower.
 - d. Fibre plants – Jute, Cotton, Ramic.
 - e. Medicinal Plants – Rauwlfra, Swertia, Ocimum and Neem.
 - f. Timber yielding – Sal, Sissa, Teak, Holokh.
 - g. Beverages – Tea and Coffee.

**BOTG 402
Botany VIII**

(Practical)

32End+8IA =40

Physiology

Marks: (24+6)=30, 9 class hours

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

Marks: (8+2)=10, 3 class hours

Candidates to submitted some specimens and herbarium sheets of some economically important plants with proper specifications.

SCHEME OF PRACTICAL EXAMINATIONS:

Time: 4hrs.

Marks⊗32+8)= 40

Plant Physiology	20
Economic botany (including collection)	10
Lab. Note Book	5
Viva Voce	5
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	Total 40

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

BOTG 501
Botany IX

Cytogenetics, Evolution & Biostatistics

48End+12IA= 60

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.

Cytogenetics

Marks: (32+8)=40

- Unit –1. Detail structure and functions of nucleus, chromosomes, cell wall, cell membrane, (physical and chemical organisation and types). 4 class hours
- Unit –2. Mitochondria, plastids & Ribosomes and replication of DNA and RNA. 4 class hours
- Unit –3. Concept of polyploidy and its application, Mendel's Laws, Linkage, Crossing over and chromosome mapping, concept of gene and allele and mutation. 6 class hours
- Unit –4. Knowledge of non-chromosomal inheritance, concept of genetic engineering and crop improvement. 3 class hours
- Unit –5. Concept of protoplast, cell and organ culture somatic hybridisation and tissue culture techniques and its application. 3 class hours

Evolution

(8+2)=10

- Unit –1: Origin of life, Evidences of organic evolution; mechanism of evolution; theories of organic evolution. 4 class hours
- Unit –2: Modern concept of evolution (Molecular basis of evolution). 4 class hours

Biostatistics

(8+2)=10

- Unit –1: Importance of biostatistics, mean, median, and mode; mean deviation and standard deviation, standard error, test of significance. 12 class hours

**BOTG 502
Botany X**

(Practical)

32End+8IA = 40

Cytogenetics Marks: (12+3)=15, 5 class hours
Study of chromosomes by smearing the root tips using proper stains.

Biostatistics Two to three suitable problem Marks: (8+2)=10, 5 class hours

Evolution: Study of fossil rocks Marks: 5, 1 class hours

SCHEME OF PRACTICAL EXAMINATIONS:

Time: 4hrs.	Marks: (32+8)=40
Cytogenetics	20
Biostatistics	10
Lab. Note Book	5
Viva Voce	5
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	Total 40

Text Book:

1. Fundamentals of Biostatistics: Prasad, Emby Publications
2. Cytology, Genetics, Evolution and Ecology: Verma & Agarwalla
3. Genetics: P.K. Gupta
4. Cytogenetics & Plant Breeding: Sukla & Chandey.
5. Elements of Cytology: N.S. Chonn

BOTG 601
Botany XI

Biochemistry, Ecology and Plant Geography

48End+12IA =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 and coenzymes, their importance.

5 class hours

Unit –2. General account of carbohydrates, fats, proteins, and nucleic acids and their importance

5 class hours

Plant Ecology

Marks: (24+6)=30

Unit –3. Ecological factors and their role in plant biodiversity.

2 class hours

Unit 4. Structure and function of ecosystem, energy flow through ecosystem, an overview on different types of ecosystem.

7 class hours

Unit 5. Plant communities: definition, classification, characteristics, function, succession.

6 class hours

Unit 6. Natural resources: Renewable and non- renewable resources with special reference to N.E. India, conservation of natural resources.

2 class hours

Unit 7. Deforestation and consequences of deforestation.

1 class hours

Unit 8. Pollution: Air, Water, Soil, global warming and green house effect, global climate change.

3 class hours

Plant Geography

(8+2)=10

Unit 1. General account on the Phytogeographical regions of India with special reference to the Eastern Himalayas

4 class hours

Unit –2. Rare, endangered, threatened, and endemic flora – a general account.

3 class hours

**BOTG 602
Botany XII**

(Practical)

32End+8IA =40

Biochemistry

Marks: 15, 6 class hours

Preparation of buffer, detection of carbohydrates, fats and proteins.

