BOTANY

CURRICULA- SEMESTER SYSTEM

Three Years Programme

B. Sc. Course in Botany syllabus, Kumaun University, Nainital

Semester system started with effect from July 2016

Total 6 Semesters

Each semester will be of 300 marks.

Semester system course structure:

1. The course work shall be divided into six semesters with three papers in each semester.
2. Each paper in semester will be of 80 marks out of which 60 marks for theory and 20 marks are allotted for internal assessment (one written test/assignment/both)
3. Each theory paper shall consists of section (A) 20% of total marks (12 marks) (one word answer fill in the blanks/ true- false, define the terms), section (B) 40% of total marks (24 marks) (short answer type questions) and section (C) 40% of total marks (24marks) (long answer type questions).
4. Students shall have to attempt 05 questions out of 07 questions in each paper. Section "A" and "B" are compulsory. Section "C" will consists of 04 questions.
5. Question paper shall be prepared from the whole syllabus proportionally.
6. Practical in each semester will be of total 60 marks, out of which 15 marks are assigned for internal assessment (Attendance, practical records and herbarium etc.).
7. Practical examination will be evaluated by both external and internal examiner.
8. The duration of theory and practical examination shall be 03 h and 04 h respectively.

B. Sc. Botany

I SEMESTER

Max. Marks: 300

Paper I: Algae	80 (60+20)
Paper II: Fungi	80 (60+20)
Paper III: Bryophyta	80 (60+20)
Practical	60 (45+15)
Total	**300**

II SEMESTER

Max. Marks: 300

Paper IV: Microbiology	80 (60+20)
Paper V: Pteridophyta	80 (60+20)
Paper VI: Gymnosperm and Palaeobotany	80 (60+20)
Practical	60 (45+15)
Total	**300**

III SEMESTER

Max. Marks: 300

Paper VII: Taxonomy of Angiosperms	80 (60+20)
Paper VIII: Cytology	80 (60+20)
Paper IX: Embryology and Morphogenesis	80 (60+20)
Practical	60 (45+15)
Total	**300**

IV SEMESTER

Max. Marks: 300

Paper X: Genetics and Plant Breeding	80 (60+20)
Paper XI: Molecular Biology	80 (60+20)
Paper XII: Plant Anatomy	80 (60+20)
Practical	60 (45+15)
Total	**300**

V SEMESTER

Max. Marks: 300

Paper XII: Economic Botany	80 (60+20)
Paper XIV: Plant Physiology	80 (60+20)
Paper XV: Biochemistry	80 (60+20)
Practical	60 (45+15)
Total	**300**

VI SEMESTER

Max. Marks: 300

Paper XVI: Ecology	80 (60+20)
Paper XVII: Biostatistics	80 (60+20)
Paper XVIII: Biotechnology	80 (60+20)
Practical	60 (45+15)
Total	**300**

BOTANY

CURRICULA- SEMESTER SYSTEM

SEMESTER-I

Bot. 101: PAPER-I ALGAE

Max. Marks: 60

1. Introduction and salient features of algae and their place among the organism.
2. Classification of algae (Smith) up to class level and basis of classification.
3. Range of vegetative structure of algae. Cell structure of Prokaryotic and Eukaryotic algae.
4. Reproduction, types of lifecycles (haplontic, diplontic, diplohaplontic, haplodiplontic and diplobiontic) and alternation of generation in algae.
5. Ecology of algae-brief idea of fresh water and marine, terrestrial, epiphytic, parasitic, symbiotic algae and phytoplanktons.
6. Economic importance of algae as food, fodder, in agriculture, industry and public health.
7. Structure reproduction and life cycles of the following genera:
   Nostoc, Chlamydomonas, Volvox, Oedogonium, Chara, Vaucheria, Sargassum, Polysiphonia, Diatoms.

Bot. 102: PAPER - II FUNGI

Max. Marks: 60

1- Introduction and salient features of Fungi. A brief history of the study of fungi and their place among the organisms.

2- A broad outline of classification of fungi up to the class level

3- Somatic structure of fungi, nutritional and environmental needs of fungi.

4- Ecological groups of fungi.

5- Reproduction in fungi: asexual and sexual reproduction, heterothallism (two allelomorph heterothallism only), heterokaryosis, a general idea of parasexual cycle.

