

GUJARAT UNIVERSITY



BOTANY

Choice Based Credit System (CBCS) Theory syllabus

Effective from June-2011

SEMESTER-I

Detailed Curriculum has been designed as per semester system. There shall be one theory paper having four units.

Contact Hours per week: 4

Exam Duration: 3 hours

Unit-1 Study of lower plants

Objective: To acquaint students with lower plants.

Algae: *Spirogyra*, *Nostoc* 3 hours

Taxonomic Position, structure of thallus, vegetative, asexual and sexual modes of reproduction of the genus, Economic importance of algae.

Fungi: *Mucor*, *Albugo* 3 hours

Taxonomic Position, structure of thallus, vegetative, asexual and sexual modes of reproduction of the genus, Economic importance of fungi.

Bryophyte: *Riccia* 2 hours

Taxonomic Position, Morphology, structure of thallus, vegetative, asexual and sexual modes of reproduction of the genus. General characters of Bryophytes.

Pteridophyte: *Nephrolepis* 2 hours

Taxonomic Position, Morphology, structure of thallus, vegetative, asexual and sexual modes of reproduction of the genus, Economic importance of Pteridophytes

Suggested Readings

- (i) A Textbook of Botany vol. I and II S.N. Pandey, P. S. Trivedi and S. P. Misra., Vikas Publication House Pvt. Ltd.
- (ii) Collage Botany Vol. I & II Das, Dutta, Gangulee and Kar., New Central Book Agency
- (iii) Algae, Fungi, Bryophyte, Pteridophyte by Vasishta., S. Chand Pub, New Delhi
- (iv) Smith, G. M. 1972. *Cryptogamic Botany*. Vol. 1 & 2. Tata McGraw Hill Publishing Co. Ltd. New Delhi.
- (v) Webster, J. 1985. *Introduction to Fungi*. Cambridge University Press.
- (vi) Sporne, K.K. 1991. *The Morphology of Pteridophytes*. B.I. Publishing Pvt. Ltd. Bombay.

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Contact Hours per week: 4

Exam Duration: 3hours

Unit-2 Genetics and Molecular biology

Objective: To acquaint students with the concepts of cell biology and genetics

1. DNA and RNA Composition and Structure	3 hours.
2. Watson and Crick's model of DNA	1 hour
3. Types of RNA	1 hour
4. DNA Replication	1 hour
5. Genetic code	1 hour
6. Protein Synthesis	2 hour
7. Regulation of gene expression in prokaryotes – Operon concept	1 hour

Suggested Readings

- (i) The World of Cell by Backer, Kleinsmith and Hardin Pearson Education
- (ii) Elements of Cytology by C. B. Powar
- (iii) Lewin, B.2000. *Genes VIII. Oxford University Press*, New York.
- (iv) Alberts, B., Bray,D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1999. *Molecular Biology of the Cell*. Garland Publishing, Inc. New York.
- (v) Wolfe, S.L. 1993. *Molecular and Cellular Biology*. Wadsworth Publishing Co. California, USA.
- (vi) Kleinsmith, L.J. and Kish, V.M.1995. *Principles of cell and Molecular Biology* (2nd Ed.). Harper Collins College Publishers, New York, USA.
- (vii) Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. *Molecular Cell Biology* (4th Ed.). W.H. Freeman and Co., New York, USA.
- (viii) Cytogenetics by S. Sundara Rajan., First edition, Anmol Publications, New Delhi

GUJARAT UNIVERSITY

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Contact Hours per week: 4

Exam Duration: 3hours

Unit-3 Plants and environment

Objective: To acquaint students with the concept of Ecology and Environment.