Plant ecology and phytogeography

Marks: 25, 6 class hours

Floristic composition study 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 through the ecosystem, collection of representative plant samples of different habitats.

SCHEME OF PRACTICAL EXAMINATIONS

Time: 4hrs.

Marks: (32+8)=40

Biochemistry	10
Environmental and Phytogeography (including collection)	15
Lab. Note Book	5
Viva Voce	5
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Total	40

Text Book:

1. A Text Book of Plant Ecology: R.S. Ambasth
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.

**B.Sc. (MAJOR) PROGRAMME
BOTANY (BOTM)
SCHEME OF COURSES**

There shall be 28 (twenty eight) courses 14(fourteen) each of theory and practical courses for TDC Botany Major programme. The distribution of courses and marks will be as follows:

SEMESTER- I

BOTM 101: Botany Major I: (Theory)	48End+12IA
BOTM 102: Botany Major II: Practical based on Botany Major-I	32End+8IA

SEMESTER- II

BOTM 201: Botany Major III: (Theory)	48End+12IA
BOTM 102: Botany Major IV Practical based on Botany Major-III	32End+8IA

SEMESTER- III

BOTM 301: Botany Major V: (Theory)	48End+12IA
BOTM 302: Botany Major VI Practical based on Botany Major-V	32End+8IA
BOTM 303: Botany Major VII: (Theory)	48End+12IA
BOTM 304: Botany Major VIII: Practical based on Botany Major-VII	32End+8IA

SEMESTER- IV

BOTM 401: Botany Major IX: (Theory)	48End+12IA
BOTM 402: Botany Major X Practical based on Botany Major-IX	32End+8IA
BOTM 403: Botany Major XI: (Theory)	48End+12IA
BOTM 404: Botany Major XII Practical based on Botany Major-XI	32End+8IA

SEMESTER- V

BOTM 501: Botany Major XIII: (Theory)	48End+12IA
BOTM 502: Botany Major XIV Practical based on Botany Major-XIII	32End+8IA
BOTM 503: Botany Major XV: (Theory)	48End+12IA
BOTM 504: Botany Major XVI Practical based on Botany Major-XV	32End+8IA
BOTM 505: Botany Major XVII: (Theory)	48End+12IA
BOTM 506: Botany Major XVIII Practical based on Botany Major-XVII	32End+8IA
BOTM 507: Botany Major XIX: (Theory)	48End+12IA
BOTM 508: Botany Major XX: Practical based on Botany Major-XIX	32End+8IA

SEMESTER- VI

BOTM 601: Botany Major XXI: (Theory)	48End+12IA
BOTM 602: Botany Major XXII Practical based on Botany Major-XXI	32End+8IA
BOTM 603: Botany Major XXIII: (Theory)	48End+12IA
BOTM 604: Botany Major XXIV Practical based on Botany Major-XXIII	32End+8IA
BOTM 605: Botany Major XXV: (Theory)	48End+12IA
BOTM 606: Botany Major XXVI Practical based on Botany Major-XXV	32End+8IA
BOTM 607: Botany Major XXVII: (Theory)	48End+12IA
BOTM 608: Botany Major XXVIII: Practical based on Botany Major-XXVII	32End+8IA

BOTM 101
Botany Major I

Algae, Fungi and Lichen

48End+12IA =60

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..

Algae

Marks: (20+5)=25

- Unit –1. General characters, classification and economic importance of algae; its phylogeny and distribution in India. 2 class hours
- Unit –2. Vegetative structure: cell and thallus structure; algal chromatophores and pigments; range of thallus structure. 4 class hours
- Unit –3. Reproduction: Vegetative, asexual, sexual and pattern of life cycles. 3 class hours
- Unit –4. A comprehensive knowledge of the following classes with special reference to the structure and life histories of the genera mentioned below: 6 class hours
- 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*.

