

DEPARTMENT OF BOTANY

UNIVERSITY OF KASHMIR, SRINAGAR

The revised curriculum to be adopted for B. Sc 1st and 2nd Semester from the academic session 2015 and subsequently for B. Sc 3rd and 4th Semester from the academic session 2016 and B. Sc 5th and 6th Semester 2017.

Course Structure: The course will comprise of 6 papers, one paper in each semester to be named as Bot-01 to Bot-06. Each paper will be of 100 marks, 20 for internal assessment and 80 for external examination. For each semester there will be one practical course to be named as L-01 to L-06 worth 50 marks, out of which 25 will be for internal assessment and 25 for external examination. Students will have to submit their practical note books as well as a plant collection herbarium at the time of practical examination..

Botanical Trips: To make on-field observations and impart on-site training in the subject botany, the colleges will ensure that a minimum of one field trip is organized for each class during the academic session to acquaint the students with the flora of the region and also to collect and prepare 10 plant specimens following standard herbarium techniques. The students will, however, avoid collection of rare and threatened plant species.

The revised curriculum is to be adopted for B. Sc 1st Semester from academic session 2015

- i. The question paper shall be of 2 1/2hrs duration
- ii. Each subject shall have internal as well as external components of examination.

Internal Examination at College Level

This test shall be called as Internal Assessment Test, it shall consist of two components:

- a. **Attendance**
- b. **Mid term test/assignment/project work**

The distribution of marks per semester is reflected in the table as under:

Theory (External)	80
Attendance (Internal)	5 marks: wherein distribution will be as 2 mark (75-80%) 3 marks (80-90%) 5 marks (90-100%)
Theory (Mid term test/ project work/assignment- Internal)	15 marks
Total (Internal Assessment)	5+15=20
G. Total (Internal+ External)	100

- i. Number of units to be covered under Internal Assessment Test shall be left to college concerned.
- ii. Composition of marks among three components of part (b) i.e. midterm examination/project work/assignment shall be decided by the college.
- iii. Student must have a minimum 75% of attendance in each semester.
- iv. Student has to secure minimum of 36% percent marks in midterm test/project work/assignment. If college offers all the three, the 36% pass percentage in each component shall be applicable.

External Examination

- i. For external examination the syllabus of each course will be divided into four equal units.
- ii. Examination will be conducted by the Controller of Examinations, University of Kashmir at the end of each semester
- iii. There will be two types of questions in the question paper i.e. medium and long answer type questions comprising of Section A and Section B, respectively
- iv. In Section "A" there will be four medium type questions, one question with internal choice from each unit. All the four questions will be compulsory.
- v. There will be four long answer type questions in Section "B", one from each unit and the student will be required to attempt any two questions.
- vi. The distribution of marks is reflected in the table as under:-

Theory paper carrying 80 marks
<p>Section A 4 medium answer type questions each carrying 12 marks (4x12) =48</p> <p>Section B 2 long answer type questions each carrying 16 marks (2x16) =32</p> <p style="text-align: center;"><u>Theory component</u></p> <p>Internal examination = 20 marks; Minimum pass marks=8 External examination = 80 marks; Minimum pass marks=32 Total (20+80) =100 marks</p> <p style="text-align: center;"><u>Practical Component</u></p> <p>Internal Assessment: 25 marks; Minimum pass marks = 9 External Examination: 25 marks; Minimum pass marks = 9</p>

- vi. Pass percentage shall remain unchanged i.e 36% for both internal and external examinations.
- vi. Re-evaluation scheme as provided under the existing statute shall ' remain unchanged. Eligibility shall be determined on the basis of 75 marks and 100 marks in case of theory paper carrying an aggregate 100 marks and 150 marks respectively. Internal Assessment shall not be subject to any re-evaluation. The single paper in no way shall affect the present eligibility norms for promotion to the next class.

Private candidates

Private candidates shall be subject to same external examination pattern as is applicable to the candidates in regular mode. In the case of regular candidates the internal assessment marks shall be added with the marks secured in the external examination. Since, there won't be any internal assessment for the private candidates the marks of the candidates will be raised strictly in proportion to the percentage of marks obtained in the external examination.

