Department of Botany

B.Sc. BOTANY

Four-Year Undergraduate Program

FYUP (Eight-Semester Course) As per NEP

Course Contents &Syllabus

(For students enrolled in 2025-26 academic session)

Hemvati Nandan Bahuguna Garhwal University

(A Central University)

Srinagar Garhwal-246174 (Uttarakhand)

Course Structure and Credit Allocation

(For Practical-based Subjects)

First Year (NHEQF Level-4.5)									
Course Category	**Semester-I**					**Semester-II**			
	Subject	**Paper**	**Credits**			**Subject**	**Paper**	**Credits**	
			T	**P**				**T**	**P**
Discipline Specific Core	DSC Subject-I (Major)	Microbiology and Plant Pathology	2	2		DSC Subject-I (Major)	Diversity of Cryptogams	2	2
	DSC Subject-II (Minor)	General Microbiology and Plant Pathology	2	2		DSC Subject-II (Minor)	Study of Cryptogams	2	2
MD/ID Subject-1	MD/ID-I	Microbial Techniques	2	2		MD/ID-II	Herbarium Methodology and Plant Nomenclature	2	2
MD/ID Subject-2	MD/ID-I	-	2	2		MD/ID-II	-	2	2
SEC/ AEC	Field work/SEC/ Communication Skills **Or** AMSC/Field Work/SEC	Communication Skills	2	--		AMSC/Field Work/SEC **Or** Field work/ SEC/ Communication Skills	AMSC*	2	--
VAC	Understanding and Connecting with Environment **Or** Life Skills & Personality development	Understanding and Connecting with Environment	2	--		Understanding and Connecting with Environment **Or** Life Skills & Personality Development	Life Skills & Personality Development	2	--
Total			12	8				12	8
NHEQF Level-4.5	Student on exit after successfully completing first year (i.e., securing minimum required 40 credits + 4 Credits in one Vocational Course/Skill-Enhancement Course of 4 credits) will be awarded "Undergraduate Certificate" of one year, in related field/discipline/subject.								

- The student may opt for any one course from Field Work/ Skill Enhancement Course (SEC)/ Communication Skills in one semester, and any one course from Additional Multidisciplinary Skill Course (AMSC)/ Field Work/ Skill Enhancement Course (SEC) in the other semester.
- Field Work/Discipline Specific Skill Enhancement Course (SEC): Student may opt SEC/Field Work related to any discipline subject opted by her/him as a DSC in the first year.
- **Field Work**: In addition to providing students with practical, experience-based learning, field work aims to expose them to real-world socio-economic and societal challenges, allowing them to bridge the gap between theory and practice and develop effective solutions to real-life problems.
- ***AMSC**: Additional Multidisciplinary Skill Course (is offered as SEC)
  Following courses are offered under AMSC, University may add new courses under AMSC in future:
  1. Plant Nursery Development and Management
  2. Basic Yoga Practices
  3. Physical Education and Sports Management
  4. Regional Folklores and their Cultural Context
  5. Indian Traditional Music
  6. Tour and Travel Operations
- **Communication Skills (AEC):** 'Communication Skills' course will be offered in Hindi, English and Sanskrit Languages, student may opt any one language for studying the course
- **Life Skill & Personality Development (VAC)** Compulsory Course [Common University Syllabus]
- **Understanding and Connecting with Environment (VAC)** Compulsory Course [Common University Syllabus]

Note: Student can opt Botany subject as either Discipline Specific Major or Discipline Specific Minor or as Multidisciplinary/Interdisciplinary (MD/ID) Subject-1 or 2.

FOUR-YEAR BACHELOR'S DEGREE PROGRAMME WITH HONOURS/RESEARCH
(B.Sc. Botany)
SYLLABUS (*w.e.f.* 2025-26)

B. Sc. First Year (I Semester)

MAJOR/CORE BOTANY

(Theory: 2 Credits; Practical: 2Credits)

SOLS/BOT/DSC (Major)-1 Microbiology and Plant Pathology	**2 Credits [30 hours]**

Unit I **[8 hours]**

History and scope of Microbiology

General account, distribution and classification of microorganisms.

Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance

Unit II **[8 hours]**

Introduction to the *Archaea*, Archaeal Cell Wall, Archaeal Lipid and Membranes, Major Archaeal Groups

Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

Unit III **[7 hours]**

Microalgae- Distribution, Classification, Ultrastructure of algal cell, nutrition, reproduction, and economic importance.

Fungi-General characteristics, nutrition, Cell wall composition, ultrastructure of Fungal Cell, life cycle, Slime molds and water Molds, Economic importance of Fungi.

Unit IV **[7 hours]**

History of Plant Pathology. Modes of Infection and general symptoms, physiology of parasitism, defense mechanism in plants, role of environment in disease development, Disease resistance in plants.

Causal organisms, symptoms, disease cycle and control of the following plant diseases: Citrus canker, TMV, wilt of tomato, bacterial blight of rice, mosaic of sugarcane and little leaf of brinjal. Late blight of potato, Wilt of Arahar, Loose smut of Wheat, Covered smut of Barley, Green ear disease of bajra, downy mildew of crucifers, rusts of pea and linseed, smut of bajra.

Suggested Readings

1. Brock Biology of Microorganisms, 13th edition (2012)
2. Van Den Hoek et al. Algae: An Introduction to Phycology, Cambridge University Press, Cambridge (1997)
3. Webster, J. 1985. Introduction to Fungi. Cambridge University Press.
4. Stainier, R.Y. General Microbiology 5th edition (2009) Mc Millan Press Ltd., Hound Mills
5. Talaro, K.P., Chess, B., 2011. Foundation in Microbiology. 8th edition. McGraw-Hill
6. Willey JM, Sherwood L, Woolverton CJ (2013) Prescott's Microbiology, 9th edition, McGraw-Hill, New York
7. Agrios, G.N., 1988. Plant Pathology, Academic Press, London.
8. Lucas, John, A., 1998. Plant Pathology and Plant Pathogens, Wiley-Blackwell, CRC Press.
9. Singh, R.S. Plant diseases, 9th edition (2009). Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi

MINOR/CORE BOTANY
(Theory: 2Credits; Practical: 2Credits)
[For students with Major Subjects other than BOTANY]

SOLS/BOT/DSC (Minor)-1 General Microbiology and Plant Pathology **2 Credits [30 Hours]**

Unit I **[8 hours]**

History and scope of Microbiology

General account, distribution and classification of microorganisms.

Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance

Unit II **[8 hours]**

Introduction to the *Archaea*, Archaeal Cell Wall, Archaeal Lipid and Membranes, Major Archaeal Groups

Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

Unit III **[7 hours]**

Microalgae- Distribution, Classification, Ultrastructure of algal cell, nutrition, reproduction, and economic importance.

Fungi-General characteristics, nutrition, Cell wall composition, ultrastructure of Fungal Cell, life cycle, Slime molds and water Molds, Economic importance of Fungi.

Unit IV **[7 hours]**

History of Plant Pathology. Modes of Infection and general symptoms, physiology of parasitism, defense mechanism in plants, role of environment in disease development, Disease resistance in plants.

Causal organisms, symptoms, disease cycle and control of the following plant diseases: Citrus canker, TMV, wilt of tomato, bacterial blight of rice, mosaic of sugarcane and little leaf of brinjal. Late blight of potato, Wilt of Arahar, Loose smut of Wheat, Covered smut of Barley, Green ear disease of bajra, downy mildew of crucifers, rusts of pea and linseed, smut of bajra.

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1. Brock Biology of Microorganisms, 13th edition (2012)
2. Van Den Hoek et al. Algae: An Introduction to Phycology, Cambridge University Press, Cambridge (1997)
3. Webster, J. 1985. Introduction to Fungi. Cambridge University Press.
4. Stainier, R.Y. General Microbiology 5th edition (2009) Mc Millan Press Ltd., Hound Mills
5. Talaro, K.P., Chess, B., 2011. Foundation in Microbiology. 8th edition. McGraw-Hill
6. Willey JM, Sherwood L, Woolverton CJ (2013) Prescott's Microbiology, 9th edition, McGraw-Hill, New York
7. Agrios, G.N., 1988. Plant Pathology, Academic Press, London.
8. Lucas, John, A., 1998. Plant Pathology and Plant Pathogens, Wiley-Blackwell, CRC Press.
9. Singh, R.S. Plant diseases, 9th edition (2009). Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi

SOLS/BOT/DSC (Major)-1(P) Microbiology and Plant Pathology (Practical)	**2 Credits**
SOLS/BOT/DSC (Minor)-1 (P) General Microbiology and Plant Pathology (Practical)	**2 Credits**

1. Laboratory safety and good laboratory practices
2. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
3. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
4. Staining method of microorganisms
5. Study of *Nostoc, Chlamydomonas, Chlorella* and Diatoms
6. Study of *Rhizopus, Penicillium*, *Aspergillus*, *Alternaria*, *Ustilago* and *Puccinia* (Asexual stage from temporary mounts and sexual structures through permanent slides).
7. Study of plant diseases with the help of infected plant specimens - TMV, citrus canker, little leaf of brinjal, loose smut of wheat, downy mildew of crucifers, rust of pea, smut of bajra

B.Sc. First Year (II Semester)

SOLS/BOT/Major-2 Diversity of Cryptogams **2 Credits [30 Hours]**

Unit I **[8 hours]**

General characteristics; Classification of algae; Morphology and life-cycles of the following: *Oscillatoria*, *Scytonema, Volvox, Ulva, Vaucheria, Fucus* and *Polysiphonia*. Economic importance of algae

Unit II **[8 hours]**

True Fungi- General characteristics, Comparative account of Ascomycetes, Basidiomycetes and dueteromycetes, Life cycle of *Puccinia* and *Agaricus* (Basidiomycota);

Symbiotic Associations- **Lichens**: General account, reproduction and significance; **Mycorrhiza**: ectomycorrhiza and endomycorrhiza and their significance

Unit III **[7 hours]**

Bryophytes: General characteristics, adaptations to land habit, Classification, Range of thallus organisation. Classification, morphology, anatomy and reproduction of *Riccia*, *Anthoceros*, *Marchantia* and *Funaria*. (Developmental details not to be included). Ecology and economic importance of bryophytes

Unit IV **[8 hours]**

Pteridophytes: General characteristics, classification, Early land plants (*Cooksonia* and *Rhynia*). Classification, morphology, anatomy and reproduction of *Selaginella, Equisetum* and *Pteris*. (Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economical importance of Pteridophytes.

Suggested Readings

1. Gangulee HC, Kar AK (2011) College Botany Vol II (Algae, Fungi, Brophyta, Pteridophyta), New Central Book Agency, Kolkata.
2. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
3. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
4. Dubey HC (2009) An Introduction to Fungi, 3rd edition, Vikash Publication House Pvt Ltd, Noida.
5. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
6. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad

SOLS/BOT/Minor-2 Study of Cryptogams **2 Credits [30 Hours]**

Unit I [8 hours]

General characteristics; Classification of algae; Morphology and life-cycles of the following: *Oscillatoria*, *Scytonema*, *Volvox*, *Ulva*, *Vaucheria*, *Fucus* and *Polysiphonia*. Economic importance of algae

Unit II [8 hours]

True Fungi- General characteristics, Comparative account of Ascomycetes, Basidiomycetes and dueteromycetes, Life cycle of Puccinia and Agaricus (Basidiomycota);
Symbiotic Associations- Lichens: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance

Unit III [7 hours]

Bryophytes: General characteristics, adaptations to land habit, Classification, Range of thallus organisation. Classification, morphology, anatomy and reproduction of Riccia, Anthoceros, Marchantia and Funaria. (Developmental details not to be included). Ecology and economic importance of bryophytes

Unit IV [8 hours]

Pteridophytes: General characteristics, classification, Early land plants (Cooksonia and Rhynia). Classification, morphology, anatomy and reproduction of Selaginella, Equisetum and Pteris. (Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economical importance of Pteridophytes.