Fungi

Marks: (20+5)=25

- Unit –1. Salient features of fungi, fungal cell structure and fungal nutrition. 2 class hours
- Unit –2. Classification of fungi (Alexopolus) and their distribution in India. 1 class hours
- Unit –3. Comparative account of structure, method of reproduction and mode of spore dispersal of fungi. 4 class hours
- Unit –4. Economic importance of fungi. 1 class hours
- Unit –5. 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. 10 class hours
- (a) **Mastigomycotina:** *Myxomycetes*: a general account, *Albugo*, *Pythium*.
 - (b) **Zygomycotina:** *Rhizopus*.
 - (c) **Ascomycotina:** *Peziza*
 - (d) **Basidiomycotina:** *Puccinia*, *Polyporus*, *Cyathus*, *Agaricus*
 - (e) **Deuteromycotina:** *Aspergillus*, *Altermaria*, *Penicillium*

Lichen

Marks: (8+2)=10

- Unit –1. A general account with particular reference to types and their detail cell structure. 3 class hours
- Unit -2. Mode of reproduction, symbiotic association, nutrition and economic importance. 4 cl hrs

BOTM 102
Botany Major II
(Practical)

Marks: 40(32End+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:

Time: 4 hrs.

Marks: (32+8)=40

1. Slide preparation (algae)	10
2. Drawing labelling & description (with Camera lucida drawing and spore measurement of fungi / pathology.	10
3. Lichen	4
4. Identification	3
5. Practical record book	5
6. Viva voce	8
Total	40

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

BOTM 201
Botany Major III

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, alteration 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. 2 class hours

Unit –2. Host parasite interaction, (toxins, enzymes ,resistant). 4 class hours

Unit–3. Plant disease management through physical, chemical, biological, regulatory and cultural methods, and post harvest management. 6 class hours

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. 8 class hours

Bryophytes

Marks: (24+6)=30

Unit _1. General account, classification and distribution in India 2 class hours

Unit _2. Comparative account of the gametophyte 2 class hours

Unit –3. Evolution of saprophytes and spore dispersal mechanism 8 class hours

Unit –4. 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 8 class hours

Riccia, Marchantia, Anthoceros, Sphagnum, Polytrichum

BOTM 202
Botany Major IV

(Practical)

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

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 pathogen types.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: (32+8)=40

1. Plant Pathology	10
2. Slide preparation (Bryophyte)	8
5. Identification	6
6. Slide submission	3
7. Practical record book	5
8. Viva voce	8
Total	<hr style="width: 100%; border: 0.5px solid black; margin-bottom: 5px;"/> 40

BOTM 301
Botany Major V

Pteridophytes, Gymnosperms, and Palaeobotany

48End+12IA = 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. 3 class hours
- Unit –2. Stelar organisation in Pteridophytes. 2 class hours
- Unit –3. Evolution of sporophytes and sporophylls in pteridophytes. 3 class hours
- Unit –4. Homospory and Heterospory and its importance in evolution of seed habit 3 class hours.
- Unit –5. Comparative study of morphology and life history of psilotum, *Lycopodium*, *Selagnella*, *Equisetum*, *Marsilea*. 4 class hours

Gymnosperms

Marks: (16+4)=20

- Unit –1. Classification, distribution and economic importance. 3 class hours
- Unit –2. Comparative and evolutionary study of morphology, anatomy and reproduction of *Cycas*, *Pinus*, *Ginkgo*, *Gnetum*. 7 class hours

Palaeobotany

Marks: (12+3)=15

- Unit –1. An elementary knowledge of paleobotany – process and the theory of fossilization, geological periods and importance of Paleobotany. 4 class hours
- Unit –2. General account of anatomy and reproduction of the following types:
- (a) Pteridophytes – *Rhynia*, *Hornea*, *Phyton*, *Sphenophyllum* 3 class hours
- (b) Gymnosperms – Cycadofilicales (Lyginopteris), Bennettitales (Willimasonia) and Cordaitales (Cordaites). 3 class hours

BOTM 302
Botany Major VI

(Practical)

Marks: 40(32End+8IA), 15 class hours

Pteridophyte

(12+3)=15

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

Gymnosperm

(12+3)=15

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

Palaeobotany

(8+2)=10

Study of specimens and slides of paleobotanical importance.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: (32+8)=40

1. Slide preparation (Pteridophytes)	10
2. Slide preparation (gymnosperms)	11
3. Identification	6
4. Practical record book	5
5. Viva voce	8
Total	40