Bot-01 (B. Sc. 1st Semester)

UNIT: I

- i. **Cell structure:** Salient features of Prokaryotic and Eukaryotic cells.
- ii. **The cell envelope:** Plant cell wall-ultrastructure; Plasma membrane: Fluid Mosaic Organization (model)
- iii. **Non-membrane organelle:** Structure and function of Ribosomes
- iv. **Single membrane organelles:** Structure and function of Endoplasmic reticulum and Golgi bodies
- v. **Double membrane organelles:** Mitochondria and Plastids
- vi. **Nucleus:** Ultrastructure, nuclear envelope, nucleolus; and functions

UNIT: II

- i. **Chromosome organization:** Nucleosome organization, Morphology of chromosome; chemical composition, characteristics and role of centromere and telomere; giant chromosomes (polytene and lampbrush chromosomes)
- ii. **Genetic material:** Structure of DNA (Watson & Crick model), DNA replication (Semi-conservative), DNA as genetic material (experimental proof)
- iii. **Chromosome alterations:** Origin and meiotic behavior of deletions, duplications, translocations and inversions; variations in chromosome number, aneuploidy and polyploidy (types, origin and significance).
- iv. **Cell cycle:** Mitosis and Meiosis – mechanism and significance

UNIT: III

- i. **RNA:** Structure, types and properties of RNA (mRNA, tRNA, rRNA), properties of genetic code, mechanism of transcription and translation (prokaryotes).
- ii. **Regulation of gene expression in prokaryotes** (Lac operon).
- iii. **Gene mutations:** Concept and types of point mutations, frame shift mutations – concept and significance.

UNIT: IV

- i. **Mendelism;** Symbols and terminology, Mendel's laws of inheritance, Monohybrid, dihybrid and test crosses (suitable examples),
- ii. **Extensions of and deviations from Mendelian Principles:** (allelic and non-allelic interactions) – incomplete dominance, Co-dominance, epistasis, complementary genes, duplicate genes and multiple alleles (with suitable examples in all).
- iii. **Linkage and crossing over:** Coupling and repulsion hypothesis, chromosome theory of linkage, mechanism of crossing over.

Laboratory Exercises: L – 01

- i. To study cell structure from onion leaf peels; demonstration of staining and mounting methods.
- ii. Comparative study of cell structure in onion cells, *Hydrilla* and *Spirogyra*.
- iii. Study of cyclosis in *Hydrilla* staminal cells.

- iv. Study of plastids to examine pigment distribution in plants (*Lycopersicon* and *Capsicum*).
- v. Examination of electron micrographs of eukaryotic cells with special reference to organelles.
- vi. Study of electron micrographs of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organization.
- vii. Examination of various stages of mitosis and meiosis using available plant material.
- viii. Demonstration of karyotypes from prepared slides and photomicrographs
- ix. Cytological examination of special types of chromosomes: bar bodies, lampbrush and polytene chromosomes from prepared slides.
- x. Working out the laws of inheritance (3:1; 9:3:3:1) and gene interaction (13:3; 9:7) using seed mixtures.

Suggested Readings:

- Gupta, P. K. 2008. Cytology, Genetics and Evolution. Rastogi Publications, Meerut.
- Gupta, P. K. 2009. Genetics. Rastogi Publications, Meerut.
- Gupta, P. K. 2007. Cytogenetics. Rastogi Publications, Meerut.
- Starr, C., Taggart, R., Evers, C. and Starr, L. 2008. Cell Biology and Genetics. Brooks, Cole.
- Cooper G.M and Hausman R.E. 2007. The Cell A Molecular Approach Sinauer associate, Inc, Sunderland (USA).
- De Robertis and De Robertis. 2005. Cell and Molecular Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].
- Hartl, D.L. and Jones, E.W. 1998. Genetics: Principles and Analysis (4th edition). Jones & Bartlett Publishers, Massachusetts, USA.
- Strickberger 2005. Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.