Course content:

1. Introduction, Scope and Branches of Ecology 0.5 hour
2. Ecosystems : 5.5 hours
Kinds of Ecosystem: Natural, Artificial
Structure and Functions of Ecosystems
Ecological Pyramids, Productivity of an Ecosystem, Energy flow in an Ecosystem
Biogeochemical Cycles-Carbon, Nitrogen, Phosphorus, Sulfur, Components of
Freshwater Ecosystem (Pond) Components of Terrestrial Ecosystem (Grassland)
3. Biotic Factors : 3 hours
Symbiosis: Mutualism, Proto-cooperation, Commensalism
Antagonism: Predation, Parasitism, Antibiosis, Competition, Saprophytism
4. Concept of Sustainable Biodiversity: 1 hour
Case study: The Messenger Pigeon gone forever

Suggested Readings

- (i) Textbook of Ecology by G.Tailer Miller, Jr.Scott E. Spoolman. Cengage Learning
- (ii) Plants and Environment by Daubenmire (Wiley-Eastern Pvt. Ltd., New Delhi)
- (iii) Ecology and Environment by P.D.Sharma Rastogee Publication
- (iv) Basic Ecology – Eugene P. Odum
- (v) Fundamentals of Ecology- P. Odum
- (vi) Concept in Indian Ecology and Environmental Science – S. V. S. Rana
- (vii) Ecology Theories and Application – Peter Stiling
- (viii) Ecology & Environment – P. D. Sharma
- (ix) Indian Manual of Plant Ecology – R .Misra & G. S. Puri

GUJARAT UNIVERSITY

BOTANY

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Contact Hours per week: 4

Exam Duration: 3 hours

Unit-4 Plant Biotechnology

Objective: To acquaint students with the latest technological developments in the field of Biotechnology and plant tissue culture.

- | | |
|--|---------|
| 1. Introduction, Brief History, Scope and Types of Plant Biotechnology | 1 hour |
| 2. Plant Tissue Culture – Tools & Technique; Applications | 2 hours |
| 3. Types of Culture- Callus, Cell | 2 hours |
| 4. Secondary Metabolites in Plant Culture | 2 hours |
| 5. Protoplast Culture and Somatic Hybridization. | 2 hours |
| 6. Applications of Plant Tissue Cultures | 1 hour |

Suggested Readings

- (i) Biotechnology by U. Satyanarayana Books and Allied (P) Ltd
- (ii) Elements of Biotechnology by P.K.Gupta, Rastogi Publications.
- (iii) Plant cell and tissue culture by Narayanswamy, Tata McGraw Hill.
- (iv) Bhojwani, S.S. 1990. Plant Tissue Culture: Theory and Practical (a revised edition). Elsevier Science Publishers, New York, USA.
- (v) Basic Biotechnology by S. Ignacimuthu, Tata McGraw Hill.
- (vi) A Text Book of Biotechnology by R.C. Dubey, S. Chand & Co.
- (vii) Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue Culture. Kluwer Academic Publishers, the Netherlands
- (viii) Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics. John Wiley & Sons, Inc., USA.
- (iv) Stent, G.S. 1986. Molecular Genetics. CBS Publication.
- (v) Brown, T.A. 1999. Genomes. John Wiley & Sons (Asia) Pvt. Ltd., Singapore.

CBCS BOTANY PRACTICAL SYLLABUS

SEMESTER 1:

1. Study of Algae- ***Spirogyra***
 - a) Mounting- Thallus, conjugation types
 - b) P.S. - Thallus and conjugations***Nostoc***
 - a) Mounting- Colony
 - b) P.S. - Colony

2. Study of Fungi- ***Mucor***
 - a) Specimen- Bread/ Roti with Mucor
 - b) Mounting- Reproductive structure- spores, sporangia
 - c) PS- Mucor sporangia, Zygosporangia***Albugo***
 - a) Specimen- On host
 - b) Mounting- Reproductive structures
 - c) PS- Vegetative and Reproductive structures

3. Study of Bryophytes-***Riccia***
 - a) Specimen - Thallus with Sporophyte
 - b) P.Slides – Thallus v.t.s., thallus with Antheridia and Archegonia

4. Study of Pteridophytes- ***Nephrolepis***
 - a) Specimen- Sporophytic plant
 - b) Mounting- Ramenta, Hydathode, Sporangia
 - c) PS- Prothallus with Antheridia and Archegonia; T.S. leaflet passing through sorus

5. Detail study of Genetic Codes.

6. Study of Biotic Factors- examples of Symbiosis and Antagonism
 - a) Symbiosis- Root nodules, Lichen
 - b) Proto-cooperation- Hermit crab and Fierasfer fish
 - c) Antagonism- Cuscuta, Loranthus, Viscum, Utricularia, Nepenthes, Drosera