6- Pathology of fungal plant diseases: A brief idea about disease symptoms, control of plant diseases; brief idea about the exclusion, eradication and protection of plants.

7- Importance of fungi both beneficial and harmful.

8- Life history of the following genera in brief:
   Stemonitis, Synchytrium, Saprolegnia, Albugo, Rhizopus, Penicillium, Eryshiphe, Morchella, Ustilago, Puccinia, Agaricus, Alternaria.

Bot. 103: PAPER-III BRYOPHYTA

Max. Marks: 60

1. Introduction, features, distribution, habitat and economic and ecological importance of Bryophyta.
2. A brief account of alternation of generation in Bryophyta.
3. Classification of Bryophyta upto order level giving the characteristic features of each class.
4. A comparative study of *Riccia, Marchantia, Pellia, Anthoceros* and *Funaria* on the basis of morphology and anatomy of gametophyte, vegetative, sexual reproduction and sporophyte.

Bot. 104: Lab course (Practical)

Max. Marks: 60

Algae

A. To study and identify the following algal material by preparing the temporary slides: *Nostoc, Chlamydomonas, Chara, Oedogonium, Spirogyra, Vaucheria, Sargassum, Fucus and Polysiphonia* including some genera available at local level.

B. To study and comment upon the specimens/slides of the given material.

Fungi

A. To study and identify the following fungal material by preparing the temporary slides: *Albugo, Rhizopus, Mucor, Penicillium, Aspergillus, Puccinia, Ustilago, Alternaria.*

B. To study and comment upon the following specimens/slides of fungi: *Morchella*, *Agaricus*, Smut, Rust, Powdery mildew, White rust, *Synchytrium*, Spores of *Puccinia*, Conidia of *Alternaria*

Bryophyta

A. To study the morphological and anatomical features of the following material and identify them: *Riccia, Marchantia, Pellia, Anthoceros, Funaria* or locally available material.

B. To comment upon the specimens/slides given.

Sample Paper for Lab Course

Department of Botany, D.S.B Campus, K.U. Nainital

SEMESTER -I

Max. Marks: 60 Time: 4 h Date: ...../…./….

1. Identify, classify and describe the given plant materials A, B and C giving reasons. Prepare a temporary stained slide and draw well labelled diagrams. 27 (9+9+9)
2. Comment upon the given spots (1-6) 12
3. Viva voce 6
4. Internal Assessment 15

Suggested readings:

Kumar H.D. 1999. Introductory phycology. Affiliated East West Press, New Delhi.

Parihar, N.S. 1991. An introduction to Bryophyta Vol I. Central Book Depot Allahabad.

Parihar, N.S. 1991. An introduction to Bryophyta Vol II. Central Book Depot Allahabad.

Sethi I.K and Walia S.K. 2011. Text book of fungi and their allies. Mc Millian Publishers, New Delhi.

Vashistha, B.R., Sinha A.K. 2012 Botany for degree students: Fungi. S. Chand New Delhi

Vashistha, B.R., Sinha A.K. and Singh, V.P 2012 Botany for degree students: Algae. S.Chand New Delhi

Vashistha, P.C., Sinha A.K. and Kumar Adarsh. 2012. Botany for degree students: Bryophyta. S. Chand, New Delhi

SEMESTER-II

Bot. 201: PAPER IV MICROBIOLOGY

(BACTERIA, VIRUSES AND LICHENS)

Max. Marks: 60

1- Diversity of Microbiology, a general account.

2- Archaebacteria and Eubacteria: General account, ultrastructure, Gram positive and Gram negative bacteria, nutrition, reproduction and economic importance.

3- Viruses: Characteristics, isolation and purification of viruses, chemical nature, replication, transmission of viruses, economic importance.

4- Lichens: Characteristics, general structure, reproduction, economic importance, symbiotic relationship and habitats.

Bot. 202: PAPER V PTERIDOPHYTA

Max. Marks: 60

1. Introduction and salient features of Pteridophyta and economic importance.
2. Alternation of generation in Pteridophyta.
3. Classification of Pteridophyta upto order level pointing out the features of special significance of each class.
4. Comparative study of *Rhynia, Lycopodium, Selaginella, Equisetum, Adiantum* on the basis of morphology and anatomy of vegetative plant body, spore producing organs and sexual reproduction.
5. Stelar system, heterospory and seed habit.