Bot-02 (B. Sc. 2nd Semester)

UNIT: I

- i. **Viruses:** Structure with special reference to TMV, T-2 phages, lytic and lysogenic cycles; general account of mycoplasma, viroids and prions.
- ii. **Bacteria and Cyanobacteria:** Bacteria – overview of structure, Gram positive and Gram negative bacteria; general characters of cyanobacteria with special reference to *Nostoc*.
- iii. **Economic aspect:** Microbes in industrial production (with emphasis on dairy industry, production of organic acids, enzymes and antibiotics).

UNIT: II

- i. **Fungi:** General characteristics, classification proposed by Alexopoulos and Mims (1973); structure and life cycle of representative types shown against each group:
- | | |
|-----------------------|---------------------|
| Oomycetes | <i>Phytophthora</i> |
| Ascomycetes | <i>Morchella</i> |
| Basidiomycetes | <i>Agaricus</i> |
| Deuteromycetes | <i>Alternaria</i> |
- ii. **Plant Pathology:** General account of Pathogenicity; Symptoms, etiology and management of black stem rust of wheat, apple scab.
- iii. **Lichens:** General characters and types.

UNIT: III

- i. **Algae:** General characteristics; Range of thallus structure; criteria for algal classification; Round's (1965) system of classification; Structure and life cycle of representative types shown against each group:
- | | |
|----------------------|------------------------|
| Chlorophyceae | <i>Volvox</i> |
| Xanthophyceae | <i>Vaucheria</i> |
| Rhodophyceae | <i>Batrachospermum</i> |
| Phaeophyceae | <i>Ectocarpus</i> |
- ii. Economic importance of algae.

UNIT: IV

- i. **Bryophytes:** General characteristics; Proskauer's (1957) system of classification..
- ii. Structure and life cycle of representative types shown against each group (Development excluded):
- | | |
|-------------------------|--------------------|
| Hepaticopsida | <i>Marchantia</i> |
| Anthocerotopsida | <i>Anthoceros</i> |
| Bryopsida | <i>Polytrichum</i> |
- iii. Evolution of sporophyte; apogamy and apospory; alternation of generation; economic importance of bryophytes.

Laboratory Exercises (L - 02):

- i. Study of vegetative and reproductive structures of *Chlorella*, *Volvox*, *Vaucheria*, *Ectocarpus*, *Batrachospermum*.
- ii. Study the mycelium and fruiting bodies of *Agaricus*, *Phytophthora*, *Alternaria* and *Morchella*.
- iii. Study of morphology, reproductive structures and anatomy of *Marchantia*, *Anthoceros* and *Polytrichum*.

- iv. Observation of disease symptoms and study of the pathogen in Wheat rust, powdery mildews and Apple scab.
- v. Study of bacteria from curd and sewage water using crystal violet stain.
- vi. Study of crustose, foliose and fruticose lichen thalli.

Suggested Readings:

- Alexopoulos, C.J. and Mims, C.W. 2002.: Introductory Mycology. 5th edition. John Wiley and Sons, New York.
- Kumar, H.D. 1999. Introductory Phycology. East-west Press Ltd., New Delhi.
- Sambamurty, A. V. S. S. 2005. A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I.K. International Pvt. Limited.
- Sharma, P.D. 2003. Microbiology. Rastogi Publications, Meerut, India.
- Shaw, A. J and Goffinet, B. 2000. Bryophyte Biology. Cambridge University Press.
- Singh, R. S. 1990. Plant Diseases. Oxford and IBH Publishers, New Delhi.
- Singh, R.S. 1990. Principles of Plant Pathology. Oxford and IBH Publishers, New Delhi
- Singh, V., Pande, P. C. and Jain, D. K. 2010. Diversity of Microbes and Cryptogams. Rastogi Publications, Meerut, India.
- Vanderpoorten, A. and Goffinet, B. 2009. Introduction to Bryophytes. Cambridge University Press.
- Vashishta, B.R., Sinha, A.K. and Singh, V.P. 2008. Botany for Degree Students-Algae. S. Chand and Company Pvt. Ltd., New Delhi.
- Webster, John. 2007. Introduction to Fungi . Cambridge University Press, London.