7. Study of structure of Nucleic acids (DNA, RNA) through charts or models- Watson & Crick Model

8. DNA Replication and Protein Synthesis through charts or models.

9. Study of various tools: Plant Tissue Culture.
 - a) Laboratory design
 - b) Laminar Air Flow, Autoclave, pH meter, oven, digital balance

GUJARAT UNIVERSITY

BOTANY

Choice Based Credit System (CBCS) Practical paper

Effective from June-2011

SEMESTER-I

Date: _____

Total Marks: 30

Time: 3 Hours

Q.1 Identify and describe Specimen A and B.	08
Q.2 Mount the _____ from the Specimen C.	04
Q.3 Mention the Amino Acids for the _____, _____, _____, Genetic Codes	02
Q.4 Identify and Describe the specimens	12
Specimen D (Algae or Fungi)	
Specimen E (Bryophytes or Pteridophytes)	
Specimen F (Ecology)	
Specimen G (Ecology)	
Specimen H (Genetics)	
Specimen I (PTC)	
Q.5 Journal	04

GUIDENCE FOR ARRANGEMENT OF SPECIMENS IN THE EXAMINATION.

Specimen A: Algae or Fungi.

Specimen B: Bryophytes or Pteridophytes.

Specimen C: Reproductive structure of Algae, Fungi, Bryophytes or Pteridophytes or Ramenta or Hydathode may be asked.

(Q.3 Different 5 types of sets should be prepared for each examination).

GUJARAT UNIVERSITY

BOTANY

Choice Based Credit System (CBCS) Theory syllabus

Effective from June-2011

SEMESTER-II

Detailed Curriculum has been designed as per semester system. There shall be one theory paper having four units.

Contact Hours per week: 4

Exam Duration: 3hours

Unit-1 Study of higher plants

Objective: To acquaint students with Higher plants.

Gymnosperms:

Outline Classification of Gymnosperms by Chamberlain 1 hour

Cycas 4 hours

Occurrence, distribution, taxonomic position, morphology, reproduction and life history of the genus (excluding anatomy), Indian contribution on Gymnosperms.

Angiosperms: Sunflower and Maize 5 hours

Occurrence, distribution, taxonomic position, morphology, reproduction and life history of the genus (excluding anatomy).

Suggested reading:

- (i) Bhatnagar, S.P. and Moitra, A. 1996. *Gymnosperms*. New Age International Pvt. Ltd., New Delhi.
- (ii) Raghavan, V.1999. *Developmental Biology of Flowering plants*. Springer - Verlag, New York.
- (iii) Singh, G. 1999. *Plant Systematics - Theory and Practice*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- (iv) Naik, V.N. 1984. *Taxonomy of Angiosperms*. Tata McGraw - Hill Publishing Co. Ltd. New Delhi.
- (v) Verma B. K. 2011. Introduction to Taxonomy of Angiosperms. PHI Learning Private Ltd. New Delhi
- (vi) Botany for degree students- Vol. V, Gymnosperm by P. C. Vasishta (S. Chand, Delhi)
- (vii) Gymnosperm by G. L. Chopra (S. Nagin & Co., Jullundhar)
- (viii) Gymnosperm by Vasishta (S. Chand, Delhi)

GUJARAT UNIVERSITY

BOTANY

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SEMESTER-II

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Contact Hours per week: 4

Exam Duration: 3 hours

Unit-2 Morphology and Taxonomy

Objective: To acquaint students with basic morphology and physiology of higher plants.

1. Morphology 4.5 hours

1. Bracts and Inflorescence :

Bracts – Scaly, Involucral, Foliaceous, Petaloid and Spathe, Inflorescence:

Racemose – Raceme Spike, Catkin, Spadix, Umbel, Capitulum

Cymose – Solitary terminal, Solitary axillary, Helicoid, Scorpioid, Biparous,
Multiparous cymes.

Special Types of Inflorescences: Hypanthodium, Verticillaster, Cyathium

2. Taxonomy

To enable students to understand systematic botany of higher plants with the economic importance of plants.