Bot. 203: PAPER VI GYMNOSPERM AND PALEOBOTANY

Max. Marks: 60

1. Introduction and salient features of Gymnosperms and their place among the plant kingdom.
2. Classification of gymnosperms upto order level pointing out the features of special significance of each class.
3. Alternation of generation in Gymnosperms.
4. Comparative study of *Cycas, Pinus* and *Ephedra* on the basis of morphology and anatomy of the vegetative plant body, sporophylls (their arrangement) and sporangia spores, male and female gametophytes, pollination, fertilization, embryology and seed germination.
5. Fossils, their types and process of fossilization, general idea about various geological eras and living fossils.

Bot. 204: Lab course (Practical)

Max. Marks: 60

Microbiology

- **A.** Study of different types of lichens: foliose, fructicose and crustose. Morphological features of viral infected plants, study of bacterial infections in plants.
- **B.** To comment on the specimens.

Pteridophyta

- **A.** To study the anatomical features of the following material and identify them: *Lycopodium, Sellaginella, Equisetum,* fern sorus, *Marsilea*
- **B.** To comment upon the specimens/slides given.

Gymnosperm

A. To study the anatomical features of the following material and identify them: *Cycas* leaflet, Pine needle, Pine stem (T.S., T.L.S., R.L.S.), male and female cone of Pine, *Ephedra*

B. To comment upon the specimens/slides given.

Sample Paper for Lab Course

Department of Botany, D.S.B Campus, K.U. Nainital

SEMESTER -II

Max. Marks: 60 Time: 4 h Date: ...../…./….

1. Identify given bacteria through Gram staining technique and explain it in detail 9

2. Prepare a double stained preparation of given material B, C. 9+9
   Study, sketch and identify giving reasons. Draw well labelled diagrams.

3. Comment upon the given spots (1-6) 12

4. Viva voce 6

5. Internal Assessment 15

Suggested readings

Bhatnagar S.P. and Moitra A. 1996. Gymnosperms. New Age International, Pvt Ltd (P) New Delhi.

Matthews, R.E. 2013. Fundamentals of Plant Virology ELSEVIER India

Tandan, Neeraj. 2014. Advances in Microbiology. Anmol

Tauro, P. 1986. An Introduction to Microbiology. New Age International

Vashistha, P.C., Sinha A.K. and Kumar Anil. 2012 Botany for degree students: Gymnosperm. S. Chand, New Delhi

Vashishta, P.C., Sinha A.K. and Kumar Anil. Botany for degree students: 2012 Pteridophyta. S. Chand, New Delhi

SEMESTER -III

Bot. 301: PAPER VII - TAXONOMY OF ANGIOSPERMS

Max. Marks: 60

1. Basic principles and broad outline of the classification proposal by Bentham and Hooker and Hutchinson.
2. International Code of Botanical Nomenclature
3. Botanical gardens and Herbaria
4. Botanical Survey of India
5. Distinguishing features of the following families Ranunculaceae, Brassicaceae, Rutaceae, Fabaceae, Rosaceae, Apiaceae, Asteraceae, Solanaceae, Lamiaceae, Orchidaceae, Liliaceae, Poaceae.

Bot. 302: PAPER VIII - CYTOLOGY

Max. Marks: 60

1. Cell structure: Prokaryotic and eukaryotic cells; ultrastructure of eukaryotic cell, cell wall and plasma membrane (ultrastructure, chemical composition and models of plasma membrane), cell connections
2. Structure and functions of cell organelles: Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi complex, Ribosome, Microbodies (Lysosomes, Peroxisomes, Glyoxisomes); structure and function of Nucleus and Nucleolus
3. Cell division: cell cycle, process and significance of mitosis and meiosis, structure and function of synaptonemal complex and crossing over
4. Eukaryotic chromosome: structure, chemical composition, Karyotype analysis, Ideogram; structure and functions of Polytene and Lampbrush chromosomes

Bot. 303: PAPER IX EMBRYOLOGY AND MORPHOGENESIS

Max. Marks: 60

1. Structure of anther and pollen, microsporogenesis and male gametophyte.
2. Structure and types of ovules, megasporogenesis and female gametophyte.
3. Pollination mechanism, Fertilization, self incompatibility, double fertilization.
4. Endosperm types, structure and functions; dicot and monocot embryo.
5. General concept of morphogenesis.
6. Seed germination and dormancy.
7. Elementary movements.
8. A general account of Plant Growth Regulators.
9. Physiology of Flowering- Photoperiodism and Vernalization.