Bot-03 (B. Sc. 3rd Semester)

UNIT: I

- i. **Pteridophytes:** General characteristics, classification of pteridophytes (Smith et al., 2006) structure and life cycle of representative types shown against each group (anatomy and development excluded):

Psilopsida	<i>Psilotum</i>
Sphenopsida	<i>Equisetum</i>
Lycopsida	<i>Lycopodium</i>
Filicopsida	<i>Dryopteris</i>

- ii. Heterospory and origin of seed habit; stellar systems in pteridophytes

UNIT: II

- i. **Gymnosperms:** General characters, Sporne's (1965) system of classification.
- ii. Morphology, anatomy and reproduction in *Cycas*, *Pinus* and *Ephedra*.
- iii. Fossilization , Geological Time scale
- iv. **Fossil gymnosperms:** *Caytonia*, *Williamsonia*.

UNIT: III

- i. **Angiosperm taxonomy:** Scope of taxonomy; fundamental components of taxonomy.
- ii. **Angiosperm evolution and classification:** Diversity and phylogeny of angiosperms; salient features of classification systems proposed by Bentham and Hooker, Takhtajan, and Angiosperm Phylogeny Group (APG).
- iii. **Botanical nomenclature:** Principles of International Code of Botanical Nomenclature (ICBN); taxonomic hierarchy; type concept.

UNIT: V

- i. **Plant identification:** Methods of plant identification, types of identification keys; role of cytology, anatomy and embryology in plant taxonomy (with suitable examples in all).
- ii. **Taxonomic institutions:** Methods of herbaria; role of botanical gardens
- iii. **Diversity of Angiosperms:** Morphology and economic importance of families- Ranunculaceae, Brassicaceae, Fabaceae, Apiaceae; Rosaceae, Asteraceae, Solanaceae, Lamiaceae; Liliaceae, and Poaceae.

Laboratory Exercises (L - 03):

- i. Study of morphology, reproductive structures and anatomy of *Lycopodium*, *Equistum*, *Marsilea* and *Dryopteris*.
- ii. Study of anatomy of root, stem, leaf and reproductive structures through prepared slides and hand sections of *Cycas*, *Pinus* and *Ephedra*.
- iii. Preparation of identification keys from the available specimens.
- iv. Taxonomic description of the following families:
Ranunculaceae (*Ranunculus/ Delphinium*); Brassicaceae (*Brassica/Iberis*); Malvaceae (*Malva/Althea*); Fabaceae (*Trifolium/Lathyrus*); Rosaceae (*Rosa/Potentilla*); Asteraceae (*Helianthus/Taraxacum*); Solanaceae (*Solanum/Datura*); Apiaceae (*Daucus/Scandix*); Lamiaceae (*Mentha/Nepeta/Salvia*); Liliaceae (*Hemerocallis/Tulipa*); Poaceae (*Avena/Poa*); and Iridaceae (*Iris/Gladiolus*).

Suggested Readings:

- Bhatnagar, S.P. 1996. Gymnosperms. New Age International Publishers Ltd.-New Delhi.
- Judd, S., Walter et al. 2008. Plant Systematics: A Phylogenetic Approach. Sinauer Associates, Inc. Sunderland, USA.
- Rashid, A. 1996. An Introduction to Pteridophyta: Diversity and Differentiation. Vikas Publishing house, New Delhi.
- Sharma, B. D. 1994. Gymnosperms: Morphology, Systematics, Reproductive Biology. Oxford and IBH Publishers, New Delhi
- Simpson, Michael G. 2006. Plant Systematics. Elsevier, California, USA.
- Singh, Gurcharan 2012. Plant Systematics: Theory and Practice. Oxford and IBH Publishers, New Delhi
- Singh, V., Pande, P. C. and Jain, D.K. 2010. Diversity and Systematics of Seed Plants. Rastogi Publications, Meerut, India.