Outline Classification of Bentham and Hooker's System of Classification. 1.5 hour

Detailed study of the following families: 4 hours

Dicotyledons- Polypetalae – *Malvaceae*

Dicotyledons- Gamopetalae- *Convolvulaceae*

Dicotyledons- Apetalae- *Nyctaginaceae*

Monocotyledons- *Amaryllidaceae*

Suggested Readings

- (i) Plant Systematics, Gurucharan Singh, Oxford & IBH.
- (ii) Advanced Plant Taxonomy, A. K. Mondal, New Central Book Agency (P) Ltd.
- (iii) Taxonomy of Angiosperms, B. P. Pandey, S. Chand Publication.
- (iv) Raghavan, V. 1999. *Developmental Biology of Flowering plants*. Springer - Verlag, New York.
- (v) Stebbins, G.L. 1974. *Flowering Plant - Evolution above Species Level*. Edward Arnold Ltd. London.
- (vi) Takhtajan, A.L. 1997. *Diversity and Classification of Flowering Plants*. Columbia University Press, New York.
- (vii) Naik, V.N. 1984. *Taxonomy of Angiosperms*. Tata McGraw - Hill Publishing Co. Ltd. New Delhi.

GUJARAT UNIVERSITY

BOTANY

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Contact Hours per week: 4

Exam Duration: 3hours

Unit-3 Plant physiology and growth and development

Objective: To acquaint students with basic physiology of higher plants and related organelles.

- | | |
|--|---------|
| 1. Structure and Functions of Chloroplast and Mitochondria | 1 hour |
| 2. Plant-Water Relations: Water Potential,
Diffusion,
Imbibition,
Osmosis,
Plasmolysis | 4 hours |
| 3. Respiration and Photosynthesis. | 2 hours |
| 4. Physiology of Flowering:
Role of temperature in flowering (Vernalization)
Role of light in flowering (Photoperiodism) | 2 hours |
| 5. Transpiration | 1 hour |

Suggested Readings

- (i) Plant Physiology by S Mukherji and A K Ghosh, New Central Book Agency(P) Ltd
- (ii) Plant Physiology by S.N.Pandey and B.K. Sinha, Vikas Publishing House.
- (iii) Plant Physiology and Biochemistry by S.K. Verma, S. Chand & Co.
- (iv) Hopkins, W. G. 1995. *Introduction to Plant Physiology*. John wiley & Sons, Inc., New York, USA.
- (v) Moore, T. C. 1989. *Biochemistry and Physiology of Plant Hormones* (2nd edition). Springer - Verlag, New York, USA
- (vi) Salisbury, F.B. and Ross, C.W. 1992. *Plant Physiology* (4th edition). wadsworth Publishing Co. california, USA.
- (vii) Singhal, G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee 1999. *Concept in Photobiology: Photosynthesis and Photomorphogenesis*. Narosa Publishing House, New Delhi.
- (viii) Taiz, L. and Zeiger, E. 1998. *Plant Physiology* (2nd edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
- (ix) Westhoff, P. 1998. *Molecular Plant Development: from Gene to Plant*. Oxford University Press, Oxford, UK.

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Contact Hours per week: 4

Exam Duration: 3hours

Unit-4 Plant resources, utilization, horticulture and gardening

4 hours

Botanical name, common name, family, useful part, brief description, important chemical constituents if any, climate and cultivation (only for cereals, pulses and oil seeds) and uses of the following plants:

1. Cereals- Wheat, Rice
2. Pulses- Gram, Pea
3. Oil seeds- Castor
4. Medicinal plants- Ginger, Aloe, Neem and Ashwagandha

Horticulture and Gardening

1. Horticulture: Definition, Scope and Branches 1 hour
2. Gardening: Introduction, Uses of gardens, Types of gardens 1 hour
(Kitchen garden, water garden, rock garden and terrace garden)
3. Garden Operations- digging, planting 1 hour
4. Identification of common plants for different garden locations 2 hours
(Minimum 5 plants for each location): paths, avenue, hedges and flower beds.
5. Cutting, Layering and grafting methods of asexual plant propagation 1 hour

Suggested Readings

- (i) Economic Botany by V. Verma
- (ii) Economic Botany of the Tropics by S.L.Kochhar
- (iii) Economic Botany by A.F. Hill & O.P.Sharma, Tata McGraw Hill, New Delhi.
- (iv) Gardening in India – Percy Lancaster, Oxford & IBH Publishing Co. Pvt Ltd.
- (v) Gardens – Laeeq Futehally, National Book Trust, India.
- (vi) Economic Botany by A.V.S.S. Samba Murty and N.S. Subramanyam, Wiley Eastern
- (vii) A Manual of Ethnobotany, 2nd Edition, by S.K. Jain. Scientific Publishers, Jodhpur.
- (viii) Ethnobiology, by Rajiv K. Sinha and Shweta Sinha, Surbhi Publication, Jaipur.