BOTM 303
Botany Major VII

Microbiology and Biotechnology

48End+12IA = 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.	1 class hours
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).	5 class hours
Unit –3. Elementary principles of isolation, and cultivation of micro-organisms and pure culture concept.	4 class hours
Unit –4. General ecology of soil microflora, mycorrhiza and bacteriorrhiza.	3 class hours
Unit –5. Microbiology of food, milk and water.	2 class hours
Unit –6. 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).	4 class hours

Biotechnology

Marks: (16+4)=20

Unit – 1. Introduction, scope of biotechnology, recent advances in biotechnology, application of biotechnology in agriculture and industry, concepts pertaining to biofertilizers.	3 class hours
Unit – 2. Genetic Engineering and its merits and demerits	4 class hours
Unit – 3. Tissue culture: basic principle, medium, protoplast fusion and somatic hybridization.	6 c h
Unit – 4. Basic knowledge of industrial microbiology with reference to production of Alcohol, vinegar and antibiotic.	3 class hours

BOTM 304
Botany Major VIII

(Practical)

Marks: 40(32End+8IA), 15 class hours

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

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: (32+8)=40

1. Different techniques (Microbiological /Biotechnological)	15
2. Demonstration	10
3. Practical record book	5
4. Viva voce	10
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Total	40

BOTM 401
Botany Major IX

Morphology and Taxonomy of Angiosperms

48End+12IA= 60

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

Morphology of Angiosperms

Marks: (16+4)=20

Unit –1. Detail study of (i) carpel polymorphism (ii) origin of angiosperms (iii) Evolution of inflorescence and (iv) Role of morphology in the classification of the flowering plants.

8 class hours

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 Linnaeus, Bentham and Hooker, Engler and Prantl, Hutchinson and Takhtajan's classification.

6 class hours

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).

6 class hours

Unit –3. Taxonomy in relation to cytology (cytotaxonomy), chemistry (chemotaxonomy) numerical taxonomy and biosystematics.

6 class hours

Unit –4. A detailed knowledge of the following families and their phylogenetic affinities and economically important plants:

6 class hours

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

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

BOTM 402
Botany Major X

(Practical)

Marks: 40(32End+8IA), 15 class hours

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 place(s) of botanical interest and to submit a field report on the visit.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: (32+8)=40

1. Dissection, drawing, labelling, description	15
2. Herbarium, Field Study Report	10
3. Practical record book	5
4. Viva voce	10
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Total	40

BOTM 403
Botany Major XI

Cell Biology and Modern Laboratory Technique

48End+12A=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.

CELL BIOLOGY:

Marks: (32+8)=40

- Unit –1. Cell theory and its exceptions, prokaryotic and eukaryotic cells. 3 class hours
- 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. 8 class hours
- Unit –3. Cell formation – amitosis, mitosis, and meiosis, and cell cycle. 3 class hours
- Unit –4. Nucleoproteins and nature of genetic material 3 class hours
- Unit –5. Structure and function of nucleic acids, DNA replication, Genetic code and RNA transcription. 4 class hours
- Unit –6. Cell adhesion, membrane transport, signal transduction (G proteins). 4 class hours

Modern Laboratory Technique

Marks: (16+4)=20

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

- a. Microscopy: Compound, Phase contrast, Dark field and Electron microscopes.
- b. Chromatography – Paper, affinity, TLC, HPLC, gel filtration.
- c. Spectrophotometer.
- d. Autoradiography.
- e. P^H meter, BOD incubator, autoclave, colorimeter, laminar air flow, centrifuge, hot air oven.
- f. Basic knowledge of computer and its application.

BOTM 404
Botany Major XII

(Practical)

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

Cell biology

20+5=25

. Paraffin methods of making permanent stained slides; preparation of paraffin blocks, teaming. fixing; stain staining techniques used in differentiation of different types of cells.

Modern Laboratory Technique

12+3=15

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:

Time: 4 hrs.