- Sporne, K. R. 1974. The morphology of gymnosperms(2nd Ed) Hutchinson Univ. Lib, London.
- Stewart, W. N. 1983. Palaeobotany and the Evolution of Plants. Cambridge University, Press, Cambridge.
- Vashishta, P.C. 1996. Botany For Degree Gymnosperm. S. Chand & Company, New Delhi.

Bot-04 (B. Sc. 4th Semester)

UNIT: I

- i. **Tissue systems:** classification, distribution and functions
- ii. **The root system:** Organization of the root apical meristem; differentiation of primary and secondary tissues and their roles; structural modifications for storage, support, respiration and reproduction; root-microbe interaction with special reference to mycorrhiza.
- iii. **The shoot system:** The shoot apical meristem and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons

UNIT: II

- i. Cambium and its functions; formation of secondary xylem; general account of wood structure; formation of growth rings, sapwood and heart wood; secondary phloem-structure and function; periderm; anomalous secondary growth in *Dracena*
- ii. **Leaf:** Origin, anatomy of monocotyledon (Wheat, Maize) and dicotyledon (Waterlily and Sunflower) leaf.
- iii. **Leaf appendages:** Structure and function of hairs, trichomes, thorns etc.
- iv. **Stomata:** types and their characteristics.

UNIT: III

- i. **Flower:** basic structure of flower; flower as a modified shoot, structure of typical flower; functions and structure of anther and pistil, development of the male and female gametophytes; types of pollination, attractants and rewards for pollinators; pollen-pistil interaction, self incompatibility; double fertilization

UNIT: IV

- i. **Formation of seed:** development of embryo and endosperm (in *Capsella* and *Poa*); fruit development
- ii. **Seed:** Seed appendages and dispersal strategies.
- iii. **Apomixis:** causes, concerns and commercial potential
- iv. **Polyembryony:** general account
- v. **Vegetative reproduction:** Vegetative propagules and vegetative propagation by different methods; economic aspects.

Laboratory Exercises (L-04):

- i. Study of a commonly occurring dicotyledonous plant e.g *Solanum nigrum* to understand the body plan and modular type of growth
- ii. Growth forms exhibited by flowering plants (herbs, undershrubs, shrubs, climbers creepers, twinnings, trees)
- iii. L.S. of shoot tip to study the cyto-histological zonation and origin of leaf primordia from prepared slides
- iv. Microscopic study of wood in T.S / T.L.S/ R.L.S from prepared slides of *Pinus* and *Populus*.
- v. Study of anatomy and secondary growth in monocots (*Dracaena*) and dicots using hand sections and prepared slides.
- vi. Study of diversity in leaf shape, size, thickness, surface features and internal structure (Maize and Sunflower leaves)
- vii. Study of anatomy of root of monocots and dicots (Maize and Sunflower roots)
- viii. Study of different types of flowers in relation to sexuality and adaptation to pollination mechanisms (Maize, *Cannabis* and *Ranunculus*)
- ix. Study of the structure of anther, micro-sporogenesis , pollen grains and pollen viability through squash technique (any available material)
- x. Study of the structure of ovule and embryo sac from prepared slides
- xi. Study of nuclear and cellular endosperm (Coconut, cucurbits)
- xii. Simple experiments to show vegetative propagation (cutting, layering and grafting)

Suggested Readings:

- Singh, V., Pande, P. C. and Jain, D.K. 2010. Structure, Development and Reproduction in Angiosperms. Rastogi Publications, Meerut, India.
- Bhojwani, S.S. and Bhatnagar, S.P. 2009. The Embryology of Angiosperms. Vikas Publishing House Pvt. Ltd.
- Maheshwari, P. 1950. An Introduction to the Embryology of Angiosperms. McGrawHill, New York.
- Pandey, A.K. 1997. Introduction to Embryology of Angiosperms. CBS Publishers and Distributors, New Delhi.
- Pandey, S.N. and Chadha. 1996. Embryology. Vikas Publishing house, New Delhi.
- Cutler, D.F., Botha, T. and Stevenson, D.W. 2008. Plant anatomy: An applied approach. Wiley-Blackwell Publishers.
- Evert, R.F. and Esau, K. 2006. Esau's Plant Anatomy. John Wiley and Sons.
- Pandey, B.P. (2001). Plant Anatomy. S. Chand and Company, New Delhi.