CBCS BOTANY PRACTICAL SYLLABUS

SEMESTER-II

1. Study of Gymnosperms- Life-History of *Cycas*
 - a) Specimen- *Cycas* whole plant, coralloid roots, compound leaf, male cone, Megasporephyll and ovules
 - b) Mounting – *Cycas* microspores
 - c) Permanent slides- TS Microsporephyll, LS Ovule
2. Study of Angiosperms - Life-History of **Sunflower**
 - a) Specimen – Whole plant, Inflorescence, Root System
 - b) Slides – Ray floret and Disc floretLife-History of **Maize**
 - a) Specimen – Whole plant, Inflorescence, Seed , Root system
 - b) Slides – LS of Seed
3. Study of Plant Morphology:
 - a) Types of Bracts- Foliaceous, Involucral, Spathe, Petaloid
 - b) Types of Inflorescences including Special types
 - i) Racemose- Raceme, Spike, Spikelet, Catkin, Umbel, Capitulum
 - ii) Cymose – Solitary –Terminal and Axillary; Monochasial- Helicoid and Scorpioid; Dichasial and Multichasial
 - iii) Special types- Verticillaster, Cyathium, Hypanthodium
1. Study of Plant families- *Malvaceae*, *Convolvulaceae*, *Nyctaginaceae* and *Amaryllidaceae* - Classification with reasons, Identifying characters, floral formula and floral diagrams, habit sketch, androecium, gynoecium and TS of ovary; 3-4 botanical and common names of examples.
5. Cell Biology and Plant Physiology- Experiments for-
 - a) Diffusion- Saffranin or Potassium permanganate in water,
 - b) Imbibition- Demonstration of Endosmosis, Exosmosis in grapes
 - c) Osmosis- Potato osmoscope
 - d) Plasmolysis- Tradescantia leaf
 - e) Transpiration- Four Leaf , Comparison of Stomata of Monocot and Dicot
 - f) Study of structure of Chloroplast and Mitochondria through charts or models
6. Economic Botany- Study of plants as per theory syllabus
7. Study of Garden tools as per theory syllabus through charts- Scissors, Hoe, Hose, Clippers, Watering can, Sprinkler
8. Study of any five Avenue trees, five ornamentals and five foliage plants of your area through fresh specimen and herbaria.

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SEMESTER-II

Date: _____

Total Marks: _____

Time: 3 Hours

- | | |
|---|----|
| Q.1 Identify and describe Specimen A. | 04 |
| Q.2 Mount the _____ from the Specimen B. | 04 |
| Q.3 Identify the Family of the Specimen C, classify it, give general characters
and draw labeled diagrams. | 04 |
| Q.4 Perform the physiological experiment as per the chit. | 04 |
| Q.5 Identify and describe the specimens | 10 |
| Specimen D (MORPHOLOGY) | |
| Specimen E (MORPHOLOGY) | |
| Specimen F (CELLBIOLOGY) | |
| Specimen G (ECONOMIC BOTANY) | |
| Specimen H (GARDEN TOOLS) | |
| Q.6 Journal | 04 |

GUIDENCE FOR ARRANGEMENT OF SPECIMENS IN THE EXAMINATION.

Specimen A: Gymnosperm or Angiosperm.

Specimen B: Gymnosperm or Angiosperm.

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Elective paper: Forestry

Unit-I: Forest types and management

Types, role and necessity, Agroforestry, Plantation Forestry, Social Forestry, Joint Forest Management , Modern Nursery Technology

Unit-II: Silviculture

General Principles, Systems, Natural and Artificial regeneration of Forest, Tree Physiology and Breeding, Silviculture for Mangroves and Shoreline Vegetation, Traditional and recent advances

Unit-III: Ecology of Soils and Hydrology

Forest Soils, Soil conservation, Watershed management, Reclamation of degraded problem areas and integrated technology for eroded soils.