Suggested Readings

1. Gangulee HC, Kar AK (2011) College Botany Vol II (Algae, Fungi, Brophyta, Pteridophyta), New Central Book Agency, Kolkata.
2. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
3. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
4. Dubey HC (2009) An Introduction to Fungi, 3rd edition, Vikash Publication House Pvt Ltd, Noida.
5. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
6. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad

SOLS/BOT/DSC (Major)-2 (P) Diversity of Cryptogams (Practical)	**2 Credits**
SOLS/BOT/DSC (Minor)-2 (P) Study of Cryptogams (Practical)	**2 Credits**

1. Study of vegetative and reproductive structures of *Nostoc, Chlamydomonas* (electron micrographs), *Oedogonium, Vaucheria, Fucus** and *Polysiphonia* through temporary preparations and permanent slides. (* *Fucus* - Specimen and permanent slides),
2. *Agaricus*: Specimens of button stage and full-grown mushroom
3. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
4. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)
5. *Marchantia and Riccia*- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides). *Funaria*- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema.
6. *Selaginella*- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
7. *Equisetum*- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry)(temporary slides); t.s rhizome (permanent slide).
8. *Pteris*- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).

MULTIDISCIPLINARY/INTERDISCIPLINARY COURSE
(Theory: 2 Credits; Practical: 2 Credits)

SOLS/BOT/MD/ID- 1 Microbial Techniques	**2 Credits [30 Hours]**

Unit I [7 Hours]

Microscopy and specimen preparation

Principles of bright-field and fluorescence microscopy, Preparation and Staining of Specimens, Scanning and Transmission Electron Microscopy: Basics and preparation of specimens, Introduction to Confocal Microscopy and Scanning Probe.

Unit [7 Hours]

Culture techniques and measurement of microbial growth

Culture media for bacteria, microalgae and Fungi. Sterilisation process, Principles and applications of autoclave, biosafety cabinets and Incubators, Batch and Continuous Cultures, Growth Curve, Microbial growth behaviour in batch system, Influence of environmental factors on growth.

Unit III [8 Hours]

Spectrophotometry and Centrifugation

UV-Visible and Fluorescence Spectrophotometry and its applications in microbial research, Differential and Density gradient centrifugation, Ultracentrifugation.

Unit IV [8 Hours]

Chromatography and other techniques

Paper Chromatography, Column Chromatography, TLC, HPLC and Ion-exchange chromatography. X-ray crystallography, PCR, AGE, PAGE and SDS-PAGE, Isolation and purification of genomic DNA, plasmid and proteins.

Suggested readings:

1. Dubey RC (2013) A Text Book of Biotechnology, 4th edition, S Chand & Co Ltd, New Delhi.
2. Green MR, Sambrook J (2000) Molecular Cloning: A Laboratory Manual, 4th edition, Cold Spring Harbor Laboratory Press, Cold Spring Harbor.
3. Dubey RC, Maheshwari DK (2016) A Text Book of Microbiology, S Chand & Co Ltd, New Delhi.
4. Brown TA (2007) Gemones-3, 3rd edition, Garland Sci Publishing, New York.
5. Willey JM, Sherwood LM, Woolverton CJ (2014) Prescott's Microbiology, 9th edition, MacGraw Hill International, New York.

SOLS/BOT/MD/ID-1 (P) Microbial Techniques (Practical) 2 Credits [30Hours]

1. Laboratory safety and good laboratory practices, Cleaning and Sterilisation of Glassware
2. Preparation of media- Nutrient Agar and Broth
3. Inoculation and culturing of bacteria/microalgae in Nutrient agar and nutrient broth, Serial dilution
4. Study and enumeration of soil bacteria/microflora using MPN
5. Preparation of agar slant, stab, agar plate
6. Isolation and pure culture techniques
7. Isolation of lactic acid bacteria from curd.
8. Isolation of nitrogen-fixing bacteria from root nodules of legumes.
9. Study of natural microalgal community
10. Study of growth of unicellular microorganism by cell counting/turbidometry
11. Pathological specimens of Loose smut of wheat, Late blight of potato, White rust of crucifer, Stem gall of Coriander, Red rot of sugarcane; Slides of uredial, telial, pycnial & aecial stages of *Puccinia*, Few viral and bacterial plant diseases.