Bot. 304: Lab Course (Practical)

Max. Marks: 60

Taxonomy

A. To identify the flowering twigs of given families by studying the taxonomic characters using technical terms: At least two specimens from each family should be studied: Ranunculaceae, Brassicaceae, Malvaceae, Caryophyllaceae, Rosaceae, Fabaceae, Cucurbitaceae, Apiaceae, Asteraceae, Apocynaceae, Solanaceae, Lamiaceae, Liliaceae and Poaceae.

B. To study and comment on the given specimens.

Cytology

A. To study the mitosis in onion root tips or any other available plant material

To study the meiosis in onion buds or any other available plant material.

To study the cell inclusions like starch grains, calcium oxalate crystals, protein grains etc.

B. To study and comment on the given specimens/slides/photographs.

Embryology

A. To study the androecium and gynoecium of different families.

To study the type of anthers and T. S. of the anther

To study the pollen grains of different families.

To study the placenta types by cutting the sections of the ovary.

B. To study and comment on the given specimens/slides/photographs.

Sample Paper for Lab Course

Department of Botany, D.S.B Campus, K.U. Nainital

SEMESTER-III

Max. Marks: 60 Time: 4 h Date: ...../…./….

Q.1. Describe the giving plant specimen by using technical terms and assign it up to family level according to the recognized scheme of classification giving reasons, including floral formula and floral diagrams.	9
2. Perform the Cytology experiment with the help of provided plant material. Describe the cell division stage observed by you.	9
3. Perform the embryology experiment as per instruction with help of given plant material	9
4. Comment upon the given spots (1-6)	12
5. Viva voce	6
6. Internal Assessment	15

Suggested readings

Bhojwani, S.S., Bhatnagar, S.P., Dantu, P.R. The Embryology of Angiosperms-6th Edition. Vikas Publishing House. New Delhi.

Saxena, N.B. and Saxena, S. 2009. Plant Taxonomy. Pragati Prakashan Meerut.

Shukla, R.S. and Chandel, P.S. 2013. Cytology, Evolution, Biostatistics and Plant Breeding. S.Chand, New Delhi.

Simpson M.G. 2006. Plant systematics. Elsevier Academic Press San Diago. CA, USA

Singh V and Jain D.K. 2012.Taxonomy of Angiosperms. Rastogi Publications, Meerut.

Singh, G. 2012. Plant systematic. Theory and practice. Oxford and IBH Pvt. Ltd.

SEMESTER -IV

Bot. 401: PAPER – X GENETICS AND PLANT BREEDING

Max. Marks: 60

1. **Structure and function of nucleic acid:** nucleic acid (DNA & RNA) as genetic material, structure of nucleic acids; different forms of DNA (A, B, Z)
2. **Genetic code:** properties of genetic code, classical and modern concept of gene.
3. **Law of inheritance:** Mendel's experiments, principle of segregation, independent assortment, incomplete dominance.
4. **Chromosomal aberration**: structural (deficiency, duplication, inversion & translocation) and numerical (Euploidy & Aneuploidy), alteration in chromosomes.
5. **Sex determination:** sex chromosomes, sex determination in Drosophila, Man and plants specially *Melandrium;*
6. Sex linked inheritance.
7. **Plant breeding**: aims and objectives, basic techniques of plant breeding (selection, plant introduction and acclimatization, hybridization and mutational breeding), hybrid vigour.

Bot. 402: PAPER - XI MOLECULAR BIOLOGY

Max. Marks: 60

1. DNA chemistry and DNA replication; replication error and repair mechanism.
2. Introns, exons, transposons, molecular basis of gene mutation.
3. C-DNA and C-DNA library; Artificial gene synthesis
4. Molecular markers: A general idea of RAPD (Random Amplified Polymorphic DNA), RFLP (Restriction Fragment Length Polymorphism), VNTR (Variable Number of Tandem Repeats).
5. Polymerase chain reaction techniques (PCR). A brief idea of DNA finger printing.