Bot-05 (B. Sc. 5th Semester)

UNIT: I

- i. **Plant water relations:** Importance of water to plant life, physical properties of water; diffusion, bulkflow, osmosis (thermodynamics concept); absorption, transport and transpiration; physiology of stomata.
- ii. **Mineral nutrition:** Essential macro- and micro-nutrient elements and their role; ion uptake; mineral deficiency and toxicity symptoms.
- iii. **Transport of organic substances:** evidences and mechanism of phloem transport; source-sink relationship.
- iv. **Proteins:** Classification of proteins based on structure and solubility.
- v. **Basics of enzymology:** Discovery and nomenclature; characteristics of enzymes; concept of holoenzyme, apoenzyme, coenzyme and cofactors; mechanism of enzyme action.

UNIT: II

- i. **Lipids:** Biological functions of triacylglycerols.
- ii. **Nitrogen metabolism:** Biology of nitrogen fixation; ammonium assimilation.
- iii. **Photosynthesis:** Photosynthetic pigments; absorption & action spectra, enhancement effect; concept of two photosystems; Z-scheme; photophosphorylation; C3, C4 and CAM pathways; photorespiration.
- iv. **Respiration:** ATP- the biological energy currency; aerobic and anaerobic respiration; Glycolysis, Krebs cycle; electron transport system, oxidative phosphorylation (chemi-osmotic mechanism).

UNIT: III

- i. **Growth and development:** Differentiation and morphogenesis (elementary idea); phases of growth, concept of phasic development; kinetics of growth.
- ii. **Physiology of flowering:** Photoperiodism; vernalization.
- iii. **Plant movements:** Tropic and nastic movements.
- iv. **Plant hormones:** History of discovery and physiological effects of auxins, gibberellins, cytokinins, abscisic acid and ethylene.

UNIT: IV

- i. **Biotechnology:** Basic aspects of plant tissue culture, cellular totipotency, differentiation and morphogenesis, applications of plant tissue culture (conservation, agriculture, industry).
- ii. **Genetic engineering:** Tools and techniques of recombinant DNA technology; cloning vectors (plasmids); construction of recombinant DNA, applications of genetic engineering.
- iii. **Polymerase chain reaction-** principle and applications; transgenic - concept and applications.

Laboratory Exercises (L-05):

- i. To study permeability of plasma membrane using different concentrations of organic solvents.
- ii. To study effect of temperature on permeability of plasma membrane.
- iii. To study the enzyme activity of catalase and peroxidase as influenced by pH and temperature.

- iv. Determining the osmotic potential of vacuolar sap by plasmolytic method
- v. Determining the water potential of any tuber.
- vi. Separation of chloroplast pigments by solvent method.
- vii. Demonstration of chromatographic separation of chloroplast pigments.
- viii. Comparison of the rate of respiration of various plants.

Suggested Readings:

- Bhojwani, S.S. and Razdan, M.K. 1983. Plant Tissue Culture: Theory and Practice: Developments in Crop Science. Elsevier, Amsterdam.
- Hopkins, W.G. and Huner, N.P. 2004. Introduction to Plant Physiology. John Wiley & Sons, Inc. USA.
- Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology. 4th Edition. Wadsworth Publishing Company, Inc. California, USA.
- Shekhawat, M.S. and Vikrant. 2011. Plant Biotechnology. MJP Publishers, Chennai.
- Smith, R.H. 2000. Plant Tissue Culture: Techniques and Experiments. Academic Press, Tokoyo.

Bot-06 (B. Sc. 6th Semester)

UNIT: I

- i. **Plants and environment:** Atmosphere (gaseous composition and layering of atmosphere); water (reservoirs and water cycle); soil (development, soil profile; basic concept of climate change and its impact on plants).
- ii. **Ecological adaptations:** Morphological, anatomical and physiological adaptation of plants to water (hydrophytes and xerophytes); chilling and light.
- iii. **Forest types of India:** Characteristics of various types as per Champion and Seth's Classification (1968).