Marks: (32+8)=40

1. Cell biology	15
2. Separation techniques	10
3. Practical record book	5
4. Viva voce	10
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Total	40

BOTM 501
Botany Major XIII

Development and Reproduction in Angiosperm

48End+12IA =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

Marks: (24+6)=30

- Unit –1. Organisation of tissues: Types of tissues, Meristematic and permanent, their types, structures, distribution and functions; theories of differentiation of roots and shoots. 8 class hours
- Unit –2. Stelar Body – origin and development, Root – stem transition, leaf traces and leaf gaps, branch gaps, abscission layer. 6 class hours
- Unit –3. Secondary structures of roots and stems, initiation of cambium and its activities. 4 class hours
- Unit –4. Anomalous secondary growth in thickness (*Amaranthus*, *Asparagms*, *Boerharia* and *Mirabilis*). 6 class hours
- Unit –5. Anatomico –physiological consideration of dermal, mechanical, conducting and photosynthetic system of tissues; anatomy of C3 and C4 plants. 5 class hours

Reproduction

Marks: (24+6)=30

- Unit –1. A general treatment of the following topics: Development of male and female gametophyte of angiosperms; a monosporic, a bisporic & tetrasporic, embryosac. 6 class hours
- Unit –2. Fertilization, development of embryo; Apomixis, polyembryony, Palynology. 6 class hours
- Unit –3. Development of Endosperm – nuclear, cellular, helobial; houstorial structures. 3 class hours

BOTM 502
Botany Major XIV

(Practical)

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

Development

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

Reproduction

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

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: (32+8)=40

1. Double staining slide (anatomy) drawing, labelling, description	15
2. Workout and study of permanent slide (embryological)	10
3. Practical record book	5
4. Viva voce	10
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Total	40

BOTM 503
Botany Major XV

Genetics & Plant Breeding, Biostatistics

48End+12IA=60

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. 2 class hours
- Unit – 2.. Linkage, crossing over and basic knowledge of gene mapping. 2 class hours
- Unit – 3. Determination of sex, sex linked and sex limited traits. 2 class hours
- Unit – 4. Cytoplasmic inheritance with reference to plastid inheritance and kappa particle inheritance. 4 class hours
- Unit – 5. Chromosomal (numerical and structural) and gene mutation, concept of biochemical mutation. 3 class hours
- Unit – 6. Basic ideas of gene and its fine structure, transposons and plasmids. 2 class hours
- Unit – 7. Microbial genetics: Basic ideas of conjugation, Transduction and Transformation. 3 cl hrs
- Unit – 8. Human genetics: Karyotype, impatant Syndromes and disorders. 2 class hours

Plant Breeding

Marks: (16+4)=20

- Unit – 1. Methods of reproduction: Sexual, vegetative, apomixes. 3 class hours
- Unit – 2. Principles and methods of plant breeding: introduction, Selection, hybridization, Heterosis breeding and concept of mutation breeding. 3 class hours
- Unit – 3. In vitro culture: Requirements, techniques and application in crop improvement. 3 cl hrs

Biostatistics

Marks: (12+3)=15

- Unit –1. Application of statistics in Biological Science, collection and classification of data for frequency distribution. 3 class hours
- Unit –2. Measurement of central tendency; mean, media , mode, standard deviation, variant and standard error. 3 class hours
- Unit –3. Test of significance, probabality test. 3 class hours

BOTM 504
Botany Major XVI

(Practical)

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

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 Mandelian 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.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: (32+8)=40

1. Genetics	12
2. Plant breeding	8
3. Biostatistics	7
4. Practical record book	5
5. Viva voce	10
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Total	40

BOTM 505
Botany Major XVII

Plant Physiology

48End+12IA=60

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, imhibition 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.
5 class hours

Unit –2. Ascent of sap: Definition; different theories related to ascent of sap; physiological effects of water deficit and stress physiology.
4 class hours

Unit –3. Mineral nutrition in plants: Role in micro and macro elements; mineral deficiency symptoms in plant growth.
3 class hours

Unit –4. Nitrogen metabolism: Nitrogen fixation (symbiotic and non-symbiotic), nif-gene and nitrification.
3 class hours

Unit –5. 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), Hetch-shack pathway (C4 pathway); differences between C3 and C4 cycle; photorespiration, crassulacian acid metabolism (CAM) and chemosynthesis; factors affecting photosynthesis.
6 class hours

Unit –6. Translocation of organic solutes: Transport of photosynthates; source sink-relationships; the mechanisms of translocation in phyloem
4 class hours.