SOLS/BOT/MD/ID- 2 Herbarium Methodology and Plant Nomenclature **2 Credits [30 Hours]**

Unit I **[7 hours]**

Introduction: History of herbarium, Types and thematic herbaria, Virtual herbarium, Functions of herbarium, Roles of herbarium in conservation and taxonomic research, Acronyms, Famous herbaria of the world and India.

Unit II **[8 hours]**

Herbarium methodology: General concept of herbarium specimen's preservation and preparation, Types of preservation techniques, herbarium slips, scaling and colour coding, herbarium techniques for Algae (Macro-algae), Lichens, Fungi (Mushrooms), Bryophytes, Ferns and Fern allies, Gymnosperms and Angiosperms, Carpological collections, Equipment and chemicals, Precautions, Maintenance and Digitization of herbarium specimens.

Unit III **[6 hours]**

Plant Nomenclature: Introduction, concept, and history of plant nomenclature; International Code of Nomenclature for Algae, Fungi, and Plants (ICN): Division-I. Principles; Division-II. Rules and Recommendations; Division-III. Provisions for governance.

Unit IV **[9 hours]**

Articles: I). Nomenclature type, type concept, typification; II). Rules of Priority; III). Rules of Effective Publication; IV). Rules of Valid publication of names; V). Citation; VI). Different types of names in code. General concept of PhyloCode and BioCode.

Suggested Readings:

1. Naik, V.N. (1991). *Taxonomy of Angiosperms*. Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Brummitt, R. K. & Powell, C. E. (1992). *Authors of Plant Names*. Kew: Royal Botanic Gardens.
3. Jain, S.K. & Rao, R.R. (1976). *A Hand Book of Field and Herbarium Methods*. Today and Tomorrow's Printers and Publishers, New Delhi.
4. Thiers, B (2025). Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff. New York Botanical Garden's Virtual. Herbarium.
5. Turland, N. J., Wiersema, J. H., Barrie, F. R., Greuter, W., Hawksworth, D. L., Herendeen, P. S., Knapp, S., Kusber, W.-H., Li, D.-Z., Marhold, K., May, T. W., McNeill, J., Monro, A. M., Prado, J., Price, M. J. & Smith, G. F. (eds) (2018). International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. *Regnum Vegetabilis* 159. Koeltz Botanical Books, Glashütten.
6. Pandey, A.K. & Kasana, S. (2021). *Plant Systematics*. Jaya Publishing House, New Delhi.

SOLS/BOT/MD/ID- 2 (P) Herbarium Methodology and Plant Nomenclature (Practical) 2 Credits

1. Preparation of a minimum of 10 herbarium specimens of different plant groups.
2. Write a report on a visit to any nearby herbarium/museum.
3. Discuss: Heterotypic and Homotypic synonyms; Replacement name and Replaced name;
4. Protologue citation (journals, authored book, edited book with standard abbreviated form) and Author citation (standard abbreviation of author names).
5. Important websites for taxonomic literature and virtual herbaria.
6. Preparation of the dissection of fragile flowers/illustrations.

SOLS/BOT/SEC- I Mushroom Cultivation Technology **2 Credits [30 Hours]**

Unit I **[7 hours]**

Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea, Pleurotus ostreatus, Agaricus bisporus*.

Unit II **[10 hours]**

Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low-cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production.

Unit III **[7 hours]**

Storage and nutrition : Short-term storage (Refrigeration – up to 24 hours) Long term Storage (canning, pickels, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.

Unit IV **[6 hours]**

Food Preparation_: Types of foods prepared from mushroom. Research Centres - National level and Regional level._Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested Readings

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

SOLS/BOT/SEC- II FLORICULTURE **2 Credits [30 Hours]**

Unit I **[8 hours]**

Introduction: History of gardening; Importance and scope of floriculture and landscape gardening.
Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

Unit II **[7 hours]**

Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai.

Unit III **[8 hours]**

Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India. Landscaping Places of Public Importance: Landscaping highways and Educational institutions.

Unit IV **[7 hours]**

Commercial Floriculture: Factors affecting flower production; Production and
packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold,Rose, Lilium, Orchids). Diseases and Pests of Ornamental Plants.

Suggested Readings

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.