UNIT: II

- i. **Population ecology:** Primary and secondary characters of population; outline of intra- and interspecific population interactions with emphasis on intra- and inter-specific competition.
- ii. **Community ecology:** General characteristics of community; community development through ecological succession (Hydrosere and Xerosere).
- iii. **Ecosystems:** Structure, abiotic and biotic components, food chains, food webs, ecological pyramids, energy flow, biogeochemical cycles of carbon, nitrogen and sulphur.

UNIT: III

- i. **Biogeographic regions of India:** status; national and global concerns
- ii. **Vegetation types of India:** Forests and grasslands
- iii. **Remote sensing and GIS:** role in environmental management

- iv. **Ex situ and In situ conservation:** strategies for plant resource maintenance; concept of rare, endangered and threatened (RET) plants
- v. **Archaeobotany and Ethnobotany:** Plant use through ages; ethnobotany and its scope.

UNIT: IV

- i. **Food Plants:** Morphology, cultivation and economic importance of Rice and Potato
- ii. **Fibres:** Morphology, cultivation, extraction and economic importance of jute.
- iii. **Vegetable oils:** Fixed and volatile oils; morphology, cultivation, extraction and economic importance of mustard.
- v. **Wood:** General account of hard and soft woods.
- vi. **Spices and Condiments:** Source, part used and uses with particular reference to spices and condiments in Kashmir.
- vii. **Medicinal and Aromatic Plants (MAPs):** Morphology and uses of *Podophyllum hexandrum* and *Crocus sativus*.
- viii. **Beverages:** Morphology, cultivation, and processing of tea.

Laboratory Exercises (L-06):

- i. To determine minimum number of quadrats required for reliable estimate of density in a grassland.
- ii. To study frequency, and importance value index of species in a grassland.
- iii. To estimate bulk density and porosity of grassland and forest soils.
- iv. To determine moisture content and water holding capacity of grassland and forest soil.
- v. To estimate transparency, pH and temperature of different water bodies.
- vi. To study the morphology and food reserves of food plants such as rice, wheat, maize, potato through chemical tests.
- vii. To demonstrate the distribution of surface (cotton) and bast fibres (hemp).
- viii. Study the distribution of oil bodies in some oil-containing seeds (mustard, linum, coconut, groundnut, walnut etc)
- ix. Examine morphologically some common spices.
- x. To study different types of archaeological materials to assess their role tracing origin of crops

Suggested Readings: .

- Chapman, J.L. and Reiss, M.J. 1997. Ecology: principles and Applications. Cambridge University Press, London.
- Colinvaux, P. 1993. Ecology. John Wiley, New York.
- Dash, M.C. 1993. Fundamental of Ecology. 1993. Tata McGraw Hill Publishing Company, Ltd.
- Gonsalves, J. 2007. Economic Botany and Ethnobotany. Vedam Books.
- Mackenzie, A., Ball, A.S. and Virdee, S.R. 1999. Instant Notes in Ecology. Viva Books Private Ltd. New Delhi.

- Maiti, R.K. & Singh, Ved Pal. 2006. An Introduction to Modern Economic Botany. Eastern Book Corporation, India.
- Molles, M.C. Jr. 1999. Ecology: Concepts and Applications. WCB/McGraw-Hill Company, London.
- Nehra, S. 2007. Economic Botany. Vedam Books.
- Odum, E.P. and Barrett, G.W. 2004. Fundamentals of Ecology. Brooks, Cole.
- Pooja, S. N. 2010. Economic Botany. Discovery Publishing House, New Delhi.
- Simpson, B. and Ogorzaly, M. 2000. Economic Botany: Plants in our World. McGraw-Hill Science.
- Stiling, P. 2001. Ecology: Theories and Applications. Printice-Hall Inc.
- Wikens, G. E 2004. Economic Botany- Principles and Practices. Kluwer Publishers, Netherlands.