Unit-IV: Conservation and utility

Environmental forestry and conservation, Forest Ecology and Ethnobotany, Forest Resources and Utilization, Forest Protection and Wildlife Biology, Forest Economics and Legislation

Suggested Readings:

1. **Botany in forestry and environment:** Ashok Kumar, Published by: Kumar Media(P) Ltd., Gandhinagar, ISBN: 81-900502-0-6
2. **A Handbook on Statistical Analysis in Forestry Research :** K. Jayaraman, Kerala Forest Research Institute, 2001, pbk, viii, 203 p, tables, figs, ISBN : 81-85041-27-X,
3. **A Manual of Indian Forest Botany :** N. L. Bor, Asiatic Pub, 2010, Second Edition, xvi, 442 p, 31 plates, ISBN : 978-81-9061-121-3
4. **A Modern Book on Forestry and Horticulture :** Benu Singh, Vista International Pub, 2010, viii, 248 p, ISBN : 93-80239-38-5

Gujarat University, Ahmedabad

Elective Paper: Production Horticulture

Unit-I: Fundamentals of Horticulture

Definition, branches, importance and scope, Classification of Horticultural Crops, Special horticultural practices

Unit-II: Soil and water considerations

Formation of soil, classification, physical and chemical properties. Soil media, nutrients and manuring. Symptoms of excesses and deficiencies of nutrients. Plant growth regulators.

Unit-III: Plant Propagation and Plant Protection

Propagation by specialized structures, nursery based propagation, Role of Biotechnology, pest management, Weed management

Unit-IV: Production, Packaging, Marketing and Conservation

Greenhouse cultivation, Floriculture, Root and tuber crops, Vegetable production, Organic gardening, Containers and packaging techniques, Local and international demand, export standards and potential.

Suggested reading:

1. Chadha KL & Pareek OP. (Eds.).1996. *Advances in Horticulture*. Vols. IIIIV. Malhotra Publishing House.
 2. Sabina GT & Peter KV. 2008. *Ornamental Plants for Gardens*. New India Publ. Agency.
 3. Valsalakumari et al. 2008. *Flowering Trees*. New India Publ. Agency.
- Woodrow MG.1999. *Gardening in India*. Biotech Books.

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Elective Paper: Medicinal Plants

Unit -I Classification and distribution

Classification based on botany, plant parts, phytochemicals and diseases,
Distribution in the state, country and global

Unit -II Cultivation and utilization

Methods of cultivation, harvesting, storage and utilization (preparation)
Different systems of medicine

Unit -III Medicinal plants and uses

Family wise (at least three plants from each family) medicinal plants,
major phytochemicals and use

Unit -IV Value addition

Photochemistry, biosynthetic relationships, extract analysis and modern
approaches

Suggested reading:

1. Desai *et al*, Medicinal plants, Bharatiya Kala Prakashan, New Delhi (2007)
2. Pandey C. N. *et al* Medicinal Plants of Gujarat, GEER Foundation and Gandhinagar (2005)
3. Cseke *et al*, Natural Products from Plants, CRC Press, Boca Ralon (2006)

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Elective Paper: Soil and Plant Nutrition

Unit- I Importance and Soil Characteristic

Importance, origin, classification and characteristics of soil

Unit -II Soil testing and amendments

Soil sampling, analysis and fertility, Fertilizers, chemical- organic, conservation

Unit -III Plant nutrition

Essential elements, deficiency symptoms, soil-root-microbe interaction, biological nitrogen fixation

Unit –IV Modern approaches

Soil-less cultures, nutrient solution, mycorrhiza, plant assimilation, tillage and sustainable agriculture

Suggested reading:

1. E J Plaster Soil Science, Cengage publication New Delhi (2009)
2. L Taiz and Zeiger E, Plant Phycology, Sinaure Association, Marsachusetts (1998)
3. Noggle G. R. and Fritz G. J. Introductory Plant Physiology, Prentice-Hall of India, New Delhi (1992)