Bot. 403: PAPER-XII PLANT ANATOMY

Max. Marks: 60

1. Meristematic and Permanent tissues: Root and Shoot apical meristems and their function; Simple, Complex and Special types of tissues.
2. Epidermis and stomata
3. Anatomy of dicot and monocot root, stem and leaf.
4. Root-stem transition
5. Secondary growth: vascular cambium, structure and function; seasonal activity (growth rings), secondary growth in root and stem; sap wood, heart wood, anomalous secondary growth in stems (a brief account).

Bot. 404: Lab Course (Practical)

Max. Marks: 60

Genetics and Plant Breeding

A. To analyze the Mendelian ratios in a given data set by applying the chi square test.
To study the incomplete dominance.
Techniques of emasculation

B. Line drawing photographs of scientists (Mendel, Watson, Beadle and Tautum etc.)
Photographs of deletion, duplication, inversion, translocation
Karyotype of Drosophila, Structure of DNA, RNA, Gynandromorph, Down's syndrome, Turner syndrome, Klinefelters syndrome etc.
Sex chromosomes in plants

Molecular Biology

A. To study the working of following instruments: PCR, incubator, Gel electrophoretic assembly, water bath, Spectrophotometer, Gel documentation Unit and centrifuge etc.

B. To study about life history of various scientists and their contribution in the field of Molecular Biology

Anatomy

A. To study the anatomical characters of different plant organs of monocots and dicots by preparing temporary slides of transverse and vertical transverse sections of the following material and identify them.

Monocot root: Maize

Dicot root: Sunflower or any other

Epiphytic root: Orchid and *Ficus*

Monocot stem: Maize, *Cynodon*

Dicot stem: Sunflower and Cucurbita

Xerophytic stem: *Casuarina, Calotropis*

Hydrophytic stem*: Hydrilla, Nymphea*

Monocot leaf: Maize or any grass leaf

Dicot leaf: *Nerium*, Mango

Anamolous features: *Mirabilis, Anemone, Chenopodium, Bouganvilia, Bignonia, Boerhaavia, Nyctanthus, Salvadora, Leptedenia* and *Dracena*.

B. To study the slides

Sample Paper for Lab Course

Department of Botany, D.S.B Campus, K.U. Nainital

SEMESTER –IV

Max. Marks: 60 Time: 4 h Date: ...../…../….

1.	Perform the given exercise based on genetics as per instruction	6
2.	Describe the emasculation technique/any cross	3
3.	Describe the given equipment/ technique used in molecular biology	7
4.	Prepare a double stained preparation of given material. Study, sketch and identify giving reasons	9
5.	Comment upon the given spot (1-7)*	14
6.	Viva voce	6
7.	Internal Assessment	15

*Spots from Molecular Biology section will be three in number

Suggested readings

Easu, K. Anatomy of seed plants. Wiley Eastern Pvt Ltd. New Delhi.

Metcalfe, C.R and Chalk, L 1983.Anatomy of Dicotyledons and Monocotyledons. 2 vols. Clarendon Press, Oxford.

Pandey, S.N. Plant Anatomy. Rastogi Publication Meerut.

Singh, B.D. 2002.Plant Breeding Principles and Methods. Kalyani Publ. New Delhi

SEMESTER -V

Bot. 501: PAPER- XIII ECONOMIC BOTANY

Max. Marks: 60

A brief knowledge of Botany and commercial utilization and uses of the following plants:

1. Cereals and millets- Wheat, Rice and Maize, Ragi, Pearl millet
2. Sugar yielding plants- Sugarcane and Sugar beet
3. Fruits- Mango, apple, banana, Citrus and Litchi.
4. Fibres- Cotton, jute, hemp, coir, Agave and Semal.
5. Vegetables- Root vegetables, stem vegetables and fruit vegetables.
6. Timbers- Teak, Shisham, Sal, Chir and Deodar.
7. Medicinal plants- *Aconitum, Atropa, Cinchona, Rauwolfia, Ephedra* and *Withania.*
8. Oils- Volatile and non-volatile oils.
9. Beverages- Tea and coffee.
10. Fumitories and masticatories.
11. Spices and Condiments.