Unit –7. Respiration: Glycolysis and TCA cycle, pentose phosphate pathway; oxidative phosphorylation.
4 class hours

Unit –8. Growth and Development: Definitions; phases of growth; kinetics of growth;physiology of seed dormancy and germination; photoperidism and vernalisation; phytohormones: auxin, gibberellins and cytokinins along-with their physiological role and mechanisms; movements –tropic and nastic.
6 class hours

BOTM 506
Botany Major XVIII
(Practical)

Marks: 40(32End+8IA), 15 class hours

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:

Time: 4 hrs.

Marks: (32+8)=40

1. Experiment	
a)Major	15
b)Minor	10
2. Practical record book	5
3. Viva voce	10
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Total	40

BOTM 507
Botany Major XIX

Plant Ecology, Phytogeography and Evolution

48End+12IA=60

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; concepts pertaining to population, community, autecology and synecology; ecological factors. 3 class hours
- Unit 2. Autecology and population dynamics: definition, characteristics of population, population growth forms 4 class hours
- Unit 3. Synecology and community dynamics: structure and classification of plant community, community characteristics, analytic and synthetic characters; plant succession: types of succession, causes of succession, the climax concept. 7 class hours
- 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. 5 class hours
- Unit -5. Conservation ecology: Conservation of nature and natural recourses, deforestation and its consequences; concept of endemic, vulnerable, rare, endangered and threatened species; Red Data Books, *ex – situ* and *in-situ* conservation, concept of Biosphere Reserve, National Park, Wild life Sanctuary, World’s biodiversity hot spots. 5 class hours
- Unit – 6. 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 warming and green house effect, global climate change 4 class hours.

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 Phytogeographical Regions of India. 4 class hours

Evolution

(8+2)=10

- Unit –1. Organic evolution: mechanism of organic evolution; theories of organic evolution (a general idea). 2 class hours
- Unit –2. Modern concept of evolution and origin of life in the light of chemical evolution. 2 class hours

BOTM 508
Botany Major XX

(Practical)

Marks: 40(32End+8IA)

Ecology:

Marks: 30, 12 class hours

1. 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.
2. Study of floristic composition within the college campus / outside near to the college campus.
3. Determination of minimum sampling size (Species-area-curve) for vegetation study.
4. Determination of minimum number of samples to be taken for vegetation study (Species-area-curve).
5. Determination of abundance and density of herbaceous species in a study area.
6. Determination of percentage frequency of herbaceous species in a study area.
7. Determination of root – shoot ratio of herbaceous plants grown in different conditions.
8. Determination of Relative Growth Rate (RGR) of herbaceous species grown in different conditions.
9. Study of ecosystem structure by analyzing the producer, consumer, and decomposer (if possible) and production of food chain and food web of a particular locality to show the probable path (s) of energy transformation through the system.
10. Study of standing crop biomass and productivity of an ecosystem.

Phytogeography:

Marks: 5, 1 class hour

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

Evolution:

Marks: 5, 1 class hour

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

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: (32+8)=40

1. Ecology	
a) Major Expt.	12
b) Minor expt.	8
2. Phytogeography and evolution	5
3. Practical record book	5
4. Viva voce	10
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Total	40

BOTM 601
Botany Major XXI

Functional and Chemical Biology

48End+12IA=60

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. Metabolic concept- Anabolism and Catabolism. 6 class hours

Unit – 2. Polymeric substances in plants- A brief study of Polysaccharides, Lipids, Proteins,
Nucleic Acids, Chlorophylls with special reference to their functions. 8 class hours

Unit 3. Secondary plant products- Terpenoids, Phenols, Flavonoids, Anthocyanins, Alkaloids,
Non-protein Amino Acids. 8 class hours

Unit 4. General account of – Plant Hormones and their role (auxins, gibberellins, cytokinins,
abscisic acid), phytochrome, and storage products. 8 class hours

Unit 5. Mechanism of source sink relationship. 5 class hours

BOTM 602
Botany Major XXII
(Practical)

Marks: 40(32End+8IA), 15 class hours

1. Qualitative analysis of secondary metabolites in different plant samples.
2. Quantitative estimation of secondary metabolites in different plant samples
3. Qualitative and quantitative estimation of different photosynthetic pigments.
4. 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. Phytochemical analysis	
a) Major	15
b) Minor	10
4. Practical record book	5
5. Viva voce	10
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Total	40