Bot. 502: PAPER- XIV PLANT PHYSIOLOGY

Max. Marks: 60

1. Diffusion, osmosis, water potential and its components, Plasmolysis, Imbibition and Absorption of water, root pressure and guttation.
2. Transpiration and its significance, Factor affecting transpiration, mechanism of stomatal opening and closing.
3. Mineral nutrition: Essential elements, macro and micro nutrients, criteria of essentiality of elements, role of essential elements, minerals deficiency symptoms, Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.
4. Translocation in phloem: composition of phloem sap, girdling experiment, pressure flow model, phloem loading and unloading
5. Respiration: aerobic and anaerobic respiration. Glycolysis and Kerb's cycle. Oxidative phosphorylation, electron transport system, fermentation, R.Q.
6. Photosynthesis: photosynthetic pigments. Photosystem I and II, electron transport system and ATP synthesis. Path of carbon in C_3 plants (C_3 cycle), C_4 plants (C_4 cycle), CAM pathway, photorespiration,

Bot. 503: PAPER XV BIOCHEMISTRY

Max. Marks: 60

1. Enzymes: Properties, classification, mechanism of enzymes action and factors affecting enzymes activities
2. Amino acids and proteins: An elementary account with special reference to plants.
3. Biological Nitrogen fixation and nitrate and ammonia assimilation.
4. Carbohydrates: Structure and function.
5. Elementary idea of fats and lipids in plants.

Bot. 504: Lab course (Practical)

Max. Marks: 60

Economic Botany

To study the economically important plants and their parts:

Cereals: Wheat, Rice, Maize

Millets: Finger millet, Foxtail, Ragi

Pulses: Gram, Green gram, Pea, Pigeon pea, Soyabean, Chick pea,

Timbers: Shisham, Sal, Teak, Deodar, Pine

Medicinal plants: Dhatura, Berginia, *Hedychium*, Poppy, Basil, Barberry

Beverages: Tea, Coffee

Oils: Mustard, Sesame, Coconut, Linseed, Groundnut, Castor, Laung, Sandal wood, Mentha

Spices: Coriander, Cardamom, Curcuma, Cinnamon, Laung, Cumin, Thyme, Nigella, Cinnamon leaf

Fibres: Jute, Coconut, Hemp, Urtica, Cotton

Sugars and starch yielding plants: Sugarcane, potato, Beet root

Fruits and vegetables available in the area.

Gums and Resins.

Physiology

To demonstrate the process of diffusion.

To demonstrate the process of osmosis by potato/ radish/ egg osmoscope.

To demonstrate the process phenomenon of imbibition.

To demonstrate the process of respiration by Ganog's respiroscope

To demonstrate that CO_2 is liberated in anaerobic respiration

To demonstrate the process of photosynthesis by inverted funnel method and Wilmott's bubbler.

To demonstrate that CO_2 is necessary for the process of photosynthesis

To demonstrate that light is necessary for photosynthesis

To observe the different stages of plasmolysis by preparing the slides of *Tradescantia*/ *Zebrina* leaf peelings in different concentrations solution of sugar.

To compare the rate of absorption with the rate of transpiration.

To measure the rate of transpiration by Ganong's photometer.

To compare the rate of transpiration on the two surfaces of a dorsiventral leaf by 4 leaf method and cobalt chloride paper method.

To measure the rate of photosynthesis in different light conditions.

To measure the R.Q. (respiratory quotient) in different respiratory substrate.

To separate the chlorophyll pigment by preparing the crude extract of spinach leaf and to separate the plant pigments by filter paper chromatography.

Biochemistry

To test the proteins in milk and pulses by Xanthoproteic reaction, Millon's test, Biuret test.

To test the reducing and non-reducing sugar in glucose/ sucrose in different plant samples by Fehling solution test, hydrolysis test.

To test the starch in: rice/wheat / potato/ sweet potato by Iodine test

To test the fats /oils in different seeds/ vegetable by Sudan test and Osmic acid test

Sample Paper for Lab Course

Department of Botany, D.S.B Campus, K.U. Nainital

SEMESTER –V

Max. Marks: 60 Time: 4 h Date: ...../…../….

1.	Perform the given exercise of Ecology with the help of provided data	9
2.	Perform the Plant Physiology experiment assigned to you. Record your observation and explain giving reason	9
3.	Perform the Biochemistry experiment	9
4.	Comment upon the given spots (1-6)	12
5.	Viva voce	6
6.	Internal Assessment	15

Suggested readings

Jain, V.K. 2014 (17th edition). Fundamentals of plant physiology. S. Chand, New Delhi

Sharma, P.D. 2014. (12th Edition).Ecology and Environment. Rastogi Publications, Meerut.

Shukla R.S. and Chandel, P.S. 2014. Plant Ecology. S. Chand, New Delhi.