BOTM 603
Botany Major XXIII
Molecular Biology and Immunology

48End+12IA=60

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

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). 9 class hours

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

eukaryotes. 6 class hours

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

eukaryotes. 4 class hours

Unit 4. Recombination in Prokaryotes; Transformation, Conjunction and Transduction;

Genome organization in prokaryotes and eukaryotes, Concept of Transposons and

Plasmids. 5 class hours

Unit 5. Regulation of Gene Expression in Prokaryotes- Operon concept (Lac) 4 class hours

Immunology

Marks: (16+4)=20

Unit -1. Plant health management. 4 class hours

Unit 2. Immunity & immunization, principle of immunological reactions- antigens and antibodies. 5 class hours

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. 5 class hours

BOTM 604
Botany Major XXIV
(Practical)

Marks: 40(32End+8IA), 12 class hours

1. Preparation of ball and stick model of Nucleotides.
2. Detection / estimation of RNA.
3. Study of antimicrobial activity (inhibition zone) of various plant extracts of economic importance.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: (32+8)=40

1. Molecular biology	13
2. Immunology	12
4. Practical record book	5
5. Viva voce	10
Total	40

BOTM 605
Botany Major XXV
Biophysics and Bioinformatics

48End+12IA=60

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: (25+5)=30

- Unit – 1. Scope and development of Biophysics. P^H and buffer concept. 5 class hours
Unit –2. Microscopy- Bright field, Dark field, Phase contrast, Electron micros 6 class hours
Unit –3. Spectrophotometry, X-ray crystallography, Chromatography, Autoradiography. 5 class hours
Unit - 4. Isotopes, Types, their importance in biological studies, measure of radioactivity. 6 class hours

Bioinformatics

Marks: (25+5)=30

- Unit-1. Fundamentals of bioinformatics: introduction, history and scope of bioinformatics; sources of information, internet world wide web and web browsers. 4 class hours
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). 6 class hours
Unit 3. Database search and sequence alignment, Tools of sequence alignment – FASTA and BLAST; methods of sequence alignment. 4 class hours
Unit 4. Phylogenetic analysis: basic concept, steps in evaluation of phylogeny and constructing phylogenetic trees. 4 class hours

BOTM 606
Botany Major XXVI
(Practical)

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

1. Application of different microscopes in biological study.
2. separation techniques.
3. Different e-resources and database search.
4. Similarity search in sequence such as BLAST / FASTA.
5. Creation of databases.
6. Submission of charts and models etc.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: (32+8)=40

1. Biophysics	15
2. Bioinformatics	10
4. Practical record book	5
5. Viva voce	10
Total	40

BOTM 607
Botany Major XXVII

Utilization of Plants

48End+12IA=60

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. 3 class hours
- Unit - 2. Agrotechnology of rice, wheat, mastered, til, soyabean, gram, mung, pea, tea, coffee, potato, cabbage, cauliflower, tomato. 8 class hours
- Unit - 3. Agrotechnology of Chilli, turmeric, zinger, cardamom, black piper, jute, cotton, ramie, bamboo, teak, sal, sisoo, ajar, nahar. 8 class hours
- Unit - 4. Agrotechnology of Sarpagandha, ashwagandha, kalmegh, satmul, bos, giloi (Tinospora), bhot jalakia, amlakhi, arjun, silikha. 8 class hours
- Unit - 5. Agrotechnology of Patchouli, citrelella, vitivar, sasi, jatropa, era, beliphul, badam, jetuka, bhringraj, kenhraj, long piper. 8 class hours

BOTM 608
Botany Major XXVIII
(Practical)

Marks: 40(32End+8IA), 15 class hours

1. Determination of soil P^H of different soil samples collected from different habitats and soil physical properties.
2. Study of botanical characteristics, useful part (s), and products of the materials in the Course XXVII.
3. Determination of protein, fat, oil content of certain materials studied in the Course XXVII.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.	Marks: (32+8)=40
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.	15
4. Practical record book	5
5. Viva voce	10
Total	40

*****PROJECT WORK:** Topic of the project may be given in the **SEMESTER-V** and the report based on proper methodology and statistically correlated data should be submitted for evaluation at the time of **SEMESTER-VI** practical examination.

Books Recommended (including text books):

1. Cryptogamic Botany Vol I & II: Smith, Tata McGraw Hill.
2. Introduction to lower plants: Round, Bultherworth.
3. Morphology of Gymnosperms: Coulter & Chamberlein.
4. Plant Anatomy: Basu, Willey.
5. Introduction to Embryology: P. Maheswari.
6. Introduction to Plant Taxonomy: Jeffrey, Churcil.
7. Int. to Plant Physiology: Meyer & Anderson, East West.
8. A Class Book of Botany: A.C. Dutta.
9. Modern Concept of Ecology: Kumer, Vikash.
10. Cell Biology: S.C. Rastogi, Rastogi Publication.
11. General Microbiology Vol. I & II: Power & Daginaqala, Himalayan Publishing House.
12. Economic Botany: Hill, McGraw Hill.
13. Genetics: Winchester, Oxford & IBH.
14. Fungi & Plant Diseases: Mundkar, Macmillan.
15. Int. to Plant Physiology: Curtis & Clarke, McGraw Hill.
16. Plant Pathology: Butter & Jones, Macmillan.

17. Taxonomy of Vascular Plants: Lawrener, Macmillan.
18. An Int. to Gymnosperms: S.C. Dutta, Asia Publishing House.
19. The Primitive Land Plants: Bower, Macmillan.
20. Fundamentals of Ecology: Odum, W.B. Saunders.
21. Elements of Cytology: Cohen, Harcourt.
22. Morphology and Taxonomy of Fungi: Bessey, Vikash.
23. Morphology of Vascular Plants: Eames, Tata McGraw Hill.
24. Introductory Mycology: Alexopolous, Willey.
25. Plant Physiology Vol. I & II: Steward, Academic Press.
26. Families of Flowering Plants Vol. I & II: Hutchinson, Macmillan.
27. Plant Diseases: R.S. Singh, Oxford Hill.
28. Fundamentals of Biostatistics: Prasad, Emkay Publication.
29. An Int. to Taxonomy of Angiospers: Shukla & Mishra, Vikash.
30. College Botany Practical Vol. I & II: Santra, Chatterjee & Das, Central Book.
31. College Botany: Das Ganguly, Central Book.
32. Economics Botany in tropics: Kochar, Macmillan.
33. Concepts of Cell Biology: Verma & Agarwal, H. Chand.
34. Industrial Microbiology: Patel, Macmillan.
35. Principles of Soil Science: Rai, Macmillan.
36. Text Book of Pteridophytes: Sharma, Macmillan.
37. Genetic Engineering: Mitra, Macmillan.
38. Genetics: Ahluwalia, Willey.
39. Elementary Principles of Plant Breeding: Chaudhury, Oxford & IBH.
40. Plant Breeding: Chopra, Oxford & IBH.
41. Genetics: Gardener.
42. Principles of Genetics: Stickferger.
43. Essentials of Genetics and Biotechnology: A.C.Gogoi
44. Molecular Cytogenetics: Sinnoll, Dunne & Donbzhosky.
45. A Text Book of Plant Ecology: R. S. Amharst.
46. Population Ecology: M. Begon & M. Mortimer.
47. Fundamentals of Ecology: M.C. Dogh.
48. The Reproductive capacity of plants: E.J. Salisbury.
49. Introduction to Environmental Management: Nag Choudhury.
50. Environmental Biology: Trivedi & Raj.
51. Microbiology: N.J. Pelczar et. al.
52. General Microbiology: R.Y. Stainer et. al.
53. Soil Microbiology: N. Walker.
54. Molecular Viscosity: G.A. Knight.
55. Petroleum Microbiology: R.M. Atlas.
56. Agricultural Microbiology: Rangaswamy and Bhagyaraj.
57. Biotechnology: Trichan.
58. Microbial Genetics: Treifelder.
59. Modern concept of Ecology: Verma & Agarwala
60. Handbook of Agriculture: ICAR
61. Economic Botany: Pandey
62. A Handbook of Medicinal Plants: Prajapati; Sharma, Kumar, Purohit
63. Medicinal Plants of N.E. India: NEDFi
64. Cultivation of Medicinal Plants: Purohit & Vyas.