Verma, S.K. and Verma M. 2014. A text book of Plant physiology, biochemistry and biotechnology. S. Chand, Meerut.

SEMESTER-VI

Bot. 601: PAPER –XVI ECOLOGY

Max. Marks: 60

1. Plant and environment: Principles of environment, atmosphere, light, temperature, water, soil and biota.
2. Morphological, anatomical and physiological responses of plants to water (Hydrophytes and Xerophytes): temperature (thermoperiodism and vernalization): light (heliophytes and sciophytes).
3. Population: Growth curves, ecotype and ecads.
4. Definition of community; Structure and attributes of community: frequency, density, cover, life forms and biological spectrum; ecological succession.
5. Ecosystem concept, energy flow, food chain, food web and ecological pyramids.
6. Biogeochemical cycles with emphasis on carbon and nitrogen cycles.
7. Basic concept of Biodiversity and its conservation.
8. Preliminary idea of environmental pollution-air, water, soil, noise and radioactive pollution.

Bot. 602: PAPER -XVII BIOSTATISTICS

Max. Marks: 60

1. Introduction, definition, scope and importance of statistics,
2. Sampling: aim, simple random sampling, stratified random sampling, systematic sampling.
3. Measures of central tendency, mean, median and mode.
4. Classification, tabulation and graphic presentation of data.
5. Measures of dispersion-range, variance, standard deviation, standard error.
6. Correlation: correlation coefficient.
7. Chi-square (χ^2) test
8. Modern approach of statistical packages.

Bot. 603: PAPER-XVIII BIOTECHNOLOGY

Max. Marks: 60

1. Introduction to Biotechnology: Role in modern life, history and ethical issues connected with Biotechnology.
2. Genetic Engineering: Enzymes and vectors involved in genetic engineering, Recombinant DNA technology, tools and techniques of genetic engineering.
3. Plant tissue culture technique: Basic requirements of Tissue culture Laboratory, different types of media and their composition, basic technique of tissue culture, types of culture on the basis of explants, collection and storage of germplasm (Cryopreservation), PTC with reference to somaclonal variations, synthetic seeds, somatic hybridization and hairy root culture.
4. Industrial Biotechnology: With reference to drinks and beverages.
5. Agricultural Biotechnology: Crop (yield /quality) improvement, bio fertilizers and biological control.
6. Biotechnology with regard to microorganisms: Mycotoxin based health hazards and their control, single cell protein.

Bot. 604: Lab course (Practical)

Max. Marks: 60

Ecology

To calculate the frequency, abundance, density and A/F ratio of the given data.
To calculate the relative frequency, relative density, relative abundance and IVI of the given data by quadrat method and by developing artificial vegetation plots.
To determine the leaf area of the given leaves.
To calculate net primary productivity of a grass land
To Study the soil pH and soil moisture content.
To develop population structure diagram

Biostatistics

A. To calculate the mean, median and mode by analysing the given data of individual, discrete and continuous series.
To calculate the standard error and deviation
To calculate the correlation coefficient
To calculate the chi square value
Representation of data by making graphs and diagrams etc.

B. Comment upon given graphs, diagrams etc.

Biotechnology

A. To study the working of following instruments: PCR, Laminar air flow chamber, autoclave, incubator, and centrifuge.

To study the Gram positive and Gram negative bacteria in root nodule, curd and soil.

Culture media preparation.

Sterilization techniques including surface sterilization of explants.

Study the use of *Azolla* as biofertilizer

B. Comment upon the given photographs, specimens etc.

Suggested reading

Dubey, R.C. Advanced Biotechnology. S. Chand & Sons, New Delhi

Pandey, B.P. Economic Botany. S. Chand & Sons, New Delhi

Shukla, R.S. and Chandel, P.S. Biostatistics. S. Chand & Sons, New Delhi.

Sample Paper for Lab Course

Department of Botany, D.S.B Campus, K.U. Nainital

SEMESTER - VI

Max. Marks: 60 Time: 4 h Date: ...../…../….

1.	Describe economic importance of given plants	9
2.	Calculate the data given for statistical analysis	9
3.	Describe the method for media preparation in detail as per slip	5
4.	Perform the given biotechnology experiment	4
5.	Comment upon the spot nos. 1-6	12
6.	Viva- voce	6
7.	Internal Assessment